GRESB REAL ESTATE

Transition Risk Report

2023

four corners

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Introduction

ⓘ This Report uses Version: **v2 - 11.01.2023** of the **Global CRREM Pathways**.

Built using asset-level data provided in the 2023 Real Estate Assessment, the GRESB Transition Risk Report contextualizes transition risk and net-zero alignment of real estate at both the portfolio and asset level. The report is structured in the following sections:

Transition Risk in Real Estate: An overview of transition risk and how it should be interpreted in the context of this report.

About Report: Description of how the report was developed and the scope of data used.

Portfolio Insights: High-level aggregated look at the portfolio's transition risk.

Portfolio Overview: Specifics on the portion of the overall portfolio for which transition risk insights are generated.

Portfolio Share at Risk: Floor area–weighted and gross asset value–weighted projections of assets at risk over time.

Country Insights: Breakdowns of portfolio risk by property type, provided for each country.

Asset-level Table: Table with asset characteristics, energy, GHG, and transition risk metrics for each asset.

Transition Risk in Real Estate

Transition Risk

Transition risk is broadly defined as those risks that arise as a result of the global transition toward a low-carbon economy. The Task Force on Climate-related Financial Disclosures (TCFD) delineates transition risk into four categories: policy and legal; technology; market; and reputation. Each category can be of greater or lesser importance depending on the sector under consideration. In the case of real estate management, policy risk is generally considered to be the predominant transition risk to an asset or portfolio.

Decarbonization Pathways

Decarbonization pathways can provide a proxy to the relative level of transition risk for a variety of sectors and are particularly useful for estimating relative transition risk within real estate portfolios and across real estate assets. They use a metric – GHG intensity – that is applicable to the entire real estate asset class. The target intensities can be calibrated for the sub-sector (i.e. Property Type) and region of an asset, providing a highly relevant performance objective at the asset level.

The Carbon Risk Real Estate Monitor (CRREM) project has derived top-down, science-based decarbonization pathways for the majority of developed real estate markets across the globe. (Starting from the global carbon budget and downscaling to be more granular.) According to the Science Based Targets initiative (SBTi), "Targets are considered 'science-based' if they are in line with what the latest climate science deems necessary to meet the goals of the Paris Agreement – limiting global warming to 1.5°C above pre-industrial levels.[1]

These decarbonization pathways are particularly useful because they translate high-level global commitments (e.g. Paris agreement, global carbon budgets, Net-Zero targets) into actionable reference points against which individual assets can be assessed. For more information on CRREM, please visit www.crrem.org.

Decarbonization pathways can be used for both alignment with Net-Zero ambitions and assessment of transition risk, as described below.

Paris / Net-Zero Alignment

Because they are science-based, the CRREM decarbonization pathways are suitable for Paris goal or Net-Zero alignment purposes. In fact, both the UN-convened Net-Zero Asset Owner Alliance (NZ AOA) and the Institutional Investors Group on Climate Change (IIGCC) recommend the use of the CRREM decarbonization pathways to monitor real estate compliance with their framework criteria. While the 1.5°C CRREM pathways don't decrease to 0 CO2e/m2 by 2050, they get very close and are considered ambitious enough to be the gold standard for Net-Zero alignment in combination with the other alignment measures of these frameworks.

Assets exposed to Transition Risk

The risk of asset exposure to transition risk is one experienced in many sectors. Even within the real estate sector, asset can become exposed to transition risk as a result of any combination of impacts described by transition risk: policy, legal, technological, market, or reputational. The most common cause is the loss of license to operate because of an asset's inability to perform in compliance with increasingly stringent regulatory requirements. Assuming that the decarbonization pathways reflect the relative level of regulatory ambition that nations have set to align themselves with higher-level international commitments, the point where an asset's projected performance crosses its corresponding decarbonization pathway can be interpretted as the year in which the asset becomes more exposed to transition risk.

Because the decarbonization pathways are normative and are not exact reflections of regulatory requirements (e.g., energy efficiency regulation, carbon markets, carbon price, building-specific regulations) in each jurisdiction, the "intersection" point should not be understood as a prediction. Rather, it is a proxy for this type of (regulatory/policy) transition risk. Thus, it may be the case that an asset's GHG intensity exceeds that of its decarbonization pathway without losing its license to operate. However, it may be interpreted as having an increased risk profile if it is assumed that the regulation in the jurisdiction in question is lagging but will eventually attempt to realign itself with national commitments.

Whole-building emissions

Traditional target-setting treats Scope 1, 2 and 3 emissions differently. The key focus has generally been on reducing Scope 1 and 2 emissions, while Scope 3 emissions have been considered a voluntary reporting effort. However, in the context of transition risk in real estate as well as target setting and net zero alignment, Scope 3 emissions are increasingly acknowledged to be just as important (if not more so, due to the fact that Scope 3 emissions can often represent the larger share of any asset's emissions.) The TCFD has updated its Annex to specify that the "Task Force believes all organizations should disclose absolute Scope 1 and Scope 2 GHG emissions, independent of a materiality assessment. The disclosure of Scope 3 GHG emissions is subject to materiality; however, the Task Force encourages organizations to disclose such emissions."[2] The NZ AOA 2025 Target Setting Protocol recommends that real estate portfolio targets be set on "Scope 1 and 2, plus, where possible, tenant-related Scope 3 emissions from heating and electricity"[3]. Finally, the IIGCC Net Zero Investment Framework states that "Carbon reduction pathways should include Scope 1, 2, and relevant Scope 3 emissions."

The emissions associated with building-related energy use are material to real estate risk management, accounting, reporting, and target setting, and are therefore included in the assessment of transition risk.

About Report

Report Approach

This report presents the risk of future regulatory changes (i.e. transition risk) to a real estate portfolio by leveraging decarbonization pathways. In other words, it compares bottom-up performance projections (i.e. built from detailed data relating to the portfolio's constituent parts) against top-down decarbonization pathways.

The top-down decarbonization pathways were developed by CRREM, leveraging a method based on the SBTi's Sectoral Decarbonization Approach. The global carbon budgets are apportioned to various economic sectors (e.g. real estate), then to each country, then split between residential and commercial real estate. The decarbonization pathways define the required decarbonization trajectory of each sector within a country, taking into account national real estate economic growth projections as well as the existing building stock[4] . GRESB was involved in the development of the pathways as a CRREM consortium member and provided the average real estate benchmarks used to calibrate the pathways.

The bottom-up estimation and calculation of asset and portfolio performance is done by GRESB. Built from the most granular level of data provided in the 2023 Real Estate Assessment, the GHG data is calculated using the floor area type energy consumption data of the asset in combination with the specific emissions factors for the particular energy source in question.

Our methodology uses the most representative data available, whether reported or statistically derived, to calculate whole-building GHG emissions and provide a complete picture of a real estate portfolio's GHG emissions. This data is projected into the future assuming a "do nothing" scenario. For more information on the GRESB GHG Calculation Methodology, please see Appendix II.

The performance projections and corresponding decarbonization pathways are then aggregated to provide portfolio- and country-level displays of the information.

Report Scope

The scope of the report is presented in the Portfolio Overview section and is limited to those regions and property types for which CRREM decarbonization pathways exist. However, the report includes estimated energy and GHG intensity values for all assets, regardless of the existence of corresponding decarbonization pathways.

Disclaimer

This section presents an analysis of the portfolio's current and projected GHG performance against the pathways developed by CRREM. The pathways are meant to be updated periodically and are always liable to change based on the state and pace of development in global real estate markets, modifications to the CRREM methodology, updating of datasets underlying the pathways, as well as revisions to the carbon budget based on the most recent science.

The information in this report is indicative. It is important to understand the methodological underpinnings of the CRREM pathways, the data used in the calculations of portfolios and assets, as well as how to interpret various resulting outputs before using this analysis. These insights are intended to drive conversation and analysis, not to be used as the basis of investment advice.

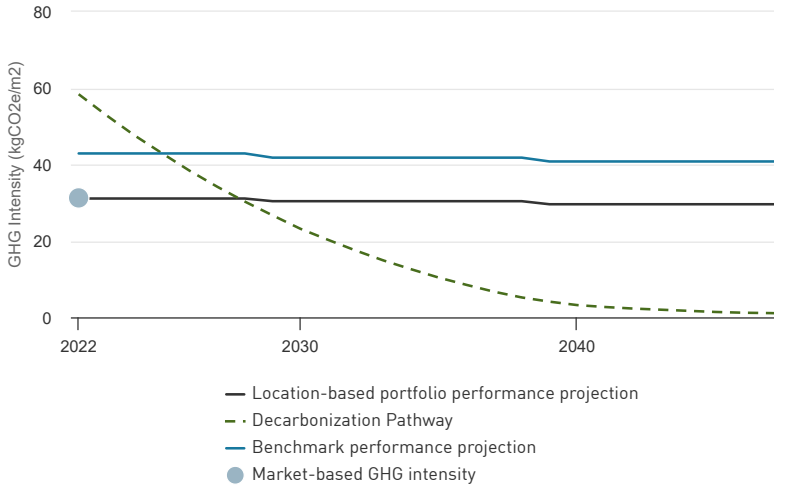
Portfolio Insights

This section compares portfolio-level GHG performance against a decarbonization pathway built for that particular portfolio, providing a high-level indication of the portfolio's current state of alignment with climate goals or transition risk objectives. The metrics in the box below refer to the aggregated assets displayed in the graph, not necessarily the entire portfolio.

The decarbonization pathway is a floor area–weighted aggregation of the top-down, property type- and region-specific decarbonization pathways derived by CRREM.

The portfolio performance projection is a floor area–weighted aggregation of the asset-specific performance modeled by GRESB for all assets with an available corresponding decarbonization pathway.

Projected Portfolio Performance Against the Decarbonization Pathway



These performance calculations are built from available asset-level energy data provided by GRESB Participant Members as part of the 2023 Real Estate Assessment. Where data was not available, the calculations include estimations modeled by GRESB. GHG emissions are calculated using the location-based method and include emissions related to the whole portfolio, regardless of their Scopes. Portfolio performance is projected into the future assuming a "do nothing" scenario by the participant. Any variation in future years is due to CRREM-projected electricity grid decarbonization.

For more information on how GRESB calculates GHG emissions, please see Appendix II.

13,643 tCO2e	9 %	22 %
Total Emissions*	Floor Area at Risk**	Estimated Data***

* Total emissions refers to the total location-based emissions of the portfolio over the year calculated by GRESB, including estimates where necessary

** Percentage of floor area with a GHG intensity above that of its corresponding underlying CRREM pathway in the current year

*** Percentage of energy consumption data estimated by GRESB

Portfolio Overview

This section describes the structure of the portfolio as well as the percentages of its floor area and aggregate gross asset value (GAV) covered by CRREM decarbonization pathways. The transition risk, Paris-alignment, or alignment with Net-Zero targets can only be evaluated for the portion of the portfolio with corresponding decarbonization pathways. This section is only provided as an overview; please note the exceptions described in Appendix I.

Floor Area with a Decarbonization Pathway

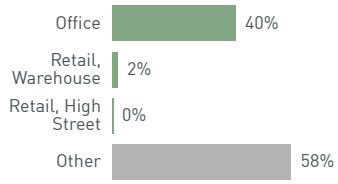
42%

Gross Asset Value (GAV)

USD 905 Million

Portfolio GAV by Country

Portfolio GAV by Property Type

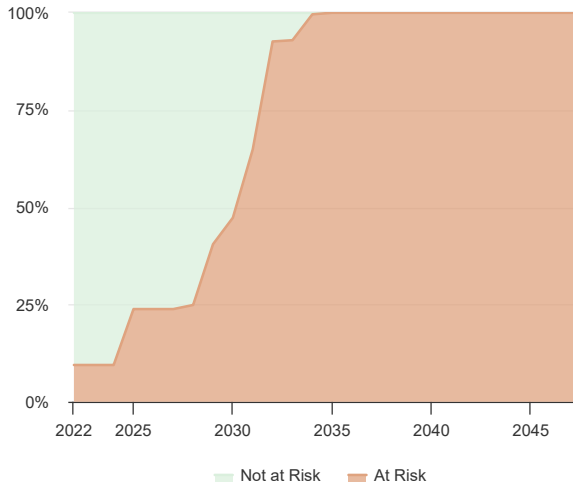


Portfolio Share at Risk

The portfolio share at risk diagrams illustrate the total percentage of a portfolio deemed "stranded" in any given year. This represents the cumulative floor area (or GAV) of those assets for which their projected GHG intensity is equal to or greater than that of their corresponding decarbonization pathway over time.

Entities that provided complete asset-level GAV information in the 2023 Real Estate Assessment will be provided with the diagram from the perspective of percentage of GAV at risk (%GAV at Risk) in any given year.

Floor Area at Risk



GAV at risk

Country Insights

This section displays property type–specific comparisons of portfolio performance against their respective decarbonization pathways, per country.

The decarbonization pathways are the top-down, property type- and country-specific decarbonization pathways derived by CRREM. Because the decarbonization pathways displayed represent the CRREM property type/country cross sections, they are not aggregated.

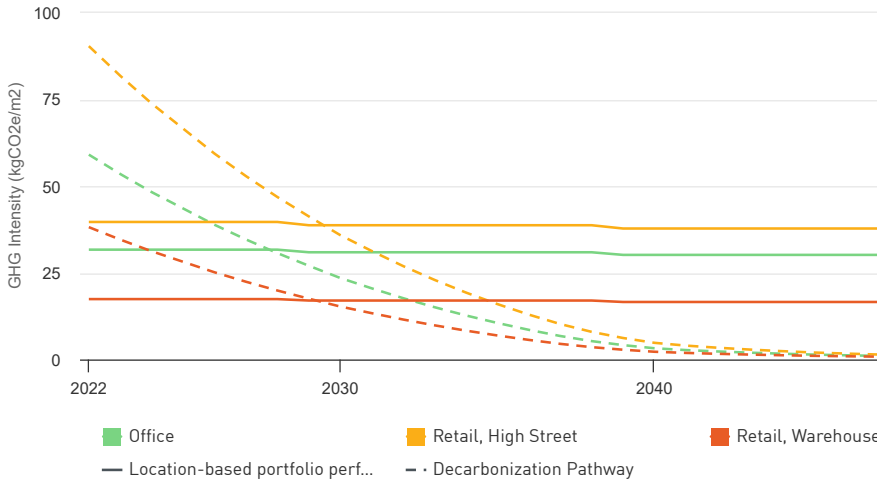
The portfolio performance projections are floor area–weighted aggregations of the asset-specific performance modeled by GRESB for all assets with an available corresponding decarbonization pathway. These performance calculations are built from available asset-level energy data provided by GRESB Participant Members as part of the 2023 Real Estate Assessment. Where data was not available, the calculations include estimations modeled by GRESB. GHG emissions are calculated using the location-based method and include emissions related to the whole portfolio, regardless of their Scopes. Portfolio performance is projected into the future assuming a "do nothing" scenario on behalf of the portfolio. Any variation in future years is due to projected electricity grid decarbonization.

For more information on how GRESB calculates GHG emissions, please see Appendix II.

Mexico

100% of GAV | **100%** of floor area

Projected Portfolio Performance Against the Decarbonization Pathway



13,643 tCO2e
Total Emissions*

9%
Floor Area at Risk**

22%
Estimated Data***

* Total emissions refers to the total location-based emissions of the portfolio over the year calculated by GRESB, including estimates where necessary

** Percentage of floor area with a GHG intensity above that of its corresponding underlying CRREM pathway in the current year

*** Percentage of energy consumption data estimated by GRESB

Asset Insights

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The asset-level table details key metrics for each asset in the portfolio, irrespective of the availability of a corresponding decarbonization pathway. The floor area refers to the entire indoor floor area of the asset. The percentage of data coverage refers to the percentage of floor area and time for which energy consumption data was reported. The energy intensities for assets with 100% data coverage represent the actual energy intensities. The energy intensities for assets with less than 100% data coverage are those resulting from the combined reported and estimated remaining energy consumption of the asset using the methodology. The GHG intensities are calculated using the GRESB's GHG calculation methodology. The CRREM GHG intensity refers to the country- and property type-specific decarbonization pathway GHG intensity in the current year. The stranding year is the year at which the projected asset GHG intensity becomes greater than the GHG intensity of its corresponding decarbonization pathway.

For more information on how GRESB calculates GHG emissions, please see Appendix II.

Asset Name	Property Sub-Type	Country	% of Ownership	Floor Area (m^2)	Data Coverage (%)	Energy Intensity (kWh/m^2)	Location-based GHG Intensity ($kgCO2e/m^2$)	Market-based GHG intensity ($kgCO2e/m^2$)	CRREM GHG Intensity ($kgCO2e/m^2$)	Projected Year at Risk
Neoris	Office: Other	MX	100%	31,060	100%	156.8	65.9	65.9	59.1	<2022
Huasteco Alfa	Office: Other	MX	100%	5,026	65%	148.1	62.2	62.2	59.1	<2022
Filios 2 Supsa O	Office: Other	MX	100%	4,199	100%	199.4	83.7	83.7	59.1	<2022
Filios 9 Call Center	Office: Other	MX	100%	1,152	100%	1340.4	563.0	563.0	59.1	<2022
Axtel	Office: Other	MX	100%	31,060	0%	104.7	44.0	44.0	59.1	2025
Cuauhtémoc	Office: Other	MX	100%	10,294	0%	104.7	44.0	44.0	59.1	2025
Filios 5 Cetec	Office: Other	MX	100%	10,061	100%	104.7	44.0	44.0	59.1	2025
Atento	Office: Other	MX	100%	6,632	0%	104.7	44.0	44.0	59.1	2025
Filios 10 ADM	Office: Other	MX	100%	4,004	100%	104.7	44.0	44.0	59.1	2025
Filios 7 IT	Office: Other	MX	100%	938	92%	114.1	47.9	47.9	59.1	2025
Monza 2	Retail: Retail Centers: Warehouse	MX	100%	4,611	100%	53.0	22.3	22.3	38.2	2028
Torre Morada 2	Office: Other	MX	100%	40,338	75%	68.6	28.8	28.8	59.1	2029
Prometeo	Office: Other	MX	100%	19,629	100%	69.8	29.3	29.3	59.1	2029
Monza Chih 1	Retail: Retail Centers: Warehouse	MX	100%	8,478	100%	45.0	18.9	18.9	38.2	2029
Redwood	Office: Other	MX	100%	27,820	99%	63.2	26.5	26.5	59.1	2030
Huasteco Zona Comercial	Retail: High Street	MX	100%	2,053	90%	94.5	39.7	39.7	90.4	2030
Plaza Central	Office: Other	MX	100%	41,229	98%	54.4	22.9	22.9	59.1	2031
Torre Morada 1	Office: Other	MX	100%	35,719	98%	56.6	23.8	23.8	59.1	2031
La Perla	Office: Other	MX	100%	83,868	90%	49.0	20.6	20.6	59.1	2032
Patria	Office: Other	MX	100%	23,642	99%	45.1	18.9	18.9	59.1	2032
Cuadrante	Office: Other	MX	100%	12,113	98%	44.6	18.7	18.7	59.1	2032
Monza Delicias	Retail: Retail Centers: Warehouse	MX	100%	1,971	100%	31.5	13.2	13.2	38.2	2032
Monza Cuauhtémoc	Retail: Retail Centers: Warehouse	MX	100%	1,440	100%	27.4	11.5	11.5	38.2	2033
Fortaleza	Office: Other	MX	100%	29,155	100%	36.2	15.2	15.2	59.1	2034

Asset Name	Property Sub-Type	Country	% of Ownership	Floor Area (m^2)	Data Coverage (%)	Energy Intensity (kWh/m^2)	Location-based GHG Intensity ($kgC02e/m^2$)	Market-based GHG intensity ($kgC02e/m^2$)	CRREM GHG Intensity ($kgC02e/m^2$)	Projected Year at Risk
Monza Chih 2	Retail: Retail Centers: Warehouse	MX	100%	1,790	100%	17.8	7.5	7.5	38.2	2035
Nico 1	Industrial: Manufacturing	MX	100%	43,272	100%	22.4	9.4	9.4	N/A	N/A
Filios 1 Supsa M	Industrial: Manufacturing	MX	100%	40,728	100%	1365.6	573.5	573.5	N/A	N/A
Huasteco Cedis	Industrial: Manufacturing	MX	100%	38,503	100%	24.4	10.2	10.2	N/A	N/A
Filios 6 Horizon	Industrial: Manufacturing	MX	100%	35,554	100%	139.0	58.4	58.4	N/A	N/A
Filios 4 CIAW FDC	Industrial: Manufacturing	MX	100%	33,389	100%	17.6	7.4	7.4	N/A	N/A
Danfoss	Industrial: Manufacturing	MX	100%	33,008	93%	617.1	259.0	259.0	N/A	N/A
Ciénega 2	Industrial: Manufacturing	MX	100%	31,724	87%	44.4	18.5	18.5	N/A	N/A
Ciénega 3	Industrial: Manufacturing	MX	100%	30,087	100%	60.4	25.4	25.4	N/A	N/A
Providencia4MAL5A6CD	Industrial: Manufacturing	MX	100%	26,165	100%	124.3	52.2	52.2	N/A	N/A
Ciénega	Industrial: Manufacturing	MX	100%	25,223	100%	11.1	4.7	4.7	N/A	N/A
Huasteco Fagor	Industrial: Manufacturing	MX	100%	20,743	100%	117.1	49.2	49.2	N/A	N/A
Zinc	Industrial: Manufacturing	MX	100%	19,663	100%	51.6	21.7	21.7	N/A	N/A
Garibaldi 1	Industrial: Manufacturing	MX	100%	18,561	100%	41.8	17.5	17.5	N/A	N/A
Providencia5MAL6A	Industrial: Manufacturing	MX	100%	18,147	100%	36.4	15.3	15.3	N/A	N/A
Santiago	Industrial: Manufacturing	MX	100%	16,497	100%	448.0	188.1	188.1	N/A	N/A
Huasteco Multitenant	Industrial: Manufacturing	MX	100%	15,728	100%	54.1	22.7	22.7	N/A	N/A
Filios 8 Horizon B	Industrial: Manufacturing	MX	100%	14,744	100%	1280.5	537.8	537.8	N/A	N/A
Providencia1MAL2A	Industrial: Manufacturing	MX	100%	13,717	42%	89.2	37.5	37.5	N/A	N/A
Casona Chihuahua	Industrial: Manufacturing	MX	100%	12,131	67%	42.4	17.8	17.8	N/A	N/A
Providencia3MAL4A	Industrial: Manufacturing	MX	100%	11,760	100%	137.6	57.8	57.8	N/A	N/A
Huasteco Nippon	Industrial: Manufacturing	MX	100%	11,753	98%	11.2	4.7	4.7	N/A	N/A
Garibaldi 2	Industrial: Manufacturing	MX	100%	10,581	100%	62.1	26.1	26.1	N/A	N/A
Casona Irapu 1	Industrial: Manufacturing	MX	100%	9,729	100%	4.1	1.7	1.7	N/A	N/A
Garibaldi 4	Industrial: Manufacturing	MX	100%	8,470	100%	119.3	50.1	50.1	N/A	N/A
Catacha	Industrial: Manufacturing	MX	100%	7,996	63%	37.4	15.7	15.7	N/A	N/A

Asset Name	Property Sub-Type	Country	% of Ownership	Floor Area (m^2)	Data Coverage (%)	Energy Intensity (kWh/m^2)	Location-based GHG Intensity ($kgC02e/m^2$)	Market-based GHG intensity ($kgC02e/m^2$)	CRREM GHG Intensity ($kgC02e/m^2$)	Projected Year at Risk
Providencia2MAL3A	Industrial: Manufacturing	MX	100%	7,013	100%	79.4	33.4	33.4	N/A	**N/A**
Garibaldi 3	Industrial: Manufacturing	MX	100%	6,587	100%	104.9	44.1	44.1	N/A	**N/A**
Providencia6MBL1A	Industrial: Manufacturing	MX	100%	6,378	100%	810.2	340.3	340.3	N/A	**N/A**
Huasteco Welldex	Industrial: Manufacturing	MX	100%	6,238	100%	44.2	18.6	18.6	N/A	**N/A**
Casona Irapu 2	Industrial: Manufacturing	MX	100%	5,950	100%	466.9	196.1	196.1	N/A	**N/A**
Casona Parral	Industrial: Manufacturing	MX	100%	5,888	100%	463.1	194.5	194.5	N/A	**N/A**
Catacha 2	Industrial: Manufacturing	MX	100%	5,400	0%	156.8	63.7	63.7	N/A	**N/A**
Providencia7MBL1B	Industrial: Manufacturing	MX	100%	5,093	100%	810.2	340.3	340.3	N/A	**N/A**
Filios 3 Supsa W	Industrial: Manufacturing	MX	100%	3,809	100%	254.2	106.8	106.8	N/A	**N/A**
Providencia8MBL2	Industrial: Manufacturing	MX	100%	3,367	100%	810.2	340.3	340.3	N/A	**N/A**

2020 - 2050

Results incorporated in this standard received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 785058.

Appendix I. GRESB/CRREM Property Type Mapping

GRESB Property Sub-Type	CRREM Property Type
Retail: High Street	Retail, High Street
Retail: Restaurants/Bars	Retail, High Street
Retail: Other	Retail, High Street
Retail: Retail Centers: Shopping Center	Retail, Shopping Center
Retail: Retail Centers: Strip Mall	Retail, Shopping Center
Retail: Retail Centers: Lifestyle Center	Retail, Shopping Center
Retail: Retail Centers: Warehouse	Retail, Warehouse
Office: Corporate: Low-Rise Office	Office
Office: Corporate: Mid-Rise Office	Office
Office: Corporate: High-Rise Office	Office
Office: Medical Office	Office
Office: Business Park	Office
Office: Other	Office
Industrial: Non-Refrigerated Warehouse	Industrial, Distribution Warehouse Warm
Industrial: Refrigerated Warehouse	Industrial, Refrigerated Warehouse Cold
Hotel	Hotel
Lodging, Leisure & Recreation: Indoor Arena	Lodging, Leisure & Recreation
Lodging, Leisure & Recreation: Fitness Center	Lodging, Leisure & Recreation
Lodging, Leisure & Recreation: Performing Arts	Lodging, Leisure & Recreation
Lodging, Leisure & Recreation: Swimming Center	Lodging, Leisure & Recreation
Lodging, Leisure & Recreation: Museum/Gallery	Lodging, Leisure & Recreation
Lodging, Leisure & Recreation: Other	Lodging, Leisure & Recreation
Healthcare: Healthcare Center	Healthcare
Healthcare: Senior Homes	Healthcare
Healthcare: Other	Healthcare
Mixed use: Office/Retail	*Not Covered*
Mixed use: Office/Residential	*Not Covered*
Mixed use: Office/Industrial	*Not Covered*
Mixed use: Other	*Not Covered*
Industrial: Industrial Park	*Not Covered*
Industrial: Manufacturing	*Not Covered*
Industrial: Other	*Not Covered*

GRESB Property Sub-Type	CRREM Property Type
Residential: Multi-Family: Low-Rise Multi-Family	Residential, Multi-family
Residential: Multi-Family: Mid-Rise Multi Family	Residential, Multi-family
Residential: Multi-Family: High-Rise Multi-Family	Residential, Multi-family
Residential: Family Homes	Residential, Single-family
Residential: Student Housing	*Not Covered*
Residential: Retirement Living	*Not Covered*
Residential: Other	*Not Covered*
Education: School	*Not Covered*
Education: University	*Not Covered*
Education: Library	*Not Covered*
Education: Other	*Not Covered*
Technology/Science: Data Center	*Not Covered*
Technology/Science: Laboratory/Life Sciences	*Not Covered*
Technology/Science: Other	*Not Covered*
Other: Parking (Indoors)	*Not Covered*
Other: Self-Storage	*Not Covered*
Other	*Not Covered*

Lodging, Leisure & Recreation CRREM pathways are *unavailable* for the following countries: Brazil, Canada, China, India, Malaysia, Mexico, the Philippines.

Residential: Single-family CRREM pathways are *unavailable* for the following countries: Australia, Brazil, Canada, China, Hong Kong, India, Japan, Malaysia, Mexico, New Zealand, the Philippines, Singapore, Korea, United States of America.

Note: The Portfolio Overview section does not account for property type and country cross sections for which decarbonization pathways are missing.

Appendix II. Methodology Overview

This methodology uses the most representative data available, whether reported or statistically derived, to calculate whole-building GHG emissions, and by extension, complete real estate portfolio GHG emissions, regardless of how much energy or GHG data is available as input.

It is aligned with global standards such as the GHG Protocol's Accounting and Reporting Standard for Corporates and the PCAF Global Standard.

At its core, the steps to calculate GHG intensity of a portfolio from energy data are as follows:

1. Estimate missing energy consumption data
2. Convert into absolute GHG emissions
3. Calculate GHG intensities
4. Aggregate GHG intensities

Particular care was taken in dealing with the imperfect cases and doing so in a way that retains the integrity of the physical reality that the information is trying to reflect, follows commonly accepted frameworks and standards, and is transparent in a way that is easily understood and supported by the industry.

The advantages of the GRESB Methodology include:

- Works for all assets globally.
- Works for all Property Sub-Types.
- Takes advantage of the most granular level of GRESB reporting with GHG emissions built-up from floor area data at the floor area type level.
- Leverage GRESB's database of real estate assets to estimate missing data with the most representative sample possible.
- Handles real estate assets for which no energy consumption data is provided.

Glossary

- *Data Availability:* The part of the reporting year for which data is available.
- *Data Coverage:* The part of the asset for which data is available, per subspace and energy type. The floor area reported in these fields reflects the floor area of the portfolio for which Absolute Consumption data is collected from.
- *Floor area type:* Floor area types refer to the most granular delineations of floor area within a building captured by the GRESB Real Estate Assessment: Common Areas, Shared Services, Landlord-controlled Tenant Spaces, Tenant-controlled Tenant Spaces.
- *Property Sub-Type/Country cross section:*This cross section refers to that subsample of GRESB Real Estate assets that are of a particular Property Sub-Type and located in a particular Country.
- *Subspace:* Subspace refers to the format by which a Participant reports asset-level data in the GRESB Real Estate Assessment: Base Building, Tenant Space.
- *Whole Building:* Whole Building refers to the format by which a Participant reports asset-level data in the GRESB Real Estate Assessment. This should not be conflated with uses such as "whole-building emissions," in which "whole-building" describes the fact that the stated emissions encompass all of the emissions that come from the entire building.

1. Estimate energy consumption data

The first step to calculating GHG emissions for GRESB Members is to fill in the gaps in energy consumption data at the Whole Building level. There are two dimensions along which data can be incomplete: area data coverage (Data Coverage) and time data coverage (Data Availability). If only a portion, or none, of the energy consumption data is reported along either dimension, the remainder must be estimated.

It is extremely important to track and disclose how much energy data, and subsequently calculated GHG data, is estimated. Otherwise, there is no indication of the data quality of the final metric, which not only reduces the confidence in the final output, but also reduces the incentive to continue measuring and gathering high-quality data in the future.

Estimating Energy Consumption from Data Availability

Summary of estimation approach

We linearly extrapolate energy consumption to account for one calendar year. We assume that energy consumption for a particular floor area stays constant throughout the year, so the estimated daily energy consumption is the same as the average reported daily energy consumption. Seasonal variation will be addressed in future development.

Edge Cases

- Trivial Case 1: Full Data Availability on energy consumption from data input
  ⇒ No energy estimation for incomplete Data Availability necessary. Proceed directly to Coverage estimation.
- Trivial Case 2: Zero Data Availability on energy consumption from data input
  ⇒ The entire energy consumption of the building is estimated using the reported floor area and the median energy intensity for the property subtype and country (see Appendix III. Data: Median Energy Intensity).

Estimating Energy Consumption from incomplete Data Coverage

Summary of estimation approach

We estimate the remaining (uncovered) energy consumption of a given floor area using the remaining floor area and a mix of (a) the energy intensity of the reported data for that floor area type and (b) the median intensity for that property subtype and country (see Appendix III. Methodology Data: Median Energy Intensity). The weight of either intensity (a) or (b) in the construction of the estimated intensity is determined by the Data Coverage for the given floor area. If the coverage is high, it can be reasonably assumed that the remaining floor area has an energy intensity closer to that of the covered floor area. If the coverage is low, there is more uncertainty that the remaining floor area follows the same pattern as the covered floor area, so the median intensity for the same Property Type and Country is given more weight.

We assume that the energy consumption characteristics of a property are more comparable with other assets from the same Property Sub-Type and Country, regardless of the energy types those properties use. Thus, gaps in energy consumption data are estimated using combined energy consumption, as opposed to per energy type.

Edge Cases

- Trivial Case 1: Full Data Coverage on energy consumption for a building from data input
  ⇒ No energy estimation necessary.
- Trivial Case 2: Zero Data Coverage on energy consumption from data input
  ⇒ The entire energy consumption of the building is estimated using the reported floor area and the median energy intensity for the property subtype and country (see Appendix III. Data: Median Energy Intensity).

Reporting method

If data is reported at the Whole Building level, the estimation procedure is conducted at the Whole Building level. If data is reported at the subspace level, the estimation procedure is conducted at the floor area type level. Furthermore, if the energy consumption relating to outdoor areas cannot be dissociated from building energy consumption, the 2023 Real Estate Assessment requirements allow participants to report both as Whole Building energy consumption. In this (rare) case, the energy consumption related to outdoor areas will be included in the estimation calculations.

2. Conversion into Absolute GHG Emissions

At its most basic, GHG emissions associated with a particular amount of energy may be calculated by multiplying that amount of energy (measured in kWh) with the emissions factor (a conversion factor with the unit kgCO2e/kWh) associated with the specific energy source.

*GHG emissions = energy consumption * emissions factor*

For all reported data, the energy consumption is multiplied by the energy type-specific emissions factor (EF) (see Appendix III. Methodology Data: Emissions Factors) for its reported energy type - electricity, fuel, or district heating and cooling.

Estimated energy consumption data is multiplied by the Floor Area Type Residual EF, which is a property subtype- and country-specific emission factor that is designed to more accurately reflect the combination of energy types that supply the remaining floor area see Appendix III. Methodology Data: Emissions Factors: Asset-specific Residual EF).

For assets with no reported energy consumption data, the estimated GHG emissions is the product of the reported floor area, the median energy intensity for the asset type (see Appendix III. Data: Average Energy Intensity), and the GRESB-derived bucket-specific EF for the asset (see Appendix III. Data: Emissions Factors: Bucket-specific EF).

Treatment of Renewable Energy

Renewable energy used in this methodology is reported by the Participant in the 2023 Real Estate Assessment. No estimation of renewable energy is conducted.

Off-site Renewable Energy

For the calculation of location-based GHG emissions[5], renewable energy that is generated off-site is not counted toward the reduction of GHG emissions.
For the calculation of market-based GHG emissions, renewable energy that is generated off-site is subtracted from the reported

building electricity consumption. If the amount of renewable energy generated off-site is greater than the reported electricity consumption, the remainder is subtracted from reported district heating and cooling.

On-site Renewable Energy

For the calculation of GHG emissions, renewable energy generated and consumed on-site is subtracted from reported building electricity consumption. If the amount of renewable energy generated and consumed on-site is greater than the reported electricity consumption, the remainder is subtracted from reported district heating and cooling.

Note: The treatment of renewable energy generated and consumed on-site assumes that such energy reported by GRESB Participants is primarily renewable electricity. As such, it does not distinguish between renewable electricity and renewable district heating when calculating the corresponding GHG emissions. As a consequence, the calculated GHG Emissions for an asset that procures geothermal energy (considered renewable heating) might be slightly off, depending on the difference between the asset's electricity EF and its heating EF.

Exported Renewable Energy

Exported renewable energy is not subtracted from the building's energy consumption before calculation of the GHG emissions. This is consistent with the GHG Protocol's Scope 2 Guidance[6].

3. Calculation of GHG Intensities

The calculation of GHG intensity is derived by dividing absolute GHG emissions (kgCO2e) by the floor area (m2) over which the corresponding energy was consumed.

$$GHG\ Intensity = \frac{GHG}{area}$$

This is generally done at the Whole Building level, but can be done at most levels - e.g. for any particular building subspace, for reported data, for estimated data, etc.

4. Aggregation of GHG Intensities

Asset-level GHG intensities are aggregated to portfolio-level (or multi-asset) GHG intensities by taking the floor area-weighted average of the asset-level intensities, as well as considering the percentage of ownership reported at the asset level in the 2023 GRESB Real Estate Assessment.

Appendix III. Methodology Data

Median Energy Intensity

The median energy intensities used in the estimation of uncovered floor area are the median of the energy intensities of the GRESB asset universe per Property Sub-Type/Country cross section. The sample used to calculate the median intensity value includes assets with 100% Data Coverage and Data Availability, and excludes outliers and non-occupied properties.

The median intensity, as opposed to the average (arithmetic mean) intensity, is used because it is more representative of the most likely intensity of the missing consumption. The average (arithmetic mean) intensity would be skewed toward the intensity of larger assets.

If there is an insufficient number of assets that fulfill the above criteria in the Property Sub-Type/Country cross section to calculate a representative median energy intensity, the cross section is widened to the next higher cross section following the Real Estate Benchmark Peer Group Allocation Logic outlined in Appendix 3b of the GRESB Real Estate Assessment Reference Guide.

Emissions Factors

Electricity (grid)

For countries covered by CRREM decarbonization pathways, we use the CRREM-derived EFs for electricity from the grid. For all other countries, we use the grid EFs from the UNFCCC's GHG Emissions Calculator v2.6[7]. The grid EFs for Taiwan are sourced from the Taiwan Bureau of Energy[8].

Fuel

GRESB does not differentiate between various possible fuel options for on-site generation and energy consumption. The EF for the GRESB fuel input is calculated as the weighted average of the corresponding EFs by the proportion of fuel supplied by coal, oil, gas, LPG, wood, and distillates used in commercial and residential buildings, respectively.[9].

District heating and cooling

The GHG intensities of district heating and cooling are generally related to that of their corresponding electricity infrastructure[10]. As implemented in the CRREM tool, the ratio between the electricity EF of the UK in 2018 and the district heating EF of the UK in 2018 was used to derive the district heating and cooling EFs of any country based on that country's electricity EF.

Building-specific EF

For assets with no reported energy consumption data, the estimated GHG emissions is the product of the reported floor area, the average energy intensity for the asset type (see Appendix I. Data: Average Energy Intensity), and the GRESB-derived bucket-specific EF for the asset.

A building-specific EF for each Property Sub-Type/Country cross section is the average of the country-specific electricity EF (see Appendix III. Methodology Data: Emissions Factors: Electricity (grid)), country-specific DHC EF (see Appendix III. Methodology Data: Emissions Factors: District Heating and Cooling), and Property Sub-Type/Country cross section-specific fuel EF, weighted by the bottom-up derived proportion of energy supplied to an average asset from electricity, district heating and cooling, and fuels, respectively.

The average energy splits used in the weighting of EFs were derived from the energy splits of the GRESB asset universe per Property Sub-Type/Country. The sample used to calculate the average energy splits includes assets with 100% Data Coverage and Data Availability, and excludes outliers and non-occupied properties.

If there is an insufficient number of assets that fulfill the above criteria to calculate a representative average energy intensity in the Property Sub-Type/Country cross section, the cross section was widened to the next higher cross section following the Real Estate Benchmark Peer Group Allocation Logic outlined in Appendix 3b of the GRESB Real Estate Assessment Reference Guide.

Floor Area Type Residual EF

A Property Sub-Type- and Country-specific EF that is designed to more accurately reflect the combination of un-reported energy types that supply the remaining floor area.

Participant Notes

A separate document is added to the Transition Risk Report so that participants can explain their results to investors.

Check Notes

Citations

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5. GHG Protocol [The Greenhouse Gas Protocol] (2004) A Corporate Accounting and Reporting Standard: Revised Edition. Online: https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf
6. "For accurate scope 2 GHG accounting, companies shall use the total—or gross—electricity purchases from the grid rather than grid purchases "net" of generation for the scope 2 calculation. A company's total energy consumption would therefore include self-generated energy (any emissions reflected in scope 1) and total electricity purchased from the grid (electricity). It would exclude generation sold back to the grid." GHG Protocol [Greenhouse Gas Protocol] (2015). GHG Protocol Scope 2 Guidance: An Amendment to the GHG Protocol Corporate Standard. Online: https://ghgprotocol.org/sites/default/files/ghgp/standards/Scope%202%20Guidance_Final_0.pdf
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