Measurabl's Benchmarks for Energy Usage Intensity and Carbon Emissions Intensity

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Executive Summary

This document provides an overview of the methodology for calculating Measurabl's Benchmarks for Energy Usage Intensity and Carbon Emissions Intensity incorporated in Measurabl's Data products. Measurabl's energy and carbon benchmarks offer detailed, historical comparative data to evaluate the estimated sustainability performance of a building against state/province, country, regional, continental, global and property type-specific performance indicators.

Methodology

Definitions

1. *Energy Use Intensity (EUI)*: Energy use per unit of floor area, measured in kWh/ft2 or kWh/m2.

2. *Carbon Emissions Intensity (CEI)*: Carbon emissions per unit of floor area, measured in kgCO2e/ft2 or kgCO2e/m2.

3. *1st Intensity Quartile (Q1):* The 25th percentile value in the intensity distribution

4. *2nd Intensity Quartile (Q2):* The 50th percentile value in the intensity distribution, also known as the median value

5. *3rd Intensity Quartile (Q3):* The 75th percentile value in the intensity distribution

6. *Mean Intensity:* The average value of the intensity distribution

7. *Benchmarking Cohort:* The set of all buildings from a certain property type that were used to compute the benchmarking metrics at a given location level

8. *Benchmarking Cohort Building Count Threshold:* The minimum number of buildings required to form a cohort, currently set to 10.

9. *Benchmarking Customer Count Threshold:* The minimum number of customers per property type and location required to form a benchmarking cohort.

Benchmarking Dataset

One of the key strengths of Measurabl's Benchmarks is the freshness of the underlying data. Utility data flows into Measurabl's database continuously, thus enabling us to update the benchmarking datasets on a monthly basis. Information regarding the present size of Measurabl's Benchmarks dataset derived from Measurabl's data through a thorough quality control process can be found in Appendix A.

Energy Usage

The dataset used for Energy benchmarking is a subset of Measurabl's data defined as follows:

1. Space-level data is aggregated at the building level, and only spaces with available, actual utility data are included. Building floor area without data coverage is subtracted from the total building floor area. This ensures that buildings' energy use intensity (EUI) is not underestimated due to spaces with missing data. Further, we exclude buildings with data only from exterior meters and/or common space meters, and buildings that don't have electric meters in Measuabl's database.

2. Outliers in the floor area, energy use, and energy use intensity distributions are removed using a thorough and robust process.

3. Annual EUI values for each building are calculated based on aggregating the monthly energy usage values which meet the data quality specifications outlined above.

Carbon Emissions

The Carbon benchmarking dataset is based on the subset of Measurabl's data incorporated in the Energy Benchmarking dataset, including the following additional steps:

1. Monthly carbon emissions are calculated at the meter-reading level as the product of the monthly energy usage and the corresponding emissions factors, in line with [Measurabl's Greenhouse Gas Emissions Methodology.](#)

2. Carbon emissions at the meter level are consolidated at the space level, followed by the building level, in order to compute the monthly building carbon emissions intensity (CEI). This data is then accumulated for each calendar year.

Benchmarking Logic

Measurabl provides EUI and CEI benchmarks across more than 100 property types with a variable location granularity based on the availability of data in Measurabl's benchmarking dataset for each calendar year.

Measurabl creates benchmarking cohorts at the most granular property type and location levels that meet specific building and customer count thresholds. These thresholds serve a dual purpose: they guarantee data anonymity, which is a top priority for Measurabl, and they ensure

that the underlying data distributions are large enough to provide meaningful benchmarking metrics.

In the case when the threshold requirements cannot be satisfied at a certain property type and location level, due to data availability limitations, Measurabl moves up in its benchmarking prioritization hierarchy, outlined below, by reducing the property type level or/and location granularity, until the thresholds are met. However, certain property types are not adequately represented even at the lowest granularity levels. In such cases, Measurabl applies a benchmarking cohort based on the "Other" property type (Appendix B), with metrics available at the country, region, continent, and/or global levels.

Benchmarking prioritization hierarchy

Measurabl prioritizes the benchmarking cohorts based on the availability of data across all property types and location levels in the following order:

1. State/Province/Prefecture + MSR Lvl 3 Use Type
2. State/Province/Prefecture + MSR Lvl 2 Use Type
3. State/Province/Prefecture + MSR Lvl 1 Use Type
4. Country Subregion + MSR Lvl 3 Use Type
5. Country Subregion + MSR Lvl 2 Use Type
6. Country Subregion + MSR Lvl 1 Use Type
7. Country + MSR Lvl 3 Use Type
8. Country + MSR Lvl 2 Use Type
9. Country + MSR Lvl 1 Use Type
10. Continental Subregion + MSR Lvl 3 Use Type
11. Continental Subregion + MSR Lvl 2 Use Type
12. Continental Subregion + MSR Lvl 1 Use Type
13. Continent + MSR Lvl 3 Use Type
14. Continent + MSR Lvl 2 Use Type
15. Continent + MSR Lvl 1 Use Type
16. Global + MSR Lvl 3 Use Type
17. Global + MSR Lvl 2 Use Type
18. Global + MSR Lvl 1 Use Type
19. Country + MSR "Other" Use Type
20. Continent Subregion + MSR "Other" Use Type

21. Continent + MSR "Other" Use Type

22. Global + MSR "Other" Use Type

Benchmarking Metrics

Measurabl offers a range of benchmarking metrics that effectively represent the EUI and CEI distributions within each benchmarking cohort, as depicted in Fig.1. The median intensity, being resistant to outliers, accurately reflects the central tendency of the data. When combined with the first and third quartiles, it conveys the variability within the cohort's intensity distribution. Along with the quartiles of the intensity distribution, Measurabl also presents the mean intensity for comparative purposes. In the figure, the color-coded areas signify the quartile ranges. For example, top-performing buildings have intensities lower than the 1st quartile, while those with intensity values exceeding the 3rd quartile are linked to subpar performance.
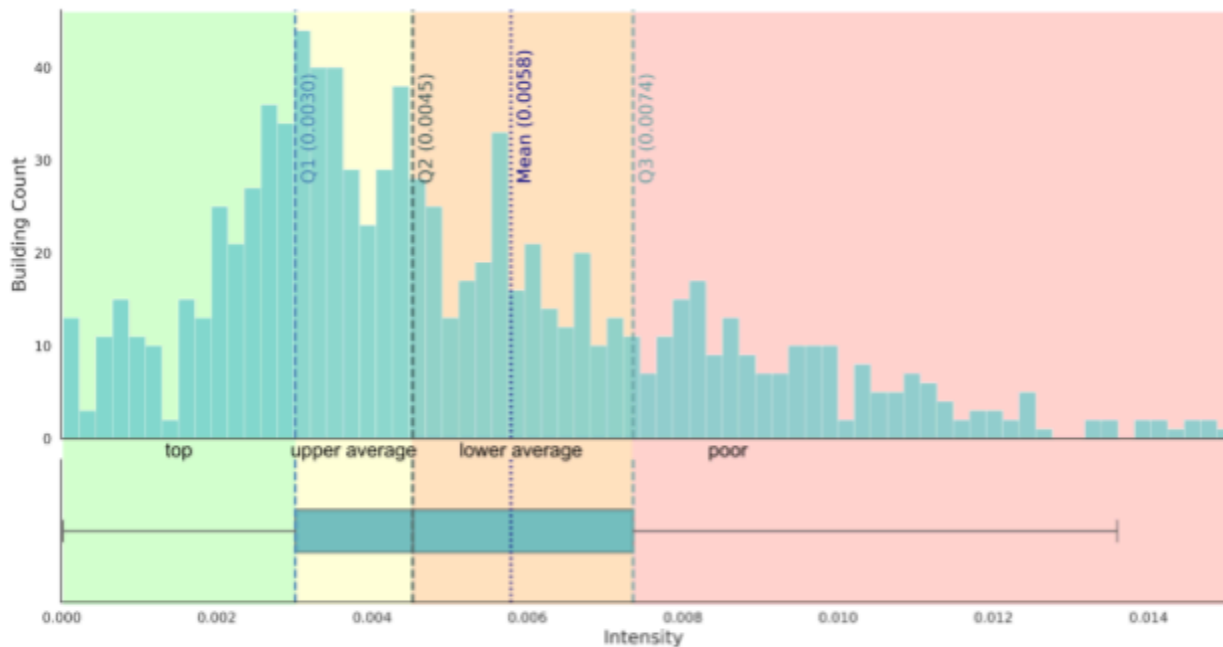
Fig.1: An example histogram (top) and a boxplot (bottom) of a distribution of intensity values with vertical lines indicating the 1st, 2nd (Median), and 3rd quartiles, along with the mean value. The vertical axis represents the number of buildings in each intensity bin. The colored zones represent the quartile ranges, e.g., top performing buildings have intensities smaller than the 1st quartile, while intensity values larger than the 3rd quartile are associated with poor performance.

Property Type Hierarchy

Measurabl's 3-tier property type hierarchy, available in Appendix B, preserves the existing relationships across property types available within Measurabl (e.g., Refrigerated Warehouse and Non-refrigerated Warehouse are subtypes of Warehouse/Distribution Center, which, in turn, is a subtype of Warehouse/Storage).

Benchmarks in Measurabl's Data Products

Measurabl's Benchmarks are available through ESGx Buildings and Diligence. Available in Appendix C, are each of the data points that are generated in relation to an energy and/or carbon estimate and utilized by Measurabl's data solutions to provide performance context in relation to asset performance estimates.

ESGx Buildings

As a component of Measurabl's ESGx Buildings, each inquiry for energy or carbon estimates pertaining to an asset triggers the delivery of a set of benchmarks that provide relevant performance context.

Diligence

Similarly, Measurabl's Diligence includes benchmarks data in each scan to illustrate trends in usage, in addition to relevant performance context. To facilitate this process, whenever a scan is generated for a particular building, Measurabl conducts a lookup against a predetermined set of benchmarking metrics that are derived from the building's requested property type and location. The output of this lookup comprises benchmarking metrics that are based on an applied benchmarking property type, covering all available location levels.

Appendix A: Size of Measurabl's Benchmarking Dataset

The size of Measurabl's Benchmarking dataset fluctuates monthly, depending on the availability of data that fulfills the necessary quality criteria. The table presented below offers an up-to-date (as of September 2024) overview of the number of buildings with high data quality incorporated in each yearly dataset.

Calendar Year	Number of Buildings
2023	12,900
2022	13,600
2021	12,050
2020	12,520
2019	11,400
2018	7,530

Appendix B: Measurabl's Property Type Hierarchy

MSR Type Level 1	MSR Type Level 2	MSR Type Level 3
Banking/Financial Services		
	Bank Branch	
	Other - Banking/Financial Services	
Data Center		
Education		
	Adult Education	
	College/University	
	K-12 School	
	Pre-school/Daycare	
	Vocational School	
	Other - Education	

Food Sales & Service		
	Cafeteria	
	Food Sales	
	Food Service	
	Restaurant/Bar	
		Fast Food Restaurant
		Restaurant
		Other - Restaurant/Bar
	Supermarket/Grocery Store	
	Wholesale Club/Supercenter	
	Other - Food Sales & Service	
Healthcare		
	Ambulatory Surgical Center	
	Hospital	
		General Medical & Surgical Hospital
		Other - Specialty Hospital
	Outpatient Rehabilitation/Physical Therapy	
	Urgent Care/Clinic/Other Outpatient	
	Other - Healthcare	
Hotel		
Indoor Parking		
Laboratory		
Leisure		
	Aquarium	
	Bar/Nightclub	
	Bowling Alley	
	Casino	

	Fitness Center/Health Club/Gym	
	Ice/Curling Rink	
	Movie Theater	
	Museum	
	Performing Arts	
	Roller Rink	
	Stadium	
		Closed Stadium
		Indoor Arena
		Open Stadium
		Race Track
		Other - Stadium
	Swimming Pool	
	Zoo	
	Other - Leisure	
Manufacturing/Industrial Plant		
Office		
	Financial Office	
	Medical Office	
	Office	
	Veterinary Office	
	Other - Office	
Public Assembly		
	Convention Center	
	Social/Meeting Hall	
	Other - Public Assembly	
Public Services		
	Airport	

	Courthouse	
	Fire Station	
	Library	
	Mailing Center/Post Office	
	Police Station	
	Transportation Terminal/Station	
	Other - Public Services	
Religious Worship Facility		
Residential		
	Barracks	
	Multifamily Housing	
		1-4 stories - Multifamily Low-rise
		5-10 stories - Multifamily Mid-rise
		10+ stories - Multifamily High-rise
		Other - Multifamily
	Prison/Incarceration	
	Residential Care Facility	
	Residence Hall/Dormitory	
	Senior Care Community	
	Single Family Home	
	Other - Residential	
Retail		
	Automobile Dealership	
	Convenience Store	
		Convenience Store with Gas Station
		Convenience Store without Gas Station
	Mall	

		Enclosed Mall
		Lifestyle Center
		Strip Mall
		Other - Mall
	Retail Store	
	Other - Retail	
Utility		
	Drinking Water Treatment & Distribution	
	Energy/Power Station	
	Wastewater Treatment Plant	
	Other - Utility	
Warehouse/Storage		
	Self-Storage Facility	
	Warehouse/Distribution Center	
		Distribution Center
		Non-Refrigerated Warehouse
		Refrigerated Warehouse
	Other - Warehouse/Storage	
Other		

Appendix C: Measurabl's Benchmarks API Fields

1. 'year': year for the provided benchmarking values
2. 'intensityType': carbon emissions intensity or energy usage intensity
3. 'appliedPropertyType': applied property type for benchmarking based on the benchmarking logic
4. 'continent': continent
5. 'continentSubregion': continent subregion
6. 'countryCode': alpha-2 country code
7. 'countrySubregion': country subregion, currently only available for the United States Census Regions
8. 'stateProvincePrefecture': state/province/prefecture value, currently only available for the United States
9. 'intensityBenchmarkUnits': units of measurement for the intensity-based metrics
10. 'globalMeanIntensity': mean value of the intensity distribution at the global level
11. 'globalFifteenthPercentileIntensity': 15th intensity percentile at the global level
12. 'globalFirstQuartileIntensity': first intensity quartile at the global level
13. 'globalThirtiethPercentileIntensity': 30th intensity percentile at the global level
14. 'globalSecondQuartileIntensity': second intensity quartile (median) at the global level
15. 'globalThirdQuartileIntensity': third intensity quartile at the global level
16. 'continentMeanIntensity': mean value of the intensity distribution at the continent level
17. 'continentFifteenthPercentileIntensity': 15th intensity percentile at the continent level
18. 'continentFirstQuartileIntensity': first intensity quartile at the continent level
19. 'continentThirtiethPercentileIntensity': 30th intensity percentile at the continent level
20. 'continentSecondQuartileIntensity': second intensity quartile (median) at the continent level
21. 'continentThirdQuartileIntensity': third intensity quartile at the continent level
22. 'continentSubregionMeanIntensity': mean value of the intensity distribution at the continent subregion level
23. 'continentSubregionFifteenthPercentileIntensity': 15th intensity percentile at the continent subregion level
24. 'continentSubregionFirstQuartileIntensity': first intensity quartile at the continent subregion level

25. 'continentSubregionThirtiethPercentileIntensity': 30th intensity percentile at the continent subregion level

26. 'continentSubregionSecondQuartileIntensity': second intensity quartile (median) at the continent subregion level

27. 'continentSubregionThirdQuartileIntensity': third intensity quartile at the continent subregion level

28. 'countryMeanIntensity': mean value of the intensity distribution at the country level

29. 'countryFifteenthPercentileIntensity': 15th intensity percentile at the country level

30. 'countryFirstQuartileIntensity': first intensity quartile at the country level

31. 'countryThirtiethPercentileIntensity': 30th intensity percentile at the country level

32. 'countrySecondQuartileIntensity': second intensity quartile (median) at the country level

33. 'countryThirdQuartileIntensity': third intensity quartile at the country level

34. 'countrySubregionMeanIntensity': mean value of the intensity distribution at the country subregion level

35. 'countrySubregionFifteenthPercentileIntensity': 15th intensity percentile at the country subregion level

36. 'countrySubregionFirstQuartileIntensity': first intensity quartile at the country subregion level

37. 'countrySubregionThirtiethPercentileIntensity': 30th intensity percentile at the country subregion level

38. 'countrySubregionSecondQuartileIntensity': second intensity quartile (median) at the country subregion level

39. 'countrySubregionThirdQuartileIntensity': third intensity quartile at the country subregion level

40. 'stateProvincePrefectureMeanIntensity': mean value of the intensity distribution at the state/province/prefecture level

41. 'stateProvincePrefectureFifteenthPercentileIntensity': 15th intensity percentile at the state/province/prefecture level

42. 'stateProvincePrefectureFirstQuartileIntensity': first intensity quartile at the state/province/prefecture level

43. 'stateProvincePrefectureThirtiethPercentileIntensity': 30th intensity percentile at the state/province/prefecture level

44. 'stateProvincePrefectureSecondQuartileIntensity': second intensity quartile (median) at the state/province/prefecture level

45. 'stateProvincePrefectureThirdQuartileIntensity': third intensity quartile at the state/province/prefecture level