CORNELL PETER AND STEPHANIE NOLAN SCHOOL OF HOTEL ADMINISTRATION
CENTER FOR HOSPITALITY RESEARCH

CHR Roundtable

Hotel Sustainability Benchmarking Index 2024

Carbon, Energy, and Water

by Eric Ricaurte and Rehmaashini Jagarajan

Executive Summary

For the first time in the ten annual cycles of the Cornell Hotel Sustainability Benchmarking study, we find a general increase from 2021 to 2022 in energy and water consumption among participating hotels. This increase is largely associated with the global recovery from the anomaly of 2021, where occupancy levels were lower than usual and most hotels were not operational for the full year due to the pandemic. The increase in hotel occupancy rates between 2021 and 2022 and recovery to pre-pandemic operating levels contributed to the increase in energy consumption levels in 2022. Comparison between 2019 and 2022 consumption levels show a general decrease in energy and water consumption per square meter, but an increase in energy and water consumption per occupied room. This observation is largely attributed to the lag time between the resumption of hotel operations and the return of travelers.

ABOUT THE AUTHORS

Eric Ricaurte founded Greenview in 2008, the leading consulting and data firm for sustainability within hospitality and tourism. Greenview's 50+ clients include hotel companies of all sizes and profiles, as well as hotel owners and developers, event organizers, cruise lines, NGOs, DMOs, OTAs and industry organizations including the WTTC, UNWTO, and AHLA. With over 25 years of hands-on experience in both sustainability and industry, Eric is a frequent speaker, convener, and researcher. His notable industry work includes working as a technical consultant for the Hotel Carbon Measurement Initiative and launching initiatives including the Cornell Hotel Sustainability Benchmarking Index, Green Lodging Trends Report, Destination Water Risk Index, Hotel Owners for Tomorrow Coalition, Global Hotel Decarbonisation Report and Hotel Net Zero Methodology. Prior to founding Greenview, Eric specialized in the operations and development of nature-based lodges, theme parks and attractions in Costa Rica, Mexico, and Brazil. Eric is a member of the International Standards Committee of the GSTC and the Board of Advisors of the Phuket Hotels Association. Eric earned a Bachelor of Science from the Cornell University School of Hotel Administration and a Master of Science in Tourism & Travel Management from New York University.

Rehmaashini Jagarajan, Ph.D., is a Senior Manager at Greenview with a primary role in data management and measurement, data platform enhancements, programs development and implementation, reporting, and research services in the areas of corporate responsibility and sustainability. She also sets up and manages company's related processes and data flows, as well as team's collaboration and productivity. She is an expert in processing, manipulating, analyzing and interpreting large data sets to identify trends and patterns and can communicate the findings efficiently. Rehma also leads the continuous development of the company's sustainability data management system; the Greenview Portal and data analytic tool; the Greenview Hotel Footprinting Tool, as well as their use with clients. Additionally, she performs benchmarking studies on sustainability programs, goals, disclosures, performance, and rankings. She leads the industry-led global data collection and benchmarking initiatives; the Cornell Hotels Sustainability Benchmarking Index (CHSB) published by Cornell's School of Hospitality Research and the global benchmarking study on sustainability best practices in hotels; the Green Lodging Trends Report (GLTR). Moreover, Rehma is also familiar with ESG reporting frameworks, and leads the data workstreams.
Prior to Greenview, she has served as a Property Researcher at Raine & Horne International (Malaysia) specializing in market research and feasibility studies. She has experience conducting and preparing market research for the purpose of determining the highest and best use of land, ascertaining appropriate development proposals, and preparing feasibility studies relating to new development projects, subdivisions and renovation and refurbishment to existing buildings. She has also served as a valuation executive at JS Valuers Property Consultants Group Malaysia providing valuation services covering extensive range of properties for various different purposes.
Rehma is based in Malaysia. She has a Doctorate Degree (PhD) in Facilities Management with a focus on sustainable buildings and a Bachelor's Degree in Property Management from the University of Technology Malaysia.

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ABOUT THIS STUDY

This document, the Cornell Hotel Sustainability Benchmarking Index's tenth annual report (CHSB 2024), summarizes the findings of the data analysis from calendar year 2022. The study is being carried out through a partnership between the Cornell University Center for Hospitality Research, participating hotels, Greenview, and an industry advisory group. This report is an update to the CHSB2023 report published with data from calendar year 2021. The industry's largest and most representative data collection for benchmarking activities related to energy, water, and emissions are presented in this year's study together with a quick overview on the year-over-year change in numerous different hotel segments. Like this report, the data set remains freely available for download from the Cornell University Center for Hospitality Research. This study presents historical patterns across like-for-like changes over the previous year, expands the data set's geographic coverage, and builds upon the existing methodology.

The 2022 dataset saw a 7.4-percent increase in the number of hotels participating in data collection. Most markets have recovered from the pandemic, and hotels have generally resumed operations. The study recorded a 24.6-percent increase in valid outputs, with 20,301 hotels contributing to the final global dataset.

The 2022 dataset features the following improvements over the 2021 dataset:

- Increased the number of geographies from 646 to 1,072 across 709 market areas, 84 regions, 83 countries, and 185 climate zones (i.e., 21 Koeppen-Geiger Climate Zones, 35 Baliey's Ecoregions, and 140 WWF Terrestrial Ecoregions);
- Increased the number of hotels for which benchmarks have been outputted to 20,301 (increase of 24.6%);
- Increased the number of hotels participating to 27,467 (increase of 7.4%);
- Increased the room count coverage of the output dataset to 3,634,864 rooms (increase of 27.5%); and
- Increased the floor area coverage of the output dataset to 306,921,582 square meters (increase of 32.8%).

The increase in data outputs enriches the quality of the dataset and better informs the resulting analysis, which can be used for further research and decision-making purposes. Data collection is now underway for CHSB2025, using calendar year 2023 data.

EXHIBIT 1

Participating organizations

Accor
AINA Hospitality
AMAN Resorts
Casale Panayiotis
Centara Hotels & Resorts
Chatham Lodging Trust
Deutsche Hospitality
DiamondRock Hospitality Company
FIVE Holdings
Four Seasons
Highgate
Hilton Worldwide
Hongkong & Shanghai Hotels
Horwath HTL Asia Pacific
Hotel Asset Value Enhancement (HotelAVE)
Hyatt Hotels Corporation
InterContinental Hotels Group
Jumeirah Group
KHP Capital Partners
Mandarin Oriental Hotel Group
Marriott International
Millennium Hotels and Resorts
Park Hotel Group
Park Hotels & Resorts
Pebblebrook Hotel Trust
Pineapple Hospitality Company
Playa Hotels & Resorts
Post Ranch Inn
Radisson Hotel Group
RLJ Lodging Trust
Rosewood Hotels & Resorts
Ryman Hospitality Properties
Six Senses
Sutton Hotel Collection
The Ascott Limited
The Fullerton Hotels Singapore
The Ranch at Laguna Beach
The RuMa Hotel and Residences
Valamar Riviera
Vista Hospitality Group
Wyndham Hotels & Resorts
Xenia Hotels & Resorts

EXHIBIT 2:

Data collection points used to generate the external CHSB2024 benchmarks

Data Point	Description
Internal Brand Code	Unique identifier code used by the property's parent brand.
Participant Code	Unique identifier code used by the participating entity, if different from the brand code. For example, an owner of a franchisee of a portfolio of hotels may use separate identifiers, to avoid duplication of properties within the data set.
Hotel Name	Name of hotel.
Address	Street address of hotel.
City	City where the hotel is located.
State or Province	State or province where the hotel is located.
Country	Country where the hotel is located.
Postal Code	Postal code (i.e., zip code) where the hotel is located.
Brand Flag	Name of brand the property is operating under.
STR Market Segment	Chain scale segment according to STR Global Chain Scales.
Asset Class	The service class of the property, either Full Service or Limited Service.
Hotel Type – Group	Type of hotel, either Resort or Non-resort
Hotel Type – Sub-group	The specific type of resort or non-resort. The types of resorts include Beach Resort, Ski Resort, Integrated Resort, All Inclusive Resort (AIR), All Other Resort (AOR). The types of non-resorts include All Suites or Extended Stay Hotel, Airport Hotel, Bed & Breakfast or Inn, Convention or Conference Hotel, Lifestyle Hotel, All Other Hotel (AOH).
Hotel Operational Type	Type of property based on when it is open and operational, either Year-Round, Summer Seasonal, or Winter Seasonal.
Expedia Stars	Number of stars listed in Expedia (or estimated where not found). Half stars are assigned one level down (i.e. 2.5 stars = 2 stars).
Location Type	The location segment of the property: Urban, Suburban, Rural/Highway, Small Metro/Town.
Room Count	The total number of guestrooms for the hotel in 2022. If a hotel's room count changed during the year, the value most representative of the hotel's room count for 2022 was used.
Area Unit	Choose either "sqft" or "sqm" to indicate the units of measurement of the floor area data being entered (either square feet or square meters).
Total Conditioned Space Area	Total floor area of a property that is heated or cooled. The total conditioned space value should equal Rooms Area + Meeting Space Area + Other Area.
Rooms Area	Total area of conditioned space of the rooms and corridors, per the HCMI guidance.
Meeting Space Area	Total area of conditioned space of the meeting space and pre-function space in the hotel, per HCMI guidance.
Other Area	The total remaining area of conditioned space within the property is not covered by rooms and meeting space.
Total Built Area	The total built floor area of the entire property.
Year Opened	The year the property originally opened, regardless of whether major renovations have occurred since that year.

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EXHIBIT 2 (CONCLUDED)

Data collection points used to generate the external CHSB2024 benchmarks

Laundry	Choose either "Included" or "Not Included" to denote whether the energy consumption includes the washing of bedroom linens. For properties with partial in-house wash, the determining factor is whether bedroom linens are included in that wash. For example, linen wash of restaurant linens or guest clothing only, would be considered "not included."
12-Month Operation	Confirm with a "Yes" that the hotel was in operation for all of 2022 without any shutting down or major renovation that would significantly alter the energy consumption or occupancy (either rooms or meeting space) during the period.
Energy Verification	Indicate whether the energy data for each property has been 3rd party verified per the following choices: Limited, Reasonable, Full, No, and Don't know. Limited refers to a company-wide 3rd party "limited assurance", Reasonable refers to a companywide 3rd party "reasonable assurance" and "full" indicates that the specific property's data have been 3rd party verified onsite or through direct examination of billing and consumption.
Water Verification	Indicate whether the water data has been 3rd party verified per the following choices: Limited, Reasonable, Full, No, Don't know. Limited refers to a company-wide 3rd party "limited assurance", Reasonable refers to a companywide 3rd party "reasonable assurance" and "full" indicates that the specific property's data have been 3rd party verified onsite or through direct examination of billing and consumption.
Unit	Enter the unit of measurement for the data entered.
Occupied Rooms	The total number of occupied rooms for the hotel for each month in 2022. Rooms sold may be used as a proxy.
Water Consumption by Type	The total water consumption for each month in 2022, as provided by the utility provider by type of water source. For a detailed description of the boundary, please refer to Appendix 1, which outlines the included and excluded water types.
Energy Consumption by Type	The total energy usage for each month in 2022, as provided by the utility provider by type of energy source. For a detailed description of the boundary, please refer to Appendix 2, which outlines the included and excluded energy types.

Overview

The tenth edition of this annual study has the following objectives:

- Establish credible benchmarks based on industry-specific segmentation and metrics on a global scale;
- Conduct industry data analysis using a confidential data set; and
- Advance toward commonly defined, transparent, and rigorous methods for modeling energy, water, and carbon, based on hotel-specific attributes and data that are applicable and current.

The index provides benchmark ranges for thirteen distinct measures related to energy, water, and carbon emissions across 1,072 geographies, defined by market area, country, climate zone, and other geographic or political boundaries. Additionally, the data are segmented by various hotel types, including asset class, location, type of hotel, market segment, and classification by stars. This comprehensive approach ensures that the benchmarking data are both detailed and relevant for a wide range of stakeholders in the hospitality industry. For the full list of examples of how different stakeholders have been using the CHSB dataset, refer to the "CHSB Uses" section of the CHSB2024 Index Tool.

This edition of the index no longer provides the statistical output for "all hotels," since a particular segment that is dominant in a given geography might skew the output for all hotels in that geography. This category's removal is intended to prevent the misrepresentation of a geography's performance that might occur due to the skewing of any hotel type that is dominant in the area. For the full list of updates and changes made to the CHSB2024 dataset, refer to the "What's New" section of the CHSB2024 Index Tool.

Data Set

Input

During the data collection process, the aggregated data for the 2022 calendar year (most recent complete year of data available) were collected from the companies listed in Exhibit 1. The participants provided data for a total of 27,467 hotels globally, which were submitted in an aggregate data set from each participating firm or its corresponding data provider. As part of this process, 911 non-duplicated additional property records were collected from 2,564 properties by Horwath HTL Asia Pacific and then validity tested by Greenview for incorporation into the 2022 calendar-year dataset. To generate the measures within the index, the data points highlighted in Exhibit 2 were collected from each participant. For a select group of participants, Greenview cross-checked utility invoices and verified the data when contracted to do so as part of other client engagements. This means that Greenview did not conduct such independent verifications for most participants. Nonetheless, most of the data submitted was part of the GHG inventories used for participant corporate reporting, wherein the respective participants had obtained external assurance in accordance with ISO 14064. Besides confirming the presence of onsite laundry for main linen washes for Measures 1, 7, 10, and 11, no additional information was collected on the range of amenities that could contribute towards hotels' utility use.

Output

To produce the output tables for the CHSB2024 index, we followed the five-step process described below:

(1) Harmonization

First, all data were harmonized into the following common units of measure:

- energy in kilowatt-hours (kWh),[1]
- water in liters (L),
- floor area in square meters (m^2), and
- greenhouse gas emissions (also termed *carbon footprint*) in kilograms of carbon dioxide equivalent ($kgCO_2e$), converting each energy source of GHG emissions into $kgCO_2e$ (using only carbon dioxide, methane, and nitrous oxide).[2]

The set of emission factors (EFs) applied to each energy type was based on available data for each geography. The list of references for all EFs used to calculate greenhouse gas emissions are outlined in the CHSB2024 Guidance on Emissions document, available via the CHSB page on the Greenview website. In the use of Global Warming Potential (GWP) values, Greenview employs distinct methodologies for varying scenarios, as follows.

- When the source document provides separate EF values for CO_2, CH_4 and N_2O, the GWP values from the IPCC Assessment Report version stated in the source document are used to calculate the respective EF values in CO_2e.
- Otherwise, the GWP values from the latest IPCC Assessment Report at the time of calculation are used to derive the Emission Factor in CO_2e. Note that when a change in GWP value occurs due to an update in a more recent IPCC Assessment Report, the GWP values and EFs are not updated retroactively.
- When the emission factor is provided in CO_2e, the source document's GWP values are embedded in the EF. The EF provided in CO_2e is used.
- For U.S. properties, EFs for electricity are extracted from eGRID, which uses GWP values from the IPCC Fourth Assessment Report (AR4). Although separate values for CO_2e, CH_4 and N_2O are provided, the summation of these three gases does not align with the CO_2e value provided in the eGRID document. To reduce potential calculation errors, align with other U.S. EPA publications, and streamline the emission calculation process, CO_2e is used.

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1 For the CHSB Index Tool, it is assumed that no coefficient of performance (COP) is applied to the chilled water consumption data submitted in energy units such as ton-hours, kWh, kBtu, Mj, etc. However, in the hotel benchmark report, a COP of 4.0 is uniformly applied to the submitted chilled water consumption data. Also, minor energy sources such as space heaters are commonly not provided by participants and not included due to being insignificant sources.

2 Coefficient of Performance (COP) is not applied when converting chilled water consumption into $kgCO_2e$ because the emissions factor used was already applying a COP.

EXHIBIT 3

Summarized list of validity tests performed on the data set

Validity Test Description	High Threshold	Low Threshold	Action taken if beyond threshold or missing	% Of Data set Excluded
Property underwent significant renovation or closed all or significant part of floor area for a portion of the year	N/A	N/A	Excluded from Measures 1-13	1.39%
Energy Per Occupied Room Outlier (kWh/ocrm)	Please refer to the Validity Testing: Energy and Water Fences Document		Excluded from Measures 1,3,5,7	14.09%
Energy Per Square Meter Outlier (kWh/m^2)			Excluded from Measures 2,4,6,12,13	16.11%
Property did not provide any energy data	N/A	N/A	Notified only, no action taken	7.98%
Property did not have 12 separate energy data points (representing 12 months in the calendar year)	N/A	N/A	Notified only, no action taken	18.20%
Property did not provide any purchased electricity data	N/A	N/A	Excluded from Measures 1,2,3,4,5,6,7,12,13	10.32%
Property did not have 12 separate electricity data points (representing 12 months in the calendar year)	N/A	N/A	Excluded from Measures 1,2,3,4,5,6,7,12,13	16.29%
Property did not provide any occupied rooms data	N/A	N/A	Excluded from Measures 1,3,5,7,8,10,11	1.22%
Property did not have 12 separate occupancy data points (representing 12 months in the calendar year)	N/A	N/A	Excluded from Measures 1,3,5,7,8,10,11	2.80%
Occupancy Outlier	104%	35%	Excluded from Measures 1,3,5,7,8,10,11	5.77%
Property did not provide any water usage data	N/A	N/A	Excluded from Measures 8-11	13.29%
Property did not have 12 separate water data points (representing 12 months in the calendar year)	N/A	N/A	Excluded from Measures 8-11	21.38%

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EXHIBIT 3 (CONCLUDED)

Summarized list of validity tests performed on the data set (concluded)

Validity Test Description	High Threshold	Low Threshold	Action taken if beyond threshold or missing	% Of Data set Excluded
Water Per Occupied Room Outlier (L/ocrm)	Please refer to the Validity Testing: Energy and Water Fences Document		Excluded from Measure 8,10,11	23.45%
Water Per Square Meter Outlier (L/m2)			Excluded from Measure 9	14.25%
% of Floor Area attributes to Rooms Footprint*	100%	40%	Excluded from Measures 1,7,10,11	45.16%
Average SqM per guestroom of entire building outlier	2500	20	Excluded from Measures 2,4,6,9	5.11%
Average size of guestroom outliers	750	15	Excluded from Measures 1,7,10,11	47.31%
Only one source of energy was indicated for calculating total energy	N/A	N/A	Notified only, no action taken	4.61%
More than five sources were indicated for calculating total energy	N/A	N/A	Notified only, no action taken	1.02%
At least one energy or water source had a high variance of a ratio of 4 to 1 between high/low months or 80% month-to-month	N/A	N/A	Notified only, no action taken	90.35%

* The high percentage of excluded properties is primarily attributed to missing floor area breakdowns, specifically for guestroom floor area data.

For energy generated from renewable sources (e.g., wood or other biomass), biogenic CO_2 was excluded. However, per the Greenhouse Gas Protocol, emissions from CH_4 and N_2O were included. An emission factor of zero was assigned to renewable sources such as solar, wind, geothermal, or deep-water cooling.

(2) Validity Testing

Next, validity tests were conducted to identify any outliers or inaccurately submitted data. Participants were provided with an initial output containing the results of the validity tests and were given the option to either correct and update their data or to override the validity flags by confirming the accuracy of the data. For instance, participants who receive utility invoices and data on a bimonthly basis could confirm the validity of their data despite flagged inconsistencies. After receiving updated data from participants in these instances, we then repeated the validity tests using the highest or lowest threshold values (i.e., fences) that had been re-confirmed by the participants.

If a property failed a validity test, it was removed from the data set for the corresponding measure. Exhibit 3 presents the full list of validity testing conducted on the dataset, with the actions taken if a property failed the test, along with the percentage of the dataset that was excluded after the test. A detailed list of validity tests and their corresponding thresholds can be found in the Validity Testing: Energy and Water Fences document, available via the CHSB page on the Greenview website. Exhibit 4 provides a count of the data set that passed each measure. Although it is possible for a property to exceed the threshold due to expansive public areas or amenities, we implemented these limitations to maintain a representative data set.

EXHIBIT 4

Count of data set included for each measure

Measure	Description	Count of Data Set Included	% Of Data set Excluded
Measure 1	HCMI footprint per occupied room	10,997	59.96%
Measure 2	Total carbon footprint of the property divided by number of rooms	20,104	26.81%
Measure 3	Total carbon footprint of the property divided by number of occupied rooms	19,949	27.37%
Measure 4	Total carbon footprint of the property divided by the total floor area in square meters	20,104	26.81%
Measure 5	Total energy usage of the property divided by number of OCCUPIED rooms	19,950	27.37%
Measure 6	Total energy usage of the property divided by floor area of the property in SQUARE METERS	20,105	26.80%
Measure 7	HCMI Footprint of Meeting Space Per Hour Per Square Meter of Meeting Space	9,569	65.16%
Measure 8	Total water usage of the property divided by the total number of OCCUPIED ROOMS	17,827	35.10%
Measure 9	Total water usage of the property divided by the floor area of the property in SQUARE METERS	18,157	33.90%
Measure 10	HWMI Footprint Per Occupied Room	9,767	64.44%
Measure 11	HWMI Footprint of Meeting Space Per Hour Per Square Meter of Meeting Space	8,541	68.90%
Measure 12	Percentage of property's total energy that is generated from renewable sources (not including renewable mix of electric power grid)	20,301* (Including 0%)	26.09%
Measure 13	Percentage of property's total energy that is generated from renewable sources (including renewable mix of electric power grid)	20,301* (Including 0%)	26.09%

Notes: The Hotel Carbon Measurement Initiative, or HCMI, is a globally utilized methodology and tool in the hotel sector for calculating the carbon footprint of guest stays or events in a standardized manner. In this report, for Measure 1 & 7, total emissions are calculated from on-site energy and fuels consumed, as well as emissions from outsourced laundry, following the HCMI 2.0 methodology. However, for mobile fuels and refrigerants, consistent with the guidelines outlined in the Determining Materiality in Carbon Footprinting: What Counts and What Does Not study, emissions from these sources are calculated by adding a standard 1% uplift to the total emissions for each.

The Hotel Water Measurement Initiative or HWMI is the industry-accepted way to measure and compare water consumption. In this report, for Measures 10 & 11, total water usage is calculated by combining water consumption from all hotel activities, including direct building use and ancillary activities such as water purchased from municipal suppliers, on-site extraction or harvesting, and water usage from outsourced laundry, following the HWMI 1.1 methodology.

The methodology of the Hotel Water Measurement Initiative (HWMI) was used for measures 10 and 11. The HWMI metrics are based on both per guest-night and per occupied room, but due to a lack of available guest-night data, the output metrics provided were based on occupied room intensity.

(3) Geographic and Climate Zone Segmentation

The third step involved segmenting the data set based on geographic location. This was done by geocoding and then clustering each property based on unified boundaries. When we refer to **geography**, it may mean any of the following:

Market area, which refers to a large urban area consisting of a major city and its surrounding suburbs or neighboring jurisdictions. This is defined by a metropolitan statistical area (MSA), national capital region (NCR), or greater metropolitan area. It can also refer to a larger tourist destination consisting of several metropolitan areas.

Country, which refers to a political or geographical region that is recognized as an independent state and has its own government and borders.

Region, which may refer to a sub-national area such as a state or province, autonomous region, unincorporated territory, or national region, or a transnational area such as a major tourist or urban market that crosses national borders or a regional grouping of countries. We use various geographies to maximize the data output depending on the data received, and to facilitate comparisons and benchmarking.

Climate-zone segmentation, which is based on three classification systems: the Köppen-Geiger climate classification system, Bailey's Ecoregions of the World, and WWF Terrestrial Ecoregions of the World. The Köppen-Geiger system is a widely used climate classification system that categorizes regions based on temperature and precipitation patterns. Bailey's Ecoregions of the World is a classification system that categorizes regions based on their ecological characteristics, such as climate, geology, vegetation, and soils. The WWF Terrestrial Ecoregions of the World classification system categorizes regions based on ecological characteristics such as biogeography, climate, vegetation, topography, and biodiversity. The combination of these three frameworks provides a more systematic way to classify different locations with similar climate attributes.

(4) Property Segmentation

Fourth, we categorized properties into segments using a revenue-based approach and property-type segmentation similar to that used by STR Global (based on 2022 global chain scales). Additionally, we used the asset-class segmentation of full-service and limited-service hotels and a global data set of star levels for hotels

EXHIBIT 5

Segmentation categories

Asset Class
Full-Service Resort
Full-Service Non-Resort
Limited Service
Number of Stars
1 and 1.5 Stars Resort
1 and 1.5 Stars Non-Resort
2 and 2.5 Stars Resort
2 and 2.5 Stars Non-Resort
3 and 3.5 Stars Resort
3 and 3.5 Stars Non-Resort
4 and 4.5 Stars Resort
4 and 4.5 Stars Non-Resort
5 Stars Resort
5 Stars Non-Resort
Market Segment
Economy Resort
Economy Non-Resort
Midscale Resort
Midscale Non-Resort
Upper Midscale Resort
Upper Midscale Non-Resort
Upscale Resort
Upscale Non-Resort
Upper Upscale Resort
Upper Upscale Non-Resort
Luxury Resort
Luxury Non-Resort
Hotel Type – Group
Resort
Non-Resort
Hotel Type - Sub-group
Beach Resort
Ski Resort
Integrated Resort
All Inclusive Resort (AIR)
All Other Resort (AOR)
All Suites or Extended Stay Hotel
Airport Hotel
Bed & Breakfast or Inn
Convention or Conference Hotel
All Other Hotel (AOH)
Location Type
Urban Location
Suburban Location
Rural/Highway Location
Small Metro/Town Location

listed by Expedia. The resulting data set was then grouped into categories and an overall grouping was created that combined all segments within a particular geography.[3]

(5) Minimum Output Thresholds

Finally, a minimum threshold of five properties for market areas and eight properties for all other geographies was set for a data output. If a particular segment within a market contained at least five properties, or if a particular segment within a region, country, and climate zone contained at least eight properties, the results were included in the index tool. On the other hand, data for geographies that did not meet the minimum threshold were excluded from the final outputs. After applying the validity tests and removing geographies with fewer than the minimum threshold, the final output tables in CHSB2024 comprise 20,301 properties across 1,072 geographies. This represents an increase from the previous year's dataset (i.e., 2021 calendar-year data for CHSB 2023), with 24.6-percent more properties contained in the 2022 dataset. The increase in data collected and changes in minimum thresholds for market areas resulted in the addition of 63.7-percent more new geographies.

FINDINGS

With the hospitality industry regaining momentum and recovering from the COVID-19 pandemic in 2022, many hotels that were closed during the pandemic have since resumed operations. To assess the impact of the global resurgence of travel and how this applies to pre-pandemic levels, we compare the 2022 dataset against two baselines: 2021 data and 2019 data. The 2021 baseline represents hotel performances during the transitional period where travel had just been reinstated in some locations but not all. The 2019 baseline represents a more typical year of hotel operation where occupancy and operations were not disrupted, allowing an assessment of pre- and post-pandemic hotel performance.

This section outlines the findings from comparing the global hotel sustainability performance during 2019, 2021, and 2022. Between 2021 and 2022, there is an overall increase in energy consumption, carbon emissions, and water consumption. In contrast to many past CHSB cycles that have mostly shown a decrease in hotel consumption over the years, this is the first time since we started this survey that hotel consumption levels recorded an increase between two consecutive CHSB cycles. We attribute the increase to the recovery of hotel operations along with the drastic post-pandemic increase in hotel occupancy in 2022.

On the other hand, between 2019 and 2022, there is some indication of a decreasing trend that aligns with past CHSB cycles, where there is an overall decrease in energy consumption, water consumption, and carbon emissions as measured by certain intensity metrics. Measuring by floor area intensities, for instance, we find an overall decrease in energy and water consumption and carbon emissions, indicating an overall increase in hotel resource efficiency. On the other hand, there is an overall increase in global energy, water, and carbon per occupied room, possibly indicating an increase in the footprint of each occupied room. This phenomenon can be attributed to lag time between the resumption in hotel operations and the return of hotel guests. That is, numerous hotels restarted operations even though occupancy rates were initially slow to return to pre-pandemic levels. The following subsections will highlight more detailed nuances and variations across different hotel types and between different intensity metrics.

Year-over-year Trends

To analyze the changes in consumption patterns between 2021 and 2022, and between 2019 and 2022, we conducted a like-for-like comparison between the two datasets. Only hotels that were present in both datasets were included in the year-over-year comparison, and only properties that passed validity tests for both datasets were included in the analysis. The resulting dataset consists of 7,911 properties for which we assess trends in energy consumption and 7,066 properties for the assessment of trends in water consumption. The analysis presented in the report utilizes different types of averages to provide a comprehensive understanding of the changes in energy and water consumption and GHG emissions across different hotel categories.

The three types of averages used in the analysis are the weighted average change, the overall average change, and the average of averages, as explained in Appendix 3 (page 26). These different averages provide a more nuanced and comprehensive understanding of the changes observed in the data set, enabling the identification of trends and patterns that may be missed when one simply looks at one type of average.

The data provided on the following pages in Exhibits 6, 7, and 8 show the average change in the following six measures from 2019 to 2022 and from 2021 to 2022: **(1)** GHG emissions per occupied room, **(2)** GHG emissions per square meter, **(3)** energy per occupied room, **(4)** energy per square meter, **(5)** water per occupied room, and **(6)** water per square meter.

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3 Please refer to Exhibit 5 for more details.

EXHIBIT 6

Year-over-year average change by measure and all hotels, resorts, non-resorts, and service class

Measure	Years	Metric	All	Resort	Non Resort	Limited Service	Full Service Resort	Full Service Non Resort
Measure 3: GHG Emissions per Occupied Room	YOY 2019-2022	Average of Averages Change	-6.87%	15.52%	-7.58%	-11.55%	15.52%	0.13%
		Overall Average Change	-8.17%	-3.40%	-8.66%	-13.32%	-3.40%	-3.97%
		Weighted Average Change	2.35%	1.77%	0.58%	-2.66%	1.77%	3.24%
	YOY 2021-2022	Average of Averages Change	26.20%	4.25%	26.90%	32.51%	4.25%	16.02%
		Overall Average Change	-1.18%	-5.44%	-0.62%	11.20%	-5.44%	-8.22%
		Weighted Average Change	14.52%	0.57%	13.95%	7.97%	0.57%	5.98%
Measure 4: GHG Emissions per Square Meter	YOY 2019-2022	Average of Averages Change	-15.35%	-0.79%	-15.81%	-16.46%	-0.79%	-14.55%
		Overall Average Change	-19.02%	-15.52%	-19.40%	-18.36%	-15.52%	-19.77%
		Weighted Average Change	-15.62%	0.23%	-15.85%	-4.75%	0.23%	-11.10%
	YOY 2021-2022	Average of Averages Change	42.41%	23.85%	43.00%	44.18%	23.85%	40.71%
		Overall Average Change	16.68%	10.91%	17.39%	22.76%	10.91%	15.60%
		Weighted Average Change	33.10%	1.53%	31.57%	11.60%	1.53%	19.97%
Measure 5: Energy per Occupied Room	YOY 2019-2022	Average of Averages Change	2.94%	7.44%	2.80%	0.90%	7.44%	6.49%
		Overall Average Change	0.67%	5.54%	0.25%	-1.86%	5.54%	4.16%
		Weighted Average Change	9.26%	0.87%	8.39%	0.60%	0.87%	7.79%
	YOY 2021-2022	Average of Averages Change	19.06%	1.89%	19.61%	24.65%	1.89%	9.83%
		Overall Average Change	0.77%	-3.57%	1.25%	11.97%	-3.57%	-6.19%
		Weighted Average Change	9.02%	0.38%	8.64%	6.01%	0.38%	2.63%
Measure 6: Energy per Square Meter	YOY 2019-2022	Average of Averages Change	-6.64%	-6.60%	-6.64%	-4.54%	-6.60%	-10.73%
		Overall Average Change	-11.22%	-7.70%	-11.55%	-7.56%	-7.70%	-12.98%
		Weighted Average Change	-9.59%	-0.45%	-9.14%	-1.66%	-0.45%	-7.48%
	YOY 2021-2022	Average of Averages Change	34.90%	21.92%	35.31%	35.88%	21.92%	34.22%
		Overall Average Change	19.00%	13.10%	19.61%	23.61%	13.10%	18.15%
		Weighted Average Change	27.38%	1.36%	26.03%	9.53%	1.36%	16.50%
Measure 8: Water per Occupied Room	YOY 2019-2022	Average of Averages Change	9.08%	10.73%	9.03%	11.12%	10.73%	5.44%
		Overall Average Change	0.84%	5.39%	0.27%	3.11%	5.39%	1.56%
		Weighted Average Change	8.84%	0.85%	8.00%	2.86%	0.85%	5.14%
	YOY 2021-2022	Average of Averages Change	-2.30%	-9.81%	-2.08%	0.09%	-9.81%	-5.81%
		Overall Average Change	-8.98%	-10.48%	-8.82%	-4.11%	-10.48%	-13.37%
		Weighted Average Change	-4.99%	-0.51%	-4.48%	-0.18%	-0.51%	-4.30%
Measure 9: Water per Square Meter	YOY 2019-2022	Average of Averages Change	-0.48%	-2.25%	-0.43%	5.94%	-2.25%	-11.43%
		Overall Average Change	-11.73%	-6.70%	-12.28%	-3.33%	-6.70%	-15.68%
		Weighted Average Change	-9.71%	-0.22%	-9.49%	0.90%	-0.22%	-10.39%
	YOY 2021-2022	Average of Averages Change	13.84%	10.29%	13.94%	10.91%	10.29%	19.17%
		Overall Average Change	8.20%	6.76%	8.37%	6.30%	6.76%	9.30%
		Weighted Average Change	13.90%	0.58%	13.33%	3.05%	0.58%	10.28%

TRENDS BETWEEN 2021 AND 2022

Asset Class and Hotel Type Grouping

The data presented in Exhibit 6 indicate the average changes in GHG emissions, energy consumption, and water consumption for hotels according to their asset class and hotel-type grouping. From 2021 to 2022, there has been a notable uptick in GHG emissions per square meter (weighted average change of 33.10%) and energy consumption per square meter (27.38%). Delving into asset class and hotel type groupings, limited-service hotels had the highest increase in both GHG emissions and energy consumption, with overall average GHG changes of 22.76 percent and energy consumption increases of 23.61 percent. Full-service resorts had the smallest increases, with overall average change of 10.91 percent for GHG emissions and a 13.10-percent rise in energy consumption. Across all hotels, there is also an increase for the GHG emissions per occupied room (weighted average increase of 14.52%) and energy per occupied room (increase of 9.02%).

EXHIBIT 7

Year-over-year average change by measure and STR segment

Measure	Years	Metric	Luxury	Upper Upscale	Upscale	Upper Midscale
Measure 3: GHG Emissions per Occupied Room	YOY 2019-2022	Average of Averages Change	16.09%	2.49%	-8.64%	-12.14%
		Overall Average Change	1.94%	-3.58%	-10.15%	-14.21%
		Weighted Average Change	3.51%	1.69%	-1.23%	-1.50%
	YOY 2021-2022	Average of Averages Change	-11.47%	12.35%	23.57%	40.44%
		Overall Average Change	-16.64%	-7.70%	6.90%	13.97%
		Weighted Average Change	-1.08%	4.27%	5.73%	5.57%
Measure 4: GHG Emissions per Square Meter	YOY 2019-2022	Average of Averages Change	-7.34%	-11.44%	-17.98%	-15.92%
		Overall Average Change	-19.17%	-19.11%	-19.02%	-18.49%
		Weighted Average Change	-1.49%	-6.38%	-4.67%	-2.97%
	YOY 2021-2022	Average of Averages Change	10.91%	40.91%	38.56%	52.15%
		Overall Average Change	4.26%	18.75%	21.81%	25.80%
		Weighted Average Change	1.94%	13.77%	9.39%	7.96%
Measure 5: Energy per Occupied Room	YOY 2019-2022	Average of Averages Change	14.82%	6.12%	2.46%	0.48%
		Overall Average Change	10.79%	4.32%	-0.38%	-3.17%
		Weighted Average Change	3.50%	4.11%	1.17%	0.50%
	YOY 2021-2022	Average of Averages Change	-10.99%	6.51%	17.54%	30.28%
		Overall Average Change	-13.86%	-6.23%	7.76%	14.27%
		Weighted Average Change	-1.18%	1.96%	4.03%	4.16%
Measure 6: Energy per Square Meter	YOY 2019-2022	Average of Averages Change	-8.21%	-11.56%	-7.96%	-3.57%
		Overall Average Change	-12.16%	-12.49%	-10.22%	-8.00%
		Weighted Average Change	-1.38%	-4.63%	-2.56%	-1.02%
	YOY 2021-2022	Average of Averages Change	11.94%	34.75%	32.21%	41.43%
		Overall Average Change	7.73%	20.63%	22.78%	26.13%
		Weighted Average Change	1.85%	11.35%	7.62%	6.50%
Measure 8: Water per Occupied Room	YOY 2019-2022	Average of Averages Change	12.91%	6.48%	10.20%	8.42%
		Overall Average Change	6.96%	3.25%	2.09%	-0.79%
		Weighted Average Change	2.19%	3.03%	2.17%	1.34%
	YOY 2021-2022	Average of Averages Change	-7.26%	-7.67%	-1.95%	0.42%
		Overall Average Change	-12.65%	-14.67%	-7.72%	-4.09%
		Weighted Average Change	-0.88%	-3.17%	-0.94%	-0.05%
Measure 9: Water per Square Meter	YOY 2019-2022	Average of Averages Change	-9.26%	-11.21%	-0.12%	4.80%
		Overall Average Change	-15.57%	-14.27%	-8.21%	-6.45%
		Weighted Average Change	-2.02%	-6.29%	-1.58%	0.04%
	YOY 2021-2022	Average of Averages Change	20.90%	20.40%	11.88%	11.67%
		Overall Average Change	9.08%	10.42%	5.07%	7.01%
		Weighted Average Change	2.55%	6.34%	2.64%	2.32%

Consistent with energy and carbon, there is also a global increase in water consumption per square meter, with an overall weighted average change of about 13.90 percent. The inconsistency lies with the water per occupied room, where there is a decrease in the weighted average change of 4.99 percent. This decrease is not uniform, however, as the overall average change across the limited-service category recorded only a slight decrease of 4.11 percent. In comparison, full-service non-resorts recorded a larger decrease in overall average change, at 13.37 percent. Exhibit 6 summarizes the different average changes in energy, water, and carbon for hotels according to their asset class and their hotel-type grouping.

STR Segment

The data presented in Exhibit 7 indicate the average changes in GHG emissions, energy consumption, and water consumption for hotels of different STR segments from 2021 to 2022, and from 2019 to 2022. Among STR segments, from 2021 to 2022, upper upscale hotels displayed the highest increase in GHG emissions per square meter with a weighted average change of 13.77 percent, while luxury hotels displayed

EXHIBIT 8

Year-over-year average change by measure and Expedia stars

Measure	Years	Metric	5 Stars	4 Stars	3 Stars	2 Stars
Measure 3: GHG Emissions per Occupied Room	YOY 2019-2022	Average of Averages Change	3.97%	8.54%	-9.26%	-13.00%
		Overall Average Change	-0.24%	-1.33%	-11.26%	-15.15%
		Weighted Average Change	1.62%	4.02%	-1.77%	-1.49%
	YOY 2021-2022	Average of Averages Change	-8.63%	-1.56%	24.27%	48.00%
		Overall Average Change	-15.95%	-13.06%	9.38%	32.52%
		Weighted Average Change	-0.70%	1.04%	7.60%	6.58%
Measure 4: GHG Emissions per Square Meter	YOY 2019-2022	Average of Averages Change	-16.86%	-6.87%	-18.08%	-15.71%
		Overall Average Change	-19.51%	-18.57%	-19.60%	-17.82%
		Weighted Average Change	-3.37%	-4.41%	-5.67%	-2.15%
	YOY 2021-2022	Average of Averages Change	17.03%	25.17%	39.83%	58.58%
		Overall Average Change	7.64%	11.72%	25.54%	43.07%
		Weighted Average Change	3.29%	8.51%	12.98%	8.32%
Measure 5: Energy per Occupied Room	YOY 2019-2022	Average of Averages Change	10.99%	8.14%	1.88%	0.31%
		Overall Average Change	8.16%	5.40%	-0.63%	-1.99%
		Weighted Average Change	3.23%	4.47%	1.34%	0.21%
	YOY 2021-2022	Average of Averages Change	-9.57%	-3.62%	18.18%	35.97%
		Overall Average Change	-14.21%	-10.72%	9.68%	28.41%
		Weighted Average Change	-1.06%	-0.23%	5.39%	4.91%
Measure 6: Energy per Square Meter	YOY 2019-2022	Average of Averages Change	-10.78%	-10.79%	-7.93%	-2.59%
		Overall Average Change	-12.73%	-13.01%	-9.97%	-5.08%
		Weighted Average Change	-1.95%	-4.27%	-2.90%	-0.48%
	YOY 2021-2022	Average of Averages Change	16.53%	23.49%	33.29%	45.79%
		Overall Average Change	9.86%	14.73%	25.89%	38.63%
		Weighted Average Change	2.91%	7.34%	10.61%	6.52%
Measure 8: Water per Occupied Room	YOY 2019-2022	Average of Averages Change	9.11%	5.40%	9.64%	10.26%
		Overall Average Change	3.99%	3.15%	2.93%	1.70%
		Weighted Average Change	2.35%	2.62%	2.62%	1.25%
	YOY 2021-2022	Average of Averages Change	-8.80%	-8.18%	-1.42%	0.94%
		Overall Average Change	-15.68%	-15.58%	-6.21%	-2.71%
		Weighted Average Change	-1.25%	-2.86%	-0.92%	0.05%
Measure 9: Water per Square Meter	YOY 2019-2022	Average of Averages Change	-10.90%	-13.09%	-0.06%	7.48%
		Overall Average Change	-15.75%	-15.90%	-6.94%	-2.13%
		Weighted Average Change	-2.77%	-6.14%	-1.50%	0.69%
	YOY 2021-2022	Average of Averages Change	23.79%	20.92%	13.03%	9.24%
		Overall Average Change	9.61%	8.44%	8.15%	5.49%
		Weighted Average Change	3.45%	5.26%	3.87%	1.32%

the smallest increase, at a weighted average change of 1.94 percent. Similarly for energy consumption per square meter, upper upscale hotels had the highest weighted average increase, 11.35 percent, while the weighted average change for luxury hotels is a more modest increase of only 1.85 percent.

For water consumption per square meter, there is a slight difference compared to energy and carbon. While upper upscale hotels had the largest weighted average increase in water per square meter, upper midscale hotels had the smallest weighted average increase of 2.32 percent.

Metrics per occupied room display a similar variation between segments. From 2021 to 2022, only luxury hotels showed a slight decrease in weighted average, 1.49 percent, while the rest of the segments recorded increases. As for energy per occupied room, only luxury hotels had a decrease in weighted average, 1.18 percent, while the rest of the segments had an increase in weighted average, with upper midscale showing the highest increase of 4.16 percent. For water per occupied room, from 2021 to 2022, all four STR segments had a decrease in weighted average, with upper upscale hotels showing the biggest decrease (-3.17%), and upper midscale hotels having the smallest decrease (-0.05%).

Star Rating

The data presented in Exhibit 8 show the average changes in GHG emissions, energy consumption, and water consumption for hotels of different star ratings from 2021 to 2022, and from 2019 to 2022. When comparing differences in average change from 2021 to 2022, a discernible pattern emerges in the changes of GHG emissions for different star ratings, as 5-star hotels recorded the smallest increase, with a weighted average change of 3.29 percent. This trend is followed by 4-star hotels at 8.51 percent, and 3-star hotels at 12.98 percent. Notably, 2-star hotels deviate from this pattern, showing a modest weighted average increase of 8.32 percent. This pattern is similar for energy per square meter, with 5-star hotels recording the smallest weighted average increase of 2.91 percent, followed by 4-star hotels at 7.34 percent, and 3-star hotels at 10.61 percent, while 2-star hotels also deviate from this pattern, as they recorded an increase of 6.52 percent. The average of averages change showed a consistent decreasing trend with increasing star ratings, suggesting that higher-rated hotels tended to maintain GHG emissions and energy consumption levels from 2021 to 2022. The weighted average change for water per occupied room showed a less obvious pattern across star ratings, as 4-star hotels recorded the largest decrease at 2.86 percent, followed by 5-star hotels at 1.25 percent and 3-star hotels at a slight 0.92 percent. Likewise, 2-star hotels showed a negligible increase of 0.05 percent.

TRENDS BETWEEN 2019 AND 2022

Asset-class and Hotel-type Grouping

Looking at the wider timeline of 2019 to 2022, there has been a general decrease in GHG emissions per square meter and energy consumption per square meter, with a weighted average decline of 15.62 percent for 2019 and a drop of 9.59 percent in 2022. These figures suggest a positive trajectory in hotel environmental performance over the longer term. Full-service non-resorts had the biggest reductions in both GHG emissions and energy consumption, with an overall average reduction of 19.77 percent in GHG emissions and 12.98 percent in energy consumption. Similarly, there is a global decrease in water per square meter, displaying a weighted average reduction of 9.71 percent across all hotels. Full-service non-resorts had the largest overall average decrease at 15.68 percent, while limited-service hotels had the smallest overall average decrease at 0.22 percent.

Contrary to the general downward trend, the energy and water per occupied room measures of intensity showed a general increase. For energy per occupied room, the weighted average change across all hotels showed an increase of 9.26 percent. For water per occupied room, the weighted average change across all hotels stands at an increase of 8.84 percent (see Exhibit 6 for a detailed summary of the average changes for energy, water, and carbon).

STR Segment

Looking at changes by STR segment from 2019 to 2022, upper upscale hotels showed the biggest weighted average decreases in GHG emissions per square meter (-6.38%) and energy per square meter (-4.63%). Luxury hotels showed the smallest decreases for the two measures, recording weighted average changes of -1.49 percent for GHG emissions and -1.38 percent for energy per square meter. For water consumption per square meter, upper upscale hotels also recorded the largest decrease, with a weighted average reduction of 6.29 percent, while upscale hotels had the smallest decrease of 1.58 percent. Upper midscale hotels had a negligible increase of 0.04 percent.

Despite those hopeful average changes, hotels divided into STR segments displayed a general increase for GHG emissions, energy, and water per occupied room measures of intensity. For GHG emissions per occupied room, the weighted average change for luxury and upper upscale hotels experienced increases of 3.51 percent for luxury hotels and 1.69 percent for upper upscale hotels However, upscale and upper midscale hotels experienced a decrease of 1.23 percent for upscale hotels and a reduction of 1.50 percent for upper midscale properties. For energy per occupied room, all segments recorded an increase, with upper upscale hotels leading at a weighted average change of 4.11 percent. The highest weighted average change in water per occupied room was also recorded for upper upscale hotels, at 3.03 percent. However, luxury (2.19%), upscale (2.17%), and upper midscale hotels (1.34%) were close (see Exhibit 7 for the summary by the hotels' STR segments).

Star Rating

Compared to the period of 2021 to 2022, the correlation between star rating and weighted average change is less clear for the period of 2019 to 2022. In the more recent period, 3-star hotels experienced the highest decrease in GHG emissions per square meter at 5.67 percent. They are followed closely, however, by 4-star, 5-star, and 2-star hotels. Energy consumption per square meter for 4-star hotels showed the largest decrease, with a drop of 4.27 percent. In contrast, 4-star and 3-star hotels each experienced an increase in water per occupied room at 2.62 percent (see Exhibit 8 for hotel statistics by star rating).

EXHIBIT 9

Energy efficiency opportunities among full service non-resorts with in-house laundry

	FULL SERVICE NON-RESORT		
	Energy Per Square Meter (M6)		
10 Lowest and Highest Efficiency Gaps	Inhouse Laundry		
GEOGRAPHY	2021	2022	% Change (2021-2022)
Des Moines, IA	1.91	1.10	-42.1%
Spokane, WA	2.26	1.12	-50.3%
Asheville, NC	2.00	1.18	-41.2%
Calgary	1.72	1.23	-28.2%
Hyderabad	1.47	1.23	-16.2%
Orlando, FL	2.18	1.25	-42.6%
Manama	1.17	1.26	7.2%
San Antonio, TX	2.25	1.26	-43.8%
Amman	1.65	1.28	-22.2%
Charleston, SC	2.37	1.34	-43.3%
Indianapolis, IN	2.24	2.17	-3.3%
Istanbul	2.93	2.19	-25.3%
Chongqing	2.06	2.23	8.2%
Chengdu	2.21	2.27	2.7%
San Bernardino, CA	2.75	2.29	-16.7%
Kunming	2.68	2.32	-13.3%
Kansas City, MO	2.89	2.38	-17.7%
Riyadh	2.05	2.56	24.9%
Kuala Lumpur	2.10	2.65	25.7%
Buenos Aires (AMBA)	1.90	2.96	55.3%
Average	**2.09**	**1.71**	**-18.3%**

Contrasting Changes in GHG emissions

The average changes in GHG emissions from 2019 to 2022 show a reduction across most hotel segments. Across all hotels, the average of averages change for GHG emissions per occupied room was recorded at -6.87 percent, while the average of averages change for GHG emissions per square meter was recorded at -15.35 percent. However, this general reduction stands in stark contrast to the increase in GHG emissions from 2021 to 2022, where the average of averages changes for GHG emissions per occupied room recorded an increase of 26.20 percent, and GHG emissions per square meter rose 42.41 percent. This fluctuation highlights the impact of COVID-19 on the industry. The notable increase in emissions per square meter between 2021 and 2022 was likely due to the post-pandemic recovery of the tourism industry, with higher hotel occupancy and the full resumption of hotel services and amenities. Conversely, the longer-term decrease from 2019 to 2022 can be explained by three possible factors. First, occupancy rates in 2022 likely remained below the pre-pandemic peaks seen in 2019, with concomitant lower energy usage (and thus emissions) in 2022. Second, the lower emissions may be driven by hotels' sustainability efforts. Finally, a significant contributor to the drop in emissions intensity is likely the decrease in the emission factors (EFs) used in calculating hotels' emissions. Between 2019 and 2022, there was a 9.9-percent decrease in the global average GHG EFs for the electric power grid, as utilities decarbonize and become more efficient.

Contrasting Changes in Water Use per Occupied Room

From 2021 to 2022, almost all property categories have exhibited a decrease in water usage per occupied room, marking a notable contrast with the increases observed from 2019 to 2022. One plausible explanation for the concerning increase over the longer period is that hotels likely resumed full operation in 2022, even though occupancy rates may not have fully recovered to pre-pandemic 2019 levels. Regardless of whether occupancy rates reached pre-pandemic peaks, hotels may have returned to water consumption levels necessary for full operation, including reopening amenities such as swimming pools, spas, and restaurants, resuming

EXHIBIT 10

Energy efficiency opportunities among full service non-resorts with outsourced laundry

	FULL SERVICE NON-RESORT		
	Energy Per Square Meter (M6)		
10 Lowest and Highest Efficiency Gaps	Outsourced Laundry		
GEOGRAPHY	2021	2022	% Change (2021-2022)
Berlin	1.77	1.30	-26.9%
Hamburg	2.55	1.35	-47.2%
Orlando, FL	1.33	1.35	1.4%
Frankfurt	1.90	1.37	-27.9%
Zurich	1.84	1.37	-25.2%
San Diego, CA	1.21	1.37	13.4%
Hong Kong	3.46	1.38	-60.1%
Seoul	1.66	1.40	-15.5%
Denver, CO	2.50	1.44	-42.5%
Munich	1.96	1.44	-26.6%
Paris	2.86	1.90	-33.6%
Wuhan	2.38	1.98	-17.1%
Milan	2.44	2.02	-17.3%
Beijing	2.45	2.09	-14.8%
Riyadh	1.81	2.23	22.9%
Glasgow	2.02	2.26	11.8%
Doha	2.43	2.32	-4.3%
Abu Dhabi	1.65	2.39	44.9%
Edinburgh	4.32	2.50	-42.0%
Mexico City	2.27	2.56	12.6%
Average	**2.22**	**1.59**	**-28.4%**

landscaping, and intensifying general property maintenance in anticipation of a rebound in travel.

Resorts and Highly Rated Hotels Fare Better in GHG Emissions and Energy Performance

From 2021 to 2022, resort hotels consistently exhibited better performance in both GHG emissions and energy consumption compared to non-resort hotels (Exhibit 6). Despite an overall increase in GHG emissions and energy consumption throughout this period, resort hotels experienced significantly smaller increases, with their average changes remaining below that of non-resort hotels. For instance, resorts recorded an average of averages change in GHG emissions per square meter of 23.85 percent, while non-resorts recorded an increase of 43.00 percent. Indeed, the smaller increase shown by resorts could be attributed to having operated at a higher baseload consistently, even during periods of fewer occupied rooms, such as in 2021. However, it is plausible that resorts also implemented enhanced sustainability measures to reduce emissions as travel resumed. More impressively, higher star-rated hotels demonstrated improvements particularly for measures which consider occupied room intensity. Hotels with 5-star and 4-star ratings have shown a commendable reduction in GHG emissions per occupied room and energy consumption per occupied room, contrasting with the increases observed in 3-star and 2-star hotels. The disparity in performance between higher and lower star-rated hotels could be attributed to resource availability, with higher-rated hotels having more funding for sustainability efforts. Moreover, efficiency improvements in resorts and higher-rated hotels possibly have a more significant impact due to the larger property areas and the broader range of services commonly associated with these hotels. This amplifies the impact of sustainability measures, resulting in notable reductions in emissions and energy consumption compared to lower-rated counterparts.

Discrepancies between Per-square-meter and Per-occupied-room Intensity Metrics

Interestingly, water usage per square meter saw an opposite trend across star ratings. From 2021 to 2022, hotels with 5-star and 4-star ratings demonstrated significantly larger increases in water per square meter than 3-star and 2-star hotels. The trend is also true for STR segments, with higher segments recording higher increases in water per square meter. However, when instead observing the measure of water per occupied room, higher-rated and higher-segmented hotels appear to perform better, having larger reductions. One plausible explanation for the inverse trend in water consumption per square meter could simply be due to a larger increase in occupancy rates for high-rated and higher-segmented hotels, requiring an increase in

EXHIBIT 11

Energy efficiency opportunities among limited-service hotels with in-house laundry

	LIMITED SERVICE		
	Energy Per Square Meter (M6)		
10 Lowest and Highest Efficiency Gaps	Inhouse Laundry		
GEOGRAPHY	2021	2022	% Change (2021-2022)
Springfield, MA	2.35	1.01	-56.8%
Kingsport, TN	1.67	1.08	-35.5%
Bloomington, IL	2.20	1.09	-50.3%
Winston-Salem, NC	1.44	1.09	-24.3%
Spokane, WA	1.55	1.12	-27.8%
Ventura, CA	1.82	1.12	-38.4%
Odessa, TX	2.20	1.13	-48.5%
Lakeland, FL	1.93	1.14	-40.9%
Panama City, FL	2.03	1.14	-43.7%
Medford, OR MSA	1.49	1.14	-23.2%
Calgary	1.97	1.88	-4.5%
New Orleans, LA	1.87	1.91	1.9%
Duluth, MN-WI	2.87	1.92	-33.2%
Lincoln, NE	2.06	2.16	5.0%
Auburn-Opelika, AL	1.97	2.18	11.0%
London, UK	1.39	2.43	75.2%
Edmonton	2.65	2.44	-7.8%
South Bend, IN	2.65	2.56	-3.5%
Binghamton, NY	2.61	2.56	-1.8%
Chengdu	2.53	2.84	12.3%
Average	**1.92**	**1.49**	**-22.1%**

EXHIBIT 12

Energy efficiency opportunities among limited-service hotels with in-house laundry

	LIMITED SERVICE		
	Energy Per Square Meter (M6)		
10 Lowest and Highest Efficiency Gaps	Outsourced Laundry		
GEOGRAPHY	2021	2022	% Change (2021-2022)
Phoenix, AZ	1.75	1.26	-28.2%
Orlando, FL	5.39	1.26	-76.6%
Hong Kong	1.58	1.30	-17.3%
Beijing	2.24	1.33	-40.7%
Chicago, IL	1.80	1.34	-25.9%
Shenzhen	1.52	1.34	-11.7%
Berlin	2.40	1.35	-43.5%
Washington DC	2.20	1.36	-37.9%
Atlanta, GA	2.34	1.38	-41.2%
Average	2.23	1.43	-36.2%
Dubai-Sharjah-Ajman	1.84	1.71	-6.9%
Paris	1.88	1.72	-8.8%
Montreal	1.91	1.85	-3.0%
Shanghai	2.27	1.93	-15.3%
Amsterdam	1.38	1.93	39.6%
Madrid	1.49	1.93	29.9%
Chengdu	2.14	1.97	-8.0%
Singapore	3.28	2.05	-37.3%
Hangzhou	2.33	2.25	-3.6%
London, UK	2.10	2.45	16.6%
Average	**2.23**	**1.43**	**-36.2%**

EXHIBIT 13

Water efficiency opportunities among full service non-resorts with in-house laundry

10 Lowest and Highest Efficiency Gaps	FULL SERVICE NON-RESORT Water Per Occupied Room (M8) Inhouse Laundry		
GEOGRAPHY	2021	2022	% Change (2021-2022)
Fuzhou	1.44	1.13	-21.4%
Guangzhou	1.72	1.14	-34.0%
Baltimore, MD	2.00	1.18	-41.0%
Kunming	2.85	1.18	-58.5%
Hefei	1.26	1.22	-3.2%
Shenyang	1.55	1.23	-20.8%
Seattle, WA	1.41	1.23	-13.1%
Chongqing	1.46	1.24	-15.2%
Qingdao	1.69	1.25	-26.4%
Ningbo	1.62	1.27	-21.4%
Jacksonville, FL	2.37	2.65	12.0%
Bengaluru	2.01	2.78	38.4%
Cairo	2.18	2.80	28.7%
Buenos Aires (AMBA)	3.59	2.92	-18.7%
Bangkok	2.75	3.07	11.5%
Madrid	1.40	3.29	134.5%
Indianapolis, IN	1.84	3.64	97.8%
Jakarta	1.52	3.87	154.4%
Abu Dhabi	1.93	4.35	125.1%
Kansas City, MO	1.71	5.06	195.9%
Average	**2.02**	**1.82**	**-10.1%**

resources for the broader range of services associated with these hotels. The prevailing trend in water per occupied room suggests that higher-rated and higher-segmented hotels remain better performers overall.

Laundry: The "Efficiency Gap" in Each Market

Similar to previous years, this year's study includes an analysis of performance ranges within a selected geography and segment, with a specific focus on laundry boundaries. The degree of dispersion within a dataset is represented by the performance ratio value, calculated by dividing the value of the worst-performing properties of the dataset (75th percentile and up) by the best-performing properties (25th percentile and down). The study revealed a significant dispersion in energy and water usage intensity across all segments, with the best-performing hotels outperforming their peers by around 1.5 to 2 times. The study disclosed smaller efficiency gaps in energy usage intensity among limited-service hotels, recording performance ratios of 1.49 for in-house laundry and 1.43 for outsourced laundry. This is compared to the higher performance ratios of full-service hotels, recorded at 1.71 for in-house laundry and 1.59 for outsourced laundry. Similarly for water usage intensity, limited-service hotels recorded performance ratios of 1.52 for in-house laundry and 1.57 for outsourced laundry, lower than that of full-service performance ratios at 1.82 in-house and 1.74 outsourced.

The study further compares year-over-year changes in performance ratios, drawing on data from 2021 and 2019 calendar years. The majority of geographies recorded encouraging improvements in performance ratios between 2021 and 2022, representing a notable reduction in efficiency gaps across various asset classes and laundry statuses. For energy performance ratios, full-service non-resorts recorded decreases of 18.3 percent for those with in-house laundry and a drop of 28.4 percent for those with outsourced laundry. Similarly for limited-service hotels, those with in-house laundry recorded a smaller decrease of 22.1 percent compared to the larger 36.2-percent decrease for those with outsourced laundry. For water performance ratios, full-service non-resorts recorded decreases of 10.1 percent for those with in-house laundry and reductions of 19.7 percent for those with outsourced laundry. Limited-service hotels recorded more notable decreases in water performance ratios at -30.1 percent for those with in-house laundry and -23.9 percent for those with outsourced laundry.

Looking across the wider period from 2019 to 2022, performance-ratio shrinkage is less noticeable. Full-service non-resorts recorded decreases in energy performance ratios of 3.0 percent for those with in-house laundry and reductions of 13.8 percent for

EXHIBIT 14

Water efficiency opportunities among full service non-resorts with outsourced laundry

	FULL SERVICE NON-RESORT		
	Water Per Occupied Room (M8)		
10 Lowest and Highest Efficiency Gaps	Outsourced Laundry		
GEOGRAPHY	2021	2022	% Change (2021-2022)
Warsaw	1.67	1.37	-17.8%
Munich	1.34	1.38	2.4%
Vienna	1.69	1.41	-16.2%
Baltimore, MD	4.04	1.44	-64.3%
Melbourne	2.36	1.45	-38.3%
Guangzhou	1.72	1.48	-13.7%
Las Vegas, NV	1.59	1.49	-5.7%
Lima	1.81	1.50	-16.9%
Philadelphia, PA	2.52	1.51	-40.0%
Jakarta	2.83	1.53	-45.9%
New Orleans, LA	1.92	1.98	3.1%
Milan	2.11	1.99	-5.6%
Prague	1.99	2.10	5.4%
Seoul	3.09	2.12	-31.2%
Nanjing	2.75	2.18	-20.8%
Kuala Lumpur	1.87	2.20	17.8%
Tokyo	2.69	2.21	-17.9%
Singapore	2.65	2.31	-12.9%
Shanghai	2.45	2.37	-3.5%
Hong Kong	3.88	2.70	-30.5%
Average	**2.17**	**1.74**	**-19.7%**

those with outsourced laundry. Limited-service hotels with in-house laundry recorded the largest decrease in energy performance ratios at -15.2 percent. For water performance ratios, full-service non-resorts recorded an increase of 11.8 percent for those with in-house laundry while recording a decrease of 16.0 percent for those with outsourced laundry. Limited-service hotels with in-house laundry recorded a smaller decrease of 9.4 percent.

Exhibits 9 through 16 display the ratio of upper quartile to lower quartile by asset class and laundry information for selected geographies for energy per square meter and water per occupied room. The geographies presented are the ten geographies with the lowest efficiency ratio in 2022, and the ten geographies with the highest efficiency ratio (provided there are sufficient data from the 2021 dataset). Performance ratios for full-service resorts were not tabulated due to an insufficient number of properties in the selected geographies. Exhibit 17 displays the average efficiency opportunities across segments for both energy and water.

In sum, the empirical data from this year's study indicates that there has been progress in closing the performance gap between hotels within the upper quartile and lower quartile in most markets. Nevertheless, given that the ratio for most markets is still higher than 1.5, significant opportunities exist for hotels within the upper quartile to reduce their utility use and improve efficiency, to catch up to the top performers in their respective markets.

LIMITATIONS

There are several limitations to this study due to the data set and representation of participating companies:

1. **The results remain skewed toward the higher end of segment tiers.** The results of CHSB2024 may again be skewed toward the higher end of segment tiers. The study relies heavily on large owners or operators of hotels to submit aggregate data sets, a practice that tends to include hotels that are managed by the same operators and not franchised. As a result, the data set may not be representative of the entire hotel industry, particularly the economy and midscale segments, which may consume less energy and water due to their smaller public areas, fewer amenities, and less spacious guestrooms. To address this limitation, we encourage more

EXHIBIT 15

Water efficiency opportunities among limited-service hotels with in-house laundry

	LIMITED SERVICE		
	Water Per Occupied Room (M8)		
10 Lowest and Highest Efficiency Gaps	Inhouse Laundry		
GEOGRAPHY	2021	2022	% Change (2021-2022)
College Station, TX	2.00	1.10	-45.2%
Duluth, MN-WI	1.47	1.10	-24.9%
Anchorage, AK	1.53	1.11	-27.5%
Columbia, MO	1.33	1.11	-16.6%
Bismarck, ND	1.21	1.14	-5.3%
Canton-Massillon, OH	1.60	1.14	-28.6%
Winston-Salem, NC	2.23	1.15	-48.4%
Akron, OH	2.54	1.16	-54.2%
Asheville, NC	1.33	1.17	-12.2%
New Haven, CT	1.37	1.17	-14.6%
Grand Rapids, MI	2.40	2.01	-16.1%
Augusta, GA	1.70	2.03	19.6%
Charleston, WV	6.19	2.09	-66.2%
Birmingham, AL	1.75	2.14	22.1%
Columbus, GA	1.68	2.15	28.0%
Queretaro	1.82	2.23	22.4%
Baltimore, MD	2.75	2.24	-18.2%
Poughkeepsie, NY	3.55	2.27	-36.2%
Beijing	2.12	3.41	61.0%
Chengdu	2.31	4.47	93.1%
Average	**2.18**	**1.52**	**-30.1%**

participation from economy and midscale or 1- and 2-star properties in future years. This would enable a more comprehensive view of the hotel industry and provide more accurate benchmarks for a metro area or country.

2. **The results are skewed toward branded chains.** Another limitation of CHSB2024 is that the results may be skewed towards branded chains. Most hotels in the study are represented by branded flags, which may not be representative of the full hotel supply. It is possible that branded hotels are more efficient than independent hotels due to the availability of capital that allows them to renovate and retrofit building equipment, furniture, and fixtures (FF&E), which may not always be available to independent hotels. To address this limitation, independent hotels are encouraged to participate in future studies. This would help to balance out the range and provide a more representative view of the actual hotel supply in any given geography.
3. **The results are skewed towards the United States.** Although this year's data set covers 64 countries, seven more than last year, the majority of the data still come from the United States. This year, 50 percent of the data set was within the U.S. geographies, showing a substantial improvement compared to CHSB2023 (64%). The ratio of hotels in the data set to potential hotels in the country is slightly lower outside of the U.S. To achieve a more equitable global representation, we are working to grow the data set both within and outside the U.S., and we will continue to seek data from all around the world.
4. **The data have not been verified.** As explained at the outset, we have conducted validity tests of these data, but it is important to note that the data have not been independently verified by a third-party provider to ensure its accuracy. However, more than 70 percent of the data set is submitted by participants who have undergone external third-party verification in their own corporate reporting, which serves as a primary validation method. To further enhance the accuracy and credibility of our data, we will continue to explore opportunities to involve third-party verification providers.
5. **External factors**. The study does not account for external factors that may affect a hotel's energy and water usage, such as regional climate patterns or the availability of renewable energy sources. This may limit the ability to accurately compare the performance of hotels across different regions.

EXHIBIT 16

Water efficiency opportunities among limited-service hotels with outsourced laundry

	LIMITED SERVICE		
	Water Per Occupied Room (M8)		
10 Lowest and Highest Efficiency Gaps	Outsourced Laundry		
GEOGRAPHY	2021	2022	% Change (2021-2022)
Tokyo	2.05	1.02	-50.4%
Paris	1.16	1.21	4.0%
Istanbul	1.57	1.24	-21.1%
Prague	1.32	1.26	-4.5%
Frankfurt	1.53	1.26	-17.2%
Moscow	1.40	1.31	-6.1%
Melbourne	1.99	1.32	-33.5%
Kuala Lumpur	1.40	1.35	-3.4%
Madrid	1.28	1.36	5.7%
Amsterdam	1.51	1.36	-9.7%
Atlanta, GA	1.37	1.82	33.0%
New York, NY	1.92	1.84	-4.1%
Beijing	1.71	1.85	7.6%
Dallas-Fort Worth, TX	1.25	1.87	49.6%
Houston, TX	2.08	1.91	-8.4%
Singapore	3.92	1.97	-49.9%
Hangzhou	2.40	2.21	-8.1%
Shanghai	2.16	2.36	9.3%
Shenzhen	1.66	2.38	43.1%
Bengaluru	2.34	2.87	22.6%
Average	**2.07**	**1.57**	**-23.9%**

EXHIBIT 17

Average efficiency opportunities across segments

SEGMENT	LAUNDRY STATUS	2019	2021	2022	% Change (2019-2022)	% Change (2021-2022)
Energy Per Square Meter (M6)						
Full Service Non-resort	Inhouse	1.76	2.09	1.71	-3.0%	-18.3%
	Outsourced	1.85	2.22	1.59	-13.8%	-28.4%
Limited Service	Inhouse	1.76	1.92	1.49	-15.2%	-22.1%
	Outsourced	-	2.23	1.43	Insufficient Data	-36.2%
Water Per Occupied Room (M8)						
Full Service Non-resort	Inhouse	1.63	2.02	1.82	11.8%	-10.1%
	Outsourced	2.08	2.17	1.74	-16.0%	-19.7%
Limited Service	Inhouse	1.68	2.18	1.52	-9.4%	-30.1%
	Outsourced	-	2.07	1.57	Insufficient Data	-23.9%

For example, a hotel located in a region with high humidity may require more energy to maintain comfortable indoor temperatures than a hotel in a drier climate.

6. **Unique characteristics**. The study does not consider the distinctive characteristics of individual hotels, such as the age of the building, the type of guests, and the amenities offered. These factors can significantly affect a hotel's energy and water usage intensity and may result in unfair comparisons. For example, an older building may have outdated HVAC systems that require more energy to operate.

As CHSB continues to evolve and gain a deeper understanding of the drivers of energy, water, and carbon within hotels, we will strive to enhance our comparisons by incorporating additional attributes and normalizing the data to ensure fair and meaningful comparisons.

OUTLOOK FOR CHSB2025

As an evolving index and process, the CHSB study strives to continuously improve and expand its data set, segmentation, and granularity for participant benchmarking. The next study, CHSB2025, will collect data from the 2023 calendar year and aim to provide an updated index with even more robust and representative data. To achieve this, we will continue to seek participation from independent hotels, smaller chains, and smaller properties currently underrepresented in the global data set. ■

Hotels interested in participating in CHSB2025 and contributing to this valuable industry benchmarking effort can email info@greenview.sg for more information.

Appendix 1

List of water types included and excluded

Water Type	Boundary
Desalinated Water	Included
Purchased Recycled Water	Included
Purchased Water	Included
Rainwater	Included
Tanker Water	Included
Water Withdrawal	Included
Cooling Tower Evaporation	Excluded
Landscaping or Other Irrigation (Discharge)	Excluded
Other Discharge	Excluded
Packaged Drinking Water	Excluded
Sewer Discharge	Excluded
Waste Water Treatment	Excluded
Water Recycled	Excluded

List of energy types included and excluded

Energy Type	Boundary
Bio-Diesel (Stationary)	Included
Bioethanol	Included
Biofuel Landfill Gas (50/50)	Included
Biofuel Used Oil	Included
Biofuel Wood Waste	Included
Biofuel-Vegetable Oil (Stationary)	Included
Biogas (Captured Methane)	Included
Biomass	Included
Butane	Included
Charcoal	Included
Coal Gas	Included
Compressed Natural Gas (CNG) (Stationary)	Included
Diesel (Stationary)	Included
Ethanol	Included
Fuel Oil #1	Included
Fuel Oil #2	Included
Fuel Oil #4	Included
Fuel Oil #5	Included
Fuel Oil #6	Included
Gasoline (Stationary)	Included
Kerosene	Included
Liquefied Petroleum Gas (LPG) (Stationary)	Included
Natural Gas	Included
Onsite Geothermal Energy	Included
Onsite Solar PV Electricity	Included
Onsite Solar Thermal	Included
Onsite Wind Power Electricity	Included
Other Onsite Renewable Energy	Included
Purchased Chilled Water (included as energy source)	Included
Purchased Electricity	Included
Purchased Heat	Included
Purchased Hot Water	Included
Purchased Renewable Energy	Included
Purchased Steam	Included
Town Gas (Hong Kong)	Included
Town Gas (Singapore)	Included
Town Gas (Tokyo)	Included
Town Gas / City Gas	Included
Bio-Diesel (Mobile)	Excluded
Biofuel-Vegetable Oil (Mobile)	Excluded
Compressed Natural Gas (CNG) (Mobile)	Excluded
Diesel (Mobile)	Excluded
Gasoline (Mobile)	Excluded
Gasoline Biofuel Blend (Mobile)	Excluded
Liquefied Natural Gas (LNG) (Mobile)	Excluded
Liquefied Petroleum Gas (LPG) (Mobile)	Excluded
Propane (Mobile)	Excluded

Appendix 3

Types of averages used in the analysis of year-over-year trends

A. The *weighted average change* is calculated by multiplying the average change of a particular hotel category by the percentage of that hotel's floor area to the total floor area of the data set.

For example, to calculate the *weighted average change* of GHG emissions per square meter for full-service resorts,

1. Calculate each full-service resort property's YOY percentage change in GHG emissions per square meter (e.g. Property A's 2022 GHG emissions per square meter divided by their 2021 GHG emissions per square meter)
2. Calculate each full-service resort property's % floor area (E.g. Property A's total floor area divided by the total floor area of the data set)
3. For each full-service resort property in the dataset, multiply values from step (1) by the values in step (2).
4. Sum up the values from step (3).

B. The *overall average change*, on the other hand, considers the average change in the total usage or emissions of the entire data set divided by the total floor area of the like-for-like data set.

For example, to calculate the overall average change of GHG emissions per square meter for full-service resorts,

1. Calculate the total GHG emissions of all full-service resort properties in 2022.
2. Calculate the total GHG emissions of all full-service resort properties in 2021.
3. Calculate the change in total GHG emissions by subtracting the value from step (2) from the value in step (1).
4. Calculate the total floor area of all full-service resort properties in 2022. (Note: This will be the same as the total floor area of full-service resort properties in 2021, because this analysis considers only hotels that were present in both datasets.)
5. Divide the value from step (3) by the value in step (4).

C. Finally, the *average of averages change* is calculated as the mean of the average change of all hotels in the like-for-like data set.

For example, to calculate the average of averages change of GHG emissions per square meter for full-service resorts,

1. Calculate each full-service resort property's YOY percentage change in GHG emissions per square meter (E.g. Property A's 2022 GHG emissions per square meter divided by their 2021 GHG emissions per square meter)
2. Calculate the mean of all values from step (1).

APPENDIX 4

Year-over-year overall average change by selected country for energy, 2021-2022 (all non-resorts)

Country	NonResort									
	Count	Floor Area (SqM)	M3 (2021-2022)	M3 (2019-2022)	M4 (2021-2022)	M4 (2019-2022)	M5 (2021-2022)	M5 (2019-2022)	M6 (2021-2022)	M6 (2019-2022)
Argentina	9	217,036	-30.8%	-15.4%	37.3%	-24.3%	-28.0%	-0.3%	43.0%	-10.8%
Australia	36	959,110	-22.8%	0.1%	21.9%	-22.5%	-20.8%	13.0%	25.0%	-12.5%
Austria	8	185,167	-46.2%	-31.9%	24.3%	-39.7%	-37.4%	2.4%	44.7%	-9.3%
Brazil	11	319,389	-23.0%	-23.2%	27.7%	-24.7%	-17.3%	-11.9%	37.1%	-13.7%
Canada	206	2,790,543	-29.9%	-3.0%	13.7%	-12.0%	-20.7%	-0.3%	28.6%	-9.5%
Chile	8	158,164	-26.4%	-7.5%	26.3%	-24.8%	-23.9%	-2.1%	30.6%	-20.3%
China	440	19,563,754	9.4%	13.9%	-5.9%	-21.1%	7.1%	10.9%	-7.9%	-23.2%
Colombia	20	361,126	-0.3%	24.3%	48.8%	27.7%	-11.2%	-10.3%	32.5%	-7.9%
Costa Rica	11	137,846	-2.6%	46.5%	52.6%	37.3%	-2.5%	33.7%	52.8%	25.4%
Czech Republic	8	217,890	-34.8%	-4.4%	49.3%	-21.8%	-36.8%	13.9%	44.7%	-6.8%
Egypt	16	868,602	-23.3%	-7.4%	-0.6%	-18.2%	-7.6%	2.9%	19.7%	-9.1%
France	19	268,943	-42.5%	2.6%	15.1%	-7.4%	-44.4%	4.2%	11.4%	-5.9%
Germany	39	808,215	-30.0%	-11.0%	33.6%	-32.2%	-32.2%	14.5%	29.4%	-12.9%
Hong Kong, China	17	617,334	-34.8%	11.2%	-24.6%	-27.9%	-16.2%	30.1%	-3.1%	-15.7%
India	84	2,044,300	-7.2%	-14.1%	21.3%	-14.2%	-8.1%	-17.0%	20.1%	-17.2%
Indonesia	40	1,108,038	-9.0%	-4.3%	25.3%	-12.4%	-10.8%	-6.6%	22.8%	-14.5%
Italy	27	289,344	-38.4%	-16.2%	13.5%	-29.2%	-35.6%	9.2%	18.6%	-7.8%
Japan	43	1,647,674	-22.9%	-0.1%	26.0%	-33.7%	-24.9%	22.2%	22.7%	-18.9%
Jordan	8	249,644	-18.1%	-7.8%	21.6%	-15.0%	-15.9%	18.5%	24.8%	9.2%
Kazakhstan	8	167,278	-14.3%	-15.9%	32.5%	-8.9%	-6.4%	0.2%	44.8%	8.6%
Korea	20	908,613	-13.0%	-6.0%	13.7%	-15.9%	-10.6%	3.3%	16.9%	-7.5%
Malaysia	12	511,475	-36.8%	17.4%	56.7%	-17.0%	-35.6%	14.9%	59.8%	-18.8%
Mexico	140	1,886,367	-12.2%	-11.0%	23.1%	-16.0%	-13.0%	-3.8%	21.9%	-9.2%
Netherlands	19	296,715	-48.7%	-9.3%	20.8%	-30.0%	-47.9%	8.1%	22.6%	-16.6%
New Zealand	8	110,569	-4.7%	12.4%	-15.6%	-39.7%	18.5%	39.8%	5.0%	-25.0%
Peru	9	250,823	17.4%	-4.6%	14.4%	-27.8%	25.9%	8.0%	22.7%	-18.2%
Philippines	8	407,624	43.4%	-14.0%	51.0%	-16.6%	33.6%	-21.8%	40.7%	-24.1%
Poland	16	270,429	-36.4%	-1.2%	27.4%	-9.6%	-39.8%	6.2%	20.6%	-2.9%
Portugal	8	157,525	-58.5%	-30.3%	5.3%	-39.7%	-53.2%	-1.1%	18.9%	-14.4%
Puerto Rico, USA	9	99,390	11.4%	-18.3%	24.5%	-15.7%	4.0%	-11.7%	16.2%	-9.0%
Qatar	11	721,811	31.7%	1.1%	10.5%	-9.1%	27.1%	0.3%	6.6%	-9.8%
Russian Federation	10	134,664	71.7%	7.4%	59.5%	-16.5%	43.3%	11.5%	33.1%	-13.3%
Saudi Arabia	41	1,618,567	-11.4%	-21.2%	13.0%	-22.5%	-11.0%	-9.6%	13.6%	-11.0%
Singapore	16	435,363	5.0%	13.1%	9.6%	-17.4%	3.8%	11.0%	8.3%	-18.9%
Spain	33	482,552	-40.8%	-26.7%	4.9%	-36.2%	-34.0%	1.1%	16.9%	-12.1%
Thailand	29	1,022,489	-49.6%	3.8%	22.5%	-28.4%	-43.1%	18.4%	38.5%	-18.4%
Turkey	63	1,637,875	3.7%	-10.7%	34.2%	-11.6%	0.0%	-3.4%	29.4%	-4.4%
United Arab Emirates	46	2,561,450	2.5%	-16.1%	16.1%	-19.8%	-2.4%	11.4%	10.5%	6.4%
United Kingdom	147	1,862,522	-21.5%	-18.9%	24.4%	-26.8%	-19.3%	-6.9%	27.9%	-16.0%
United States	5,793	57,046,793	13.7%	-12.4%	30.5%	-19.4%	12.4%	-0.4%	29.0%	-8.3%
Vietnam	9	344,466	-41.8%	84.3%	19.7%	23.8%	-39.9%	11.4%	23.5%	-25.2%

Note: For the full appendices, visit https://greenview.sg/services/chsb-index/

Appendix 5

Year-over-year overall average change by selected metro area for energy, 2021-2022 (all non-resorts)

Market Area	NonResort									
	Count	Floor Area (SqM)	M3 (2021-2022)	M3 (2019-2022)	M4 (2021-2022)	M4 (2019-2022)	M5 (2021-2022)	M5 (2019-2022)	M6 (2021-2022)	M6 (2019-2022)
Abilene, TX	6	35,145	2.6%	-25.3%	3.6%	-22.7%	7.6%	-12.7%	8.7%	-9.6%
Abu Dhabi	12	680,744	-3.1%	-22.2%	3.2%	-28.6%	-6.2%	-0.2%	-0.1%	-8.4%
Ahmedabad	6	102,127	6.0%	-22.2%	20.1%	-13.4%	12.4%	-21.4%	27.3%	-12.5%
Akron, OH	16	95,585	5.3%	-21.3%	26.0%	-22.4%	6.9%	-6.3%	28.0%	-7.7%
Alabama State Non-Met	20	140,799	50.7%	-17.6%	54.0%	-17.4%	42.6%	-0.3%	45.7%	0.0%
Albany, NY	22	170,033	22.9%	-18.9%	43.4%	-21.1%	31.7%	-9.8%	53.6%	-12.3%
Albuquerque, NM	26	205,777	-13.5%	-16.5%	-1.0%	-21.0%	-9.0%	-4.4%	4.1%	-9.6%
Allentown, PA	13	73,692	1.8%	-17.4%	1.5%	-15.9%	6.4%	-8.4%	6.1%	-6.7%
Amarillo, TX	7	34,240	25.3%	-23.1%	19.3%	-23.6%	27.0%	-1.2%	20.9%	-1.9%
Amman	5	189,214	-20.6%	-4.6%	25.4%	-11.3%	-17.0%	26.6%	31.1%	17.7%
Amsterdam	12	193,014	-54.2%	-7.2%	20.1%	-31.6%	-52.5%	10.7%	24.4%	-18.4%
Anchorage, AK	9	127,039	8.2%	-15.1%	22.1%	-7.2%	-7.6%	-20.9%	4.2%	-13.6%
Anderson, SC	5	22,838	29.7%	-22.1%	44.3%	-25.0%	28.9%	-5.7%	43.5%	-9.2%
Arizona State Non-Metr	9	42,837	6.6%	-15.5%	-1.2%	-19.8%	14.7%	-1.7%	6.3%	-6.8%
Arkansas State Non-Met	15	64,558	16.5%	-19.9%	23.5%	-11.7%	18.4%	-10.1%	25.6%	-0.9%
Asheville, NC	15	110,001	19.2%	-23.7%	23.7%	-28.4%	15.7%	-2.8%	20.0%	-8.8%
Atlanta, GA	143	1,939,207	1.5%	-14.3%	19.1%	-25.1%	7.5%	2.9%	26.1%	-10.1%
Augusta, GA	14	97,674	14.0%	-16.2%	15.0%	-20.1%	25.1%	0.8%	26.2%	-3.9%
Austin, TX	57	639,817	18.1%	-19.2%	37.9%	-25.6%	16.4%	-6.8%	35.9%	-14.2%
Bakersfield, CA	9	81,532	22.1%	-19.0%	33.2%	-20.5%	13.2%	-18.0%	23.4%	-19.5%
Bali	5	84,621	-44.5%	8.7%	76.0%	-18.5%	-44.7%	6.1%	75.3%	-20.5%
Baltimore, MD	42	483,691	2.8%	-7.8%	20.8%	-13.5%	4.3%	3.0%	22.5%	-3.3%
Bandung	8	223,942	3.7%	-8.8%	36.9%	-6.5%	1.8%	-5.6%	34.4%	-3.3%
Bangkok	23	920,881	-52.1%	3.6%	19.8%	-29.3%	-46.3%	17.1%	34.2%	-20.1%
Barcelona	9	184,023	-47.1%	-27.6%	10.0%	-36.0%	-40.5%	0.4%	23.7%	-11.3%
Barnstable Town, MA	5	48,351	21.6%	12.7%	29.0%	10.2%	15.4%	17.2%	22.4%	14.6%
Baton Rouge, LA	12	138,471	30.4%	-24.2%	28.3%	-20.2%	32.2%	-19.1%	30.1%	-14.7%
Beaumont-Port Arthur,	5	24,828	58.9%	7.2%	44.2%	-12.8%	59.4%	22.0%	44.6%	-0.8%
Beijing	29	1,184,631	32.3%	49.2%	-5.7%	-24.9%	30.2%	49.4%	-7.2%	-24.8%
Bend, OR	5	27,840	7.6%	-13.9%	13.1%	-10.2%	10.2%	-10.5%	15.7%	-6.6%
Bengaluru	7	150,637	1.7%	14.8%	74.4%	7.6%	-16.7%	-11.0%	42.7%	-16.6%
Berlin	8	246,947	-35.5%	0.8%	34.0%	-33.2%	-38.4%	32.0%	27.8%	-12.5%
Billings, MT	9	59,060	42.5%	-15.3%	50.4%	-14.2%	38.9%	-12.2%	46.5%	-11.1%
Binghamton, NY	6	67,383	12.9%	-6.1%	33.3%	-12.0%	16.1%	2.0%	37.1%	-4.3%
Birmingham, AL	29	247,406	55.3%	-15.3%	62.7%	-21.1%	51.9%	0.7%	59.1%	-6.2%
Bismarck, ND	6	30,203	13.7%	5.2%	20.5%	-2.7%	18.3%	14.3%	25.3%	5.7%
Blacksburg, VA	6	38,795	17.6%	-18.9%	22.0%	-22.4%	14.6%	-1.1%	18.8%	-5.4%
Bloomington, IL	6	51,201	42.0%	-17.2%	42.6%	-8.6%	33.4%	-13.3%	34.0%	-4.3%
Bloomington, IN	5	35,873	9.3%	7.8%	22.0%	-12.0%	9.5%	19.0%	22.2%	-2.9%
Bogota	6	107,762	-13.9%	36.3%	51.5%	23.4%	-22.2%	3.4%	36.9%	-6.3%
Boise City, ID	19	124,959	22.1%	-3.1%	24.2%	-4.5%	26.9%	1.2%	29.2%	-0.2%
Boston, MA	76	974,208	-1.2%	0.2%	31.2%	-11.5%	-6.0%	4.0%	24.8%	-8.2%
Boulder, CO	10	70,194	16.4%	-14.4%	35.9%	-20.1%	17.9%	0.7%	37.5%	-6.0%
Bowling Green, KY	8	55,677	0.7%	-36.5%	15.6%	-29.2%	2.4%	-18.0%	17.5%	-8.5%
Bridgeport, CT	20	240,436	4.5%	-9.8%	24.7%	-14.9%	-2.5%	-8.8%	16.4%	-13.9%
Brownsville, TX	6	33,865	17.6%	-43.2%	23.8%	-37.6%	16.9%	-46.7%	23.1%	-41.4%
Brunswick, GA	6	38,528	45.9%	-1.2%	58.1%	-6.6%	46.6%	21.2%	58.9%	14.6%
Buffalo, NY	19	148,285	-10.8%	-14.0%	5.5%	-17.6%	-3.7%	-4.9%	13.9%	-8.9%
Cairo	13	779,432	-27.0%	-8.9%	-2.2%	-16.3%	-11.1%	2.0%	19.2%	-6.4%
Calgary	10	97,818	-31.6%	-25.0%	15.4%	-22.6%	-28.8%	-12.3%	20.1%	-9.6%

Note: Continued on next page

Year-over-year overall average change by selected metro area for energy, 2021-2022 (all non-resorts)

Market Area	NonResort									
	Count	Floor Area (SqM)	M3 (2021-2022)	M3 (2019-2022)	M4 (2021-2022)	M4 (2019-2022)	M5 (2021-2022)	M5 (2019-2022)	M6 (2021-2022)	M6 (2019-2022)
Canton-Massillon, OH	9	52,226	13.9%	-15.3%	28.2%	-14.9%	11.6%	2.7%	25.6%	3.2%
Cartagena	5	132,387	12.1%	24.5%	49.6%	37.4%	-1.8%	-16.4%	31.0%	-7.6%
Cedar Rapids, IA	5	70,063	57.1%	4.5%	80.2%	-13.1%	46.9%	17.7%	68.5%	-2.1%
Changsha	5	268,286	3.3%	7.2%	-11.0%	-14.8%	4.7%	4.3%	-9.7%	-17.1%
Changzhou	7	285,283	-3.6%	14.0%	11.1%	2.7%	-12.5%	-10.5%	0.8%	-19.4%
Charleston, SC	25	213,207	15.8%	-19.9%	27.9%	-23.2%	16.9%	-4.0%	29.2%	-7.8%
Charleston, WV	10	84,777	27.1%	-18.2%	34.7%	-27.8%	24.2%	1.3%	31.6%	-10.6%
Charlotte, NC	60	578,820	5.6%	-14.5%	31.3%	-25.6%	4.4%	2.1%	29.8%	-11.2%
Charlottesville, VA	8	56,114	3.5%	-18.9%	0.4%	-24.1%	12.1%	-0.8%	8.7%	-7.2%
Chattanooga, TN	19	116,200	29.8%	-22.5%	28.7%	-28.4%	30.2%	4.6%	29.1%	-3.5%
Chengdu	22	1,034,865	16.3%	17.4%	-6.1%	-20.7%	12.0%	14.4%	-9.6%	-22.7%
Chennai	5	134,620	-7.3%	-33.9%	9.1%	-35.1%	-6.8%	-33.2%	9.7%	-34.4%
Chicago, IL	132	1,758,194	4.1%	-8.4%	31.8%	-19.3%	2.2%	10.1%	29.5%	-3.0%
Chongqing	10	433,372	17.9%	18.5%	0.1%	-19.2%	11.2%	16.3%	-5.7%	-20.7%
Cincinnati, OH	42	333,029	14.2%	-11.8%	28.1%	-20.8%	13.9%	6.1%	27.8%	-4.8%
Clarksville, TN-KY	6	31,721	40.8%	-24.3%	43.9%	-23.8%	44.1%	4.0%	47.2%	4.8%
Cleveland, OH	27	295,842	21.3%	-4.9%	40.8%	-14.5%	11.6%	8.7%	29.5%	-2.3%
College Station, TX	8	52,249	40.3%	-16.9%	47.4%	-17.6%	30.2%	-3.4%	36.7%	-4.2%
Colorado Springs, CO	13	114,249	40.7%	-2.4%	44.8%	-14.0%	23.6%	9.4%	27.1%	-3.5%
Colorado State Non-Met	17	83,195	27.7%	-18.0%	30.7%	-13.7%	23.3%	-4.2%	26.3%	0.7%
Columbia, MO	11	87,673	38.6%	-0.4%	61.2%	-5.2%	32.0%	12.4%	53.4%	7.0%
Columbia, SC	19	152,889	32.2%	-17.1%	39.6%	-26.1%	29.3%	-0.9%	36.5%	-11.7%
Columbus, GA	10	54,491	50.7%	-6.5%	67.4%	-10.0%	51.6%	20.6%	68.4%	16.1%
Columbus, OH	43	385,256	23.1%	-15.8%	47.6%	-27.5%	10.9%	0.2%	32.9%	-13.7%
Corpus Christi, TX	12	66,446	31.6%	-13.8%	31.1%	-22.4%	31.5%	1.9%	31.0%	-8.2%
Dallas-Fort Worth, TX	153	1,865,034	17.0%	-14.5%	38.9%	-20.0%	15.4%	-3.6%	37.0%	-9.8%
Dammam	6	164,855	29.6%	-14.0%	15.4%	-26.4%	29.1%	-1.0%	15.0%	-15.3%
Davenport, IA (Quad Cit	9	67,010	3.2%	-14.4%	11.8%	-20.8%	7.9%	-5.5%	16.9%	-12.6%
Dayton, OH	17	106,896	7.4%	-15.7%	21.0%	-22.9%	10.5%	2.7%	24.4%	-6.1%
Daytona Beach, FL	10	58,896	22.3%	-21.4%	30.5%	-18.8%	19.9%	-7.6%	27.9%	-4.6%
Delhi	13	490,070	-7.5%	-13.9%	17.2%	-14.3%	-16.8%	-20.2%	5.4%	-20.6%
Denver, CO	79	950,272	4.6%	-12.6%	24.8%	-21.3%	5.5%	-3.4%	25.9%	-13.0%
Des Moines, IA	19	173,240	-3.7%	-11.8%	13.3%	-21.0%	-0.3%	2.8%	17.3%	-7.9%
Destin, FL	18	114,910	17.7%	-15.0%	14.1%	-24.6%	19.1%	2.3%	15.4%	-9.3%
Detroit, MI	37	381,600	17.5%	-5.2%	41.8%	-17.5%	12.3%	2.8%	35.6%	-10.6%
Doha	11	721,811	31.7%	1.1%	10.5%	-9.1%	27.1%	0.3%	6.6%	-9.8%
Dothan, AL	5	23,542	14.5%	-14.9%	21.6%	-19.9%	17.7%	10.1%	24.9%	3.6%
Dubai-Sharjah-Ajman	31	1,737,994	1.5%	-12.5%	18.2%	-14.9%	-2.8%	18.5%	13.2%	15.3%
Dublin	5	96,400	-49.0%	-19.2%	32.8%	-26.5%	-47.6%	-7.2%	36.5%	-15.7%
Durham, NC	24	207,700	8.2%	-10.1%	30.3%	-27.6%	10.8%	8.0%	33.3%	-13.0%
Eau Claire, WI	5	33,806	7.7%	6.7%	25.8%	-5.5%	10.2%	28.1%	28.7%	13.6%
Edmonton	7	61,650	9.3%	0.3%	51.5%	-8.7%	7.9%	15.3%	49.6%	4.9%
El Paso, TX	15	87,749	36.3%	-7.4%	28.3%	-9.8%	39.0%	7.7%	30.9%	4.8%
Erie, PA	8	46,397	11.1%	-6.1%	21.0%	-15.2%	11.3%	4.7%	21.2%	-5.4%
Eugene-Springfield, OR	5	26,720	-0.4%	-25.7%	4.4%	-27.7%	7.4%	-20.9%	12.6%	-23.1%
Evansville, IN-KY	8	56,772	50.0%	-14.4%	60.4%	-16.9%	45.8%	9.5%	55.9%	6.4%
Fargo, ND	10	69,708	-1.0%	-28.3%	9.9%	-21.6%	2.0%	-16.5%	13.3%	-8.6%
Fayetteville, AR	20	169,510	41.9%	-20.4%	75.9%	-24.6%	25.8%	-1.7%	55.9%	-6.9%
Fayetteville, NC	10	73,980	47.5%	-10.4%	46.8%	-8.4%	46.7%	10.5%	46.0%	13.1%
Flagstaff, AZ	7	51,136	22.9%	-13.1%	25.1%	-15.1%	20.3%	1.0%	22.5%	-1.3%

Year-over-year overall average change by selected country for water, 2021-2022

All non-resorts

Country	NonResort					
	Count	Floor Area (SqM)	M8 (2021-2022)	M8 (2019-2022)	M9 (2021-2022)	M9 (2019-2022)
Argentina	9	231,677	-32.9%	8.0%	-15.1%	35.4%
Australia	27	779,876	-13.1%	0.1%	-23.8%	37.7%
Austria	11	241,056	-26.3%	-13.1%	-22.3%	57.5%
Belgium	11	144,740	-18.1%	-2.3%	-18.0%	53.1%
Brazil	10	345,162	-15.7%	-5.2%	-11.5%	39.3%
Canada	182	2,417,541	-12.8%	-1.8%	-10.1%	41.5%
Chile	8	137,156	-0.4%	-26.1%	-34.4%	37.6%
China	420	20,107,123	-1.2%	9.6%	-24.9%	-14.9%
Colombia	23	414,759	-15.8%	-3.1%	-0.4%	26.1%
Costa Rica	12	213,036	-11.1%	-20.8%	-21.9%	38.7%
Czech Republic	9	226,299	-22.2%	4.2%	-15.8%	80.5%
Egypt	16	844,789	-15.3%	-0.3%	-11.1%	10.3%
France	25	238,026	-24.5%	-7.3%	-18.2%	44.9%
Germany	48	949,187	-19.7%	-1.6%	-23.7%	49.5%
Hong Kong, China	17	604,870	-18.7%	25.0%	-17.0%	-5.0%
India	73	1,737,973	-4.9%	0.1%	0.5%	27.5%
Indonesia	27	878,133	-4.7%	-7.1%	-15.3%	23.1%
Italy	19	209,657	-28.8%	-13.9%	-23.4%	24.6%
Japan	42	1,559,070	-22.1%	14.1%	-24.8%	28.4%
Jordan	10	309,644	-11.7%	0.7%	-8.1%	30.6%
Kazakhstan	10	224,047	-18.1%	1.1%	10.3%	24.3%
Korea	15	795,770	-12.2%	6.3%	-4.2%	16.4%
Malaysia	14	531,118	-19.1%	11.7%	-17.8%	56.9%
Mexico	125	1,808,845	-9.2%	-10.1%	-14.9%	25.3%
Netherlands	19	292,334	-32.1%	0.4%	-23.1%	61.1%
New Zealand	8	114,289	12.4%	1.9%	-44.4%	-6.0%
Peru	10	156,633	22.8%	-13.8%	-29.1%	23.3%
Philippines	9	434,296	39.5%	-11.0%	-14.9%	42.0%
Poland	17	289,197	-17.5%	-4.6%	-12.9%	54.1%
Portugal	10	182,232	-25.4%	0.4%	-12.7%	84.1%
Puerto Rico, USA	9	107,895	-7.1%	7.8%	9.6%	4.0%
Qatar	12	773,444	9.6%	-13.5%	-26.3%	-9.0%
Russian Federation	16	189,113	5.5%	11.0%	-9.4%	-1.6%
Saudi Arabia	32	1,423,571	-9.7%	-1.4%	-4.2%	12.5%
Singapore	18	503,238	5.2%	-9.0%	-33.7%	15.9%
Spain	38	503,205	-22.5%	-0.9%	-14.3%	33.6%
Switzerland	8	142,277	-9.8%	8.2%	-9.7%	62.0%
Taiwan, China	8	300,225	-18.4%	13.4%	-17.9%	13.3%
Thailand	33	1,322,257	-42.0%	11.6%	-23.0%	43.1%
Turkey	68	1,724,180	-1.0%	2.3%	-1.2%	28.7%
United Arab Emirates	56	3,050,310	-8.1%	-4.2%	-8.2%	4.5%
United Kingdom	161	2,020,470	-13.1%	-9.2%	-19.5%	37.0%
United States	5,009	50,673,080	-5.0%	3.8%	-5.0%	9.7%
Vietnam	11	442,257	-26.2%	11.2%	-20.6%	39.9%

Note: Continued on next page

Year-over-year overall average change by selected country for water, 2021-2022

Full-service non-resorts

Country	Full Service NonResort					
	Count	Floor Area (SqM)	M8 (2021-2022)	M8 (2019-2022)	M9 (2021-2022)	M9 (2019-2022)
Argentina	8	225,827	-36.3%	6.2%	-16.6%	35.5%
Australia	23	721,933	-12.3%	0.8%	-24.6%	36.9%
Austria	9	202,531	-27.7%	-7.0%	-16.8%	61.6%
Brazil	8	329,287	-17.5%	-1.8%	-10.9%	40.1%
Canada	74	1,592,459	-17.2%	-2.5%	-13.3%	46.5%
China	333	18,390,594	-0.9%	11.0%	-24.3%	-14.7%
Colombia	12	280,425	-18.5%	-7.2%	-4.1%	24.4%
Egypt	16	844,789	-15.3%	-0.3%	-11.1%	10.3%
France	17	197,235	-26.0%	-8.6%	-19.5%	40.8%
Germany	31	828,711	-21.9%	-0.3%	-23.2%	53.6%
Hong Kong, China	11	530,254	-20.1%	42.2%	-17.8%	-5.2%
India	50	1,535,280	-5.0%	0.5%	-0.8%	26.9%
Indonesia	20	790,028	-5.2%	-8.1%	-15.6%	23.1%
Italy	11	161,472	-33.2%	-16.1%	-23.9%	21.8%
Japan	37	1,506,423	-22.7%	13.1%	-24.8%	27.6%
Jordan	10	309,644	-11.7%	0.7%	-8.1%	30.6%
Kazakhstan	9	211,630	-19.4%	-2.4%	8.4%	21.6%
Korea	12	741,462	-10.3%	10.3%	-4.7%	15.6%
Malaysia	11	466,145	-18.1%	12.3%	-15.9%	57.3%
Mexico	50	1,029,850	-12.7%	-10.6%	-18.8%	24.1%
Netherlands	13	239,160	-30.4%	-1.3%	-25.0%	65.5%
Philippines	8	386,123	33.0%	-0.9%	-14.2%	43.6%
Poland	14	260,876	-19.0%	-5.1%	-13.3%	53.5%
Qatar	12	773,444	9.6%	-13.5%	-26.3%	-9.0%
Saudi Arabia	24	1,229,183	-11.9%	-0.6%	-5.2%	14.4%
Singapore	13	437,190	5.7%	-1.4%	-34.0%	15.2%
Spain	12	347,261	-32.2%	0.7%	-15.4%	30.6%
Thailand	26	1,157,397	-46.1%	14.9%	-23.5%	44.7%
Turkey	48	1,523,552	-2.2%	2.1%	-0.3%	30.3%
United Arab Emirates	40	2,696,468	-10.3%	-4.0%	-9.1%	4.4%
United Kingdom	119	1,781,177	-15.4%	-8.9%	-20.5%	37.0%
United States	1,246	26,723,537	-9.1%	4.1%	-8.8%	14.5%
Vietnam	10	437,017	-26.9%	10.3%	-20.4%	40.5%

Year-over-year overall average change by selected metro area for water (all non-resorts), 2021-2022

Market Area	NonResort					
	Count	Floor Area (SqM)	M8 (2021-2022)	M8 (2019-2022)	M9 (2021-2022)	M9 (2019-2022)
Abilene, TX	6	30,693	18.2%	43.5%	46.3%	18.4%
Abu Dhabi	12	690,765	-0.1%	2.7%	-7.7%	4.2%
Akron, OH	11	75,121	-6.9%	-2.4%	-3.4%	13.8%
Alabama State Non-Met	22	135,474	10.3%	11.5%	15.2%	9.2%
Albany, NY	10	85,832	-28.3%	-31.0%	-33.2%	-15.9%
Albuquerque, NM	24	206,690	-6.1%	-7.3%	-15.0%	7.5%
Allentown, PA	10	58,113	15.4%	3.1%	3.0%	11.2%
Amarillo, TX	8	40,743	26.9%	32.3%	32.0%	20.7%
Amman	6	231,214	-14.6%	2.4%	-4.8%	34.6%
Amsterdam	14	218,217	-34.7%	0.2%	-25.4%	69.9%
Anchorage, AK	9	127,039	-1.1%	-9.0%	-0.5%	11.6%
Anderson, SC	5	29,364	-8.5%	5.8%	1.2%	3.7%
Ankara	6	211,915	-4.9%	11.2%	-6.0%	19.7%
Arizona State Non-Metr	6	22,467	-0.5%	-1.9%	-0.8%	1.4%
Arkansas State Non-Met	13	50,991	0.5%	-10.0%	-3.4%	5.4%
Asheville, NC	13	105,216	-3.5%	3.3%	-4.0%	0.0%
Athens	5	133,379	-10.6%	-5.9%	-10.3%	72.3%
Atlanta, GA	128	1,834,845	-11.0%	1.6%	-12.9%	5.5%
Augusta, GA	5	26,601	0.8%	-25.5%	-20.1%	0.4%
Austin, TX	47	586,353	-4.8%	1.3%	-7.8%	10.4%
Bakersfield, CA	8	79,838	7.9%	9.1%	5.2%	14.5%
Baltimore, MD	24	272,896	-12.3%	-7.0%	-12.7%	3.0%
Bandung	5	141,229	0.3%	-24.5%	-24.1%	26.5%
Bangkok	30	1,215,645	-43.4%	11.0%	-22.8%	43.9%
Barcelona	10	187,431	-24.6%	1.5%	-10.2%	55.7%
Baton Rouge, LA	13	141,923	13.8%	-9.4%	-5.0%	9.3%
Beijing	27	1,284,683	12.4%	31.9%	-33.2%	-17.1%
Bengaluru	10	215,080	-1.2%	18.4%	12.9%	62.7%
Berlin	10	276,238	-27.7%	12.6%	-25.4%	50.9%
Billings, MT	8	55,988	-18.4%	-20.8%	-21.3%	-16.1%
Birmingham, AL	30	251,894	0.6%	9.9%	1.3%	4.6%
Bismarck, ND	6	37,582	-11.1%	8.1%	-4.0%	-4.6%
Blacksburg, VA	6	38,795	9.2%	2.8%	-1.6%	13.2%
Bloomington, IL	5	41,724	-2.9%	-1.8%	6.2%	-3.3%
Bloomington, IN	5	35,873	7.7%	39.8%	14.0%	20.1%
Bogota	8	121,385	-24.0%	-0.2%	-10.0%	38.5%
Boise City, ID	11	71,186	1.0%	-12.3%	-12.2%	5.6%
Boston, MA	55	767,429	-10.0%	4.7%	-8.1%	22.7%
Boulder, CO	10	78,886	-11.1%	2.5%	-4.5%	9.4%
Bowling Green, KY	5	27,944	-2.5%	-6.9%	1.3%	12.2%
Bridgeport, CT	18	248,928	-7.3%	8.9%	0.5%	12.7%
Brownsville, TX	7	39,474	8.5%	10.3%	21.1%	13.6%
Brunswick, GA	5	34,812	-15.2%	-1.9%	-6.0%	-8.2%
Brussels	5	75,185	-22.7%	-4.3%	-20.0%	55.3%
Buffalo, NY	14	113,807	6.0%	16.5%	8.5%	23.1%
Cairo	12	736,504	-17.2%	-2.5%	-10.0%	11.6%
Calgary	17	225,272	-16.1%	4.3%	-3.1%	46.9%
Canton-Massillon, OH	5	29,938	13.7%	19.9%	26.6%	29.4%
Cartagena	6	139,827	-12.3%	2.7%	12.1%	16.4%
Cedar Rapids, IA	5	70,063	1.6%	7.6%	-10.5%	16.5%

Note: Continued on next page

APPENDIX 7 (CONCLUDED)

Year-over-year overall average change by selected metro area for water (all non-resorts), 2021-2022

Market Area	NonResort					
	Count	Floor Area (SqM)	M8 (2021-2022)	M8 (2019-2022)	M9 (2021-2022)	M9 (2019-2022)
Champaign-Urbana, IL	5	25,767	5.3%	30.2%	26.1%	12.9%
Changsha	6	301,286	6.2%	27.6%	2.8%	-7.3%
Changzhou	5	214,483	-9.8%	7.0%	-9.3%	0.5%
Charleston, SC	29	229,946	-2.4%	5.6%	-0.7%	6.4%
Charleston, WV	8	76,084	-13.9%	-15.5%	-26.4%	-6.5%
Charlotte, NC	56	582,274	-10.7%	2.2%	-10.4%	14.2%
Charlottesville, VA	10	73,502	14.4%	-10.9%	-14.5%	16.9%
Chattanooga, TN	16	103,647	-7.6%	-6.1%	-15.1%	-9.1%
Chengdu	19	804,655	13.5%	16.9%	-23.6%	-11.7%
Chennai	7	174,482	15.5%	4.4%	10.3%	44.0%
Chicago, IL	111	1,596,637	-12.2%	-0.2%	-12.1%	15.9%
Chongqing	10	781,210	3.8%	11.9%	-28.2%	-14.4%
Cincinnati, OH	37	318,564	-5.9%	8.5%	-2.1%	7.8%
Clarksville, TN-KY	5	27,208	-4.5%	18.1%	17.2%	-2.1%
Cleveland, OH	27	292,321	-12.8%	2.1%	-7.6%	-0.8%
College Station, TX	8	52,249	-11.8%	13.9%	13.0%	-7.4%
Colorado Springs, CO	14	130,228	-6.0%	-2.9%	-13.7%	-3.2%
Colorado State Non-Me	20	166,864	4.9%	11.3%	13.5%	5.0%
Columbia, MO	11	75,811	-4.9%	9.4%	6.4%	6.9%
Columbia, SC	16	148,868	-7.2%	9.5%	-1.5%	1.9%
Columbus, GA	10	56,345	-6.3%	6.7%	3.2%	3.5%
Columbus, OH	41	385,611	-2.6%	0.9%	-17.7%	16.6%
Corpus Christi, TX	12	65,761	-8.4%	5.2%	-5.3%	-8.4%
Dallas-Fort Worth, TX	144	1,945,571	1.0%	9.9%	1.6%	21.4%
Davenport, IA (Quad Cit	6	35,950	12.5%	6.9%	12.3%	25.0%
Dayton, OH	13	86,259	0.4%	-0.4%	-9.8%	12.2%
Daytona Beach, FL	13	81,027	-0.6%	0.8%	0.9%	3.5%
Delhi	11	399,296	-8.8%	-4.6%	-2.9%	16.6%
Denver, CO	74	1,037,652	-9.1%	-5.9%	-13.8%	10.3%
Des Moines, IA	22	211,600	-10.3%	14.4%	1.9%	6.6%
Destin, FL	11	77,001	10.0%	30.3%	12.8%	4.6%
Detroit, MI	38	443,810	-3.5%	6.8%	-8.0%	17.9%
Doha	12	773,444	9.6%	-13.5%	-26.3%	-9.0%
Dubai-Sharjah-Ajman	40	2,202,720	-10.5%	-5.5%	-7.6%	5.1%
Durham, NC	20	183,309	-1.2%	3.8%	-15.9%	17.7%
Edmonton	12	138,339	-6.5%	21.2%	15.3%	51.2%
El Paso, TX	19	129,301	17.4%	6.6%	1.3%	10.7%
Erie, PA	5	26,451	4.6%	10.0%	3.4%	17.7%
Evansville, IN-KY	7	49,115	-15.5%	-2.7%	-4.6%	-9.2%
Fargo, ND	9	64,859	-0.5%	-16.9%	-13.1%	11.0%
Fayetteville, AR	19	120,156	-4.5%	9.9%	3.5%	14.8%
Fayetteville, NC	11	78,219	5.0%	0.8%	3.1%	4.2%
Flagstaff, AZ	8	54,401	-5.8%	1.0%	-3.9%	1.4%
Florida State Non-Metro	13	56,972	-0.7%	7.4%	6.8%	-0.2%
Fort Collins, CO	11	109,959	-6.6%	1.3%	-9.5%	9.9%
Fort Myers, FL	17	119,107	-2.0%	-6.3%	-1.8%	0.5%
Fort Wayne, IN	8	52,443	-7.3%	2.9%	-5.5%	2.6%
Foshan	8	418,466	-4.4%	27.5%	-24.3%	-16.5%
Fresno, CA	6	47,712	0.4%	10.9%	0.9%	8.4%
Gainesville, FL	8	63,845	0.3%	-1.8%	7.0%	3.4%

Appendix 8

Energy efficiency opportunities among full-service non-resorts by selected metro area

	FULL SERVICE NON-RESORT									
	Energy Per Square Meter (M6)									
	Inhouse Laundry					Outsourced Laundry				
GEOGRAPHY	2019	2021	2022	% Change (2019-2022)	% Change (2021-2022)	2019	2021	2022	% Change (2019-2022)	% Change (2021-2022)
Abu Dhabi			1.89	Insufficient Data	Insufficient Data		1.65	2.39	Insufficient Data	44.9%
Ahmedabad				Insufficient Data	Insufficient Data			1.58	Insufficient Data	Insufficient Data
Albany, NY		2.53		Insufficient Data	Insufficient Data			1.34	Insufficient Data	Insufficient Data
Albuquerque, NM		2.15	1.91	Insufficient Data	-11.4%			1.62	Insufficient Data	Insufficient Data
AMBA		1.90	2.96	Insufficient Data	55.3%			2.19	Insufficient Data	Insufficient Data
Amman		1.65	1.28	Insufficient Data	-22.2%				Insufficient Data	Insufficient Data
Amsterdam		2.07		Insufficient Data	Insufficient Data		1.94	1.59	Insufficient Data	-18.0%
Ankara				Insufficient Data	Insufficient Data			1.75	Insufficient Data	Insufficient Data
Asheville, NC		2.00	1.18	Insufficient Data	-41.2%			1.38	Insufficient Data	Insufficient Data
Athens			1.32	Insufficient Data	Insufficient Data			1.22	Insufficient Data	Insufficient Data
Atlanta, GA	1.61	2.15	1.75	8.5%	-18.7%		2.06	1.44	Insufficient Data	-30.0%
Auckland				Insufficient Data	Insufficient Data			1.18	Insufficient Data	Insufficient Data
Austin, TX	1.57	2.31	1.53	-2.5%	-33.9%			1.44	Insufficient Data	Insufficient Data
Bali				Insufficient Data	Insufficient Data			1.81	Insufficient Data	Insufficient Data
Baltimore, MD		2.12	1.90	Insufficient Data	-10.7%		2.11	1.79	Insufficient Data	-15.3%
Bandung				Insufficient Data	Insufficient Data			1.82	Insufficient Data	Insufficient Data
Bangkok	1.59	2.30	1.91	20.1%	-17.0%	1.56	3.27	1.74	11.9%	-46.6%
Barcelona		1.76	1.55	Insufficient Data	-11.7%			1.58	Insufficient Data	Insufficient Data
Baton Rouge, LA		1.79		Insufficient Data	Insufficient Data			1.42	Insufficient Data	Insufficient Data
Beijing	2.00	2.16	2.06	3.1%	-4.5%	2.02	2.45	2.09	3.7%	-14.8%
Belfast				Insufficient Data	Insufficient Data			1.30	Insufficient Data	Insufficient Data
Bengaluru		1.91	1.39	Insufficient Data	-27.3%			1.36	Insufficient Data	Insufficient Data
Berlin				Insufficient Data	Insufficient Data		1.77	1.30	Insufficient Data	-26.9%
Birmingham, AL		2.41		Insufficient Data	Insufficient Data			1.69	Insufficient Data	Insufficient Data
Bogota			1.98	Insufficient Data	Insufficient Data			1.56	Insufficient Data	Insufficient Data
Bordeaux				Insufficient Data	Insufficient Data			1.19	Insufficient Data	Insufficient Data
Boston, MA	1.82	2.20	1.39	-23.4%	-36.7%		2.35	1.64	Insufficient Data	-30.5%
Bridgeport, CT				Insufficient Data	Insufficient Data			1.39	Insufficient Data	Insufficient Data
Brisbane				Insufficient Data	Insufficient Data			1.18	Insufficient Data	Insufficient Data
Bristol				Insufficient Data	Insufficient Data			1.60	Insufficient Data	Insufficient Data
Brussels				Insufficient Data	Insufficient Data		1.97	1.64	Insufficient Data	-16.5%
Budapest				Insufficient Data	Insufficient Data			1.78	Insufficient Data	Insufficient Data
Buffalo, NY		2.06		Insufficient Data	Insufficient Data			1.35	Insufficient Data	Insufficient Data
Cairo		3.13	1.62	Insufficient Data	-48.2%			1.19	Insufficient Data	Insufficient Data

Energy efficiency opportunities among limited service hotels by selected metro area

	LIMITED SERVICE									
	Energy Per Square Meter (M6)									
	Inhouse Laundry					Outsourced Laundry				
GEOGRAPHY	2019	2021	2022	% Change (2019-2022)	% Change (2021-2022)	2019	2021	2022	% Change (2019-2022)	% Change (2021-2022)
Aberdeen				Insufficient Data	Insufficient Data		2.22	1.69	Insufficient Data	-23.7%
Abilene, TX		1.71	1.17	Insufficient Data	-31.1%				Insufficient Data	Insufficient Data
Akron, OH		2.20	1.38	Insufficient Data	-37.4%			1.33	Insufficient Data	Insufficient Data
Alabama State Non-Metropolitan Areas	1.73	1.39	1.89	9.5%	35.9%			1.44	Insufficient Data	Insufficient Data
Albany, NY		2.14	1.50	Insufficient Data	-29.8%			1.71	Insufficient Data	Insufficient Data
Albuquerque, NM	1.73	1.82	1.45	-16.0%	-20.5%			1.48	Insufficient Data	Insufficient Data
Allentown, PA		2.08	1.57	Insufficient Data	-24.6%			1.46	Insufficient Data	Insufficient Data
Amarillo, TX		1.56	1.49	Insufficient Data	-4.3%				Insufficient Data	Insufficient Data
Amiens				Insufficient Data	Insufficient Data			1.32	Insufficient Data	Insufficient Data
Amsterdam				Insufficient Data	Insufficient Data		1.38	1.93	Insufficient Data	39.6%
Anchorage, AK		1.91	1.19	Insufficient Data	-37.4%				Insufficient Data	Insufficient Data
Anderson, SC				Insufficient Data	Insufficient Data			1.84	Insufficient Data	Insufficient Data
Ann Arbor, MI		1.98	1.32	Insufficient Data	-33.1%			1.22	Insufficient Data	Insufficient Data
Annecy				Insufficient Data	Insufficient Data			1.28	Insufficient Data	Insufficient Data
Antwerp				Insufficient Data	Insufficient Data			1.41	Insufficient Data	Insufficient Data
Arizona State Non-Metropolitan Areas		2.08	2.00	Insufficient Data	-3.7%				Insufficient Data	Insufficient Data
Arkansas State Non-Metropolitan Areas	1.89	1.61	1.84	-2.4%	14.5%			1.20	Insufficient Data	Insufficient Data
Asheville, NC		1.49	1.68	Insufficient Data	13.0%			1.18	Insufficient Data	Insufficient Data
Atlanta, GA	1.69	1.84	1.52	-10.4%	-17.9%		2.34	1.38	Insufficient Data	-41.2%
Auburn-Opelika, AL		1.97	2.18	Insufficient Data	11.0%			1.00	Insufficient Data	Insufficient Data
Augusta, GA		1.48	1.17	Insufficient Data	-20.7%			1.29	Insufficient Data	Insufficient Data
Austin, TX	1.89	1.71	1.47	-22.1%	-14.0%			1.34	Insufficient Data	Insufficient Data
Avignon				Insufficient Data	Insufficient Data			1.82	Insufficient Data	Insufficient Data
Bakersfield, CA		2.24	1.33	Insufficient Data	-40.8%			1.34	Insufficient Data	Insufficient Data
Bali				Insufficient Data	Insufficient Data			1.87	Insufficient Data	Insufficient Data
Baltimore, MD	1.94	1.84	1.40	-27.9%	-24.1%			1.48	Insufficient Data	Insufficient Data
Bandung			1.48	Insufficient Data	Insufficient Data				Insufficient Data	Insufficient Data
Bangkok				Insufficient Data	Insufficient Data		1.90	1.54	Insufficient Data	-18.8%
Barcelona		2.55	1.43	Insufficient Data	-43.9%			2.21	Insufficient Data	Insufficient Data
Baton Rouge, LA		2.01	1.64	Insufficient Data	-18.7%			1.13	Insufficient Data	Insufficient Data
Bayonne-Anglet-Biarritz				Insufficient Data	Insufficient Data			1.29	Insufficient Data	Insufficient Data
Beaumont-Port Arthur, TX		1.82	1.18	Insufficient Data	-35.0%			1.35	Insufficient Data	Insufficient Data
Beijing			2.55	Insufficient Data	Insufficient Data		2.24	1.33	Insufficient Data	-40.7%
Bend, OR			1.17	Insufficient Data	Insufficient Data				Insufficient Data	Insufficient Data

Appendix 10

Water efficiency opportunities among full service non-resorts by selected metro area

	FULL SERVICE NON-RESORT									
	Water Per Occupied Room (M8)									
	Inhouse Laundry					Outsourced Laundry				
GEOGRAPHY	2019	2021	2022	% Change (2019-2022)	% Change (2021-2022)	2019	2021	2022	% Change (2019-2022)	% Change (2021-2022)
Abu Dhabi		1.93	4.35	Insufficient Data	125.1%		2.17	1.58	Insufficient Data	-27.4%
Adelaide				Insufficient Data	Insufficient Data			1.26	Insufficient Data	Insufficient Data
Albany, NY		1.20		Insufficient Data	Insufficient Data			1.47	Insufficient Data	Insufficient Data
Albuquerque, NM		2.61	1.37	Insufficient Data	-47.3%			1.74	Insufficient Data	Insufficient Data
AMBA		3.59	2.92	Insufficient Data	-18.7%			1.80	Insufficient Data	Insufficient Data
Amman		1.76	1.40	Insufficient Data	-20.5%				Insufficient Data	Insufficient Data
Amsterdam				Insufficient Data	Insufficient Data		2.28	1.70	Insufficient Data	-25.4%
Ankara				Insufficient Data	Insufficient Data			2.88	Insufficient Data	Insufficient Data
Asheville, NC		1.28		Insufficient Data	Insufficient Data			1.09	Insufficient Data	Insufficient Data
Athens			1.71	Insufficient Data	Insufficient Data				Insufficient Data	Insufficient Data
Atlanta, GA	1.54	1.84	1.80	16.8%	-2.1%		2.08	1.63	Insufficient Data	-21.6%
Auckland				Insufficient Data	Insufficient Data			1.99	Insufficient Data	Insufficient Data
Austin, TX		2.01	1.43	Insufficient Data	-28.7%			1.49	Insufficient Data	Insufficient Data
Baltimore, MD		2.00	1.18	Insufficient Data	-41.0%		4.04	1.44	Insufficient Data	-64.3%
Bandung				Insufficient Data	Insufficient Data			2.77	Insufficient Data	Insufficient Data
Bangkok	1.74	2.75	3.07	76.1%	11.5%	2.73	3.32	1.74	-36.1%	-47.4%
Barcelona		1.88	1.48	Insufficient Data	-21.2%			1.72	Insufficient Data	Insufficient Data
Baton Rouge, LA		1.54		Insufficient Data	Insufficient Data			1.22	Insufficient Data	Insufficient Data
Beijing	1.54	1.70	1.82	18.3%	6.7%	1.75	1.90	1.74	-0.2%	-8.4%
Belgrade				Insufficient Data	Insufficient Data			1.59	Insufficient Data	Insufficient Data
Bengaluru		2.01	2.78	Insufficient Data	38.4%			1.54	Insufficient Data	Insufficient Data
Berlin				Insufficient Data	Insufficient Data		2.21	1.60	Insufficient Data	-27.5%
Birmingham, AL		2.24	1.31	Insufficient Data	-41.4%			1.38	Insufficient Data	Insufficient Data
Bogota			2.10	Insufficient Data	Insufficient Data			1.52	Insufficient Data	Insufficient Data
Boston, MA		2.17	1.52	Insufficient Data	-30.2%		1.68	1.59	Insufficient Data	-5.7%
Bridgeport, CT				Insufficient Data	Insufficient Data			1.46	Insufficient Data	Insufficient Data
Brisbane				Insufficient Data	Insufficient Data			1.30	Insufficient Data	Insufficient Data
Bristol				Insufficient Data	Insufficient Data			1.24	Insufficient Data	Insufficient Data
Brussels				Insufficient Data	Insufficient Data		1.76	1.53	Insufficient Data	-13.0%
Budapest				Insufficient Data	Insufficient Data			2.19	Insufficient Data	Insufficient Data
Buffalo, NY		1.73		Insufficient Data	Insufficient Data			1.74	Insufficient Data	Insufficient Data
Cairo		2.18	2.80	Insufficient Data	28.7%			1.61	Insufficient Data	Insufficient Data
Calgary		2.90	1.76	Insufficient Data	-39.3%			1.53	Insufficient Data	Insufficient Data
Canberra				Insufficient Data	Insufficient Data			2.70	Insufficient Data	Insufficient Data

Appendix 11

Water efficiency opportunities among limited-service hotels by selected metro area

	LIMITED SERVICE									
	Water Per Occupied Room (M8)									
	Inhouse Laundry					Outsourced Laundry				
GEOGRAPHY	2019	2021	2022	% Change (2019-2022)	% Change (2021-2022)	2019	2021	2022	% Change (2019-2022)	% Change (2021-2022)
Abilene, TX		1.38	1.34	Insufficient Data	-2.8%				Insufficient Data	Insufficient Data
Akron, OH		2.54	1.16	Insufficient Data	-54.2%			1.18	Insufficient Data	Insufficient Data
Alabama State Non-Metropolitan Areas	1.94	2.40	1.81	-6.4%	-24.5%			1.55	Insufficient Data	Insufficient Data
Albany, NY		1.72	1.89	Insufficient Data	10.0%			2.21	Insufficient Data	Insufficient Data
Albuquerque, NM	1.56	1.57	1.40	-9.9%	-10.4%			1.27	Insufficient Data	Insufficient Data
Allentown, PA		1.58	1.36	Insufficient Data	-14.0%			1.23	Insufficient Data	Insufficient Data
Amarillo, TX		2.62	1.76	Insufficient Data	-32.7%				Insufficient Data	Insufficient Data
Amsterdam				Insufficient Data	Insufficient Data		1.51	1.36	Insufficient Data	-9.7%
Anchorage, AK		1.53	1.11	Insufficient Data	-27.5%				Insufficient Data	Insufficient Data
Anderson, SC				Insufficient Data	Insufficient Data			1.80	Insufficient Data	Insufficient Data
Ann Arbor, MI		1.90	1.77	Insufficient Data	-7.0%			1.63	Insufficient Data	Insufficient Data
Anniston, AL				Insufficient Data	Insufficient Data			1.38	Insufficient Data	Insufficient Data
Antwerp				Insufficient Data	Insufficient Data			1.09	Insufficient Data	Insufficient Data
Arkansas State Non-Metropolitan Areas		2.13	1.43	Insufficient Data	-33.0%			1.40	Insufficient Data	Insufficient Data
Asheville, NC		1.33	1.17	Insufficient Data	-12.2%			1.24	Insufficient Data	Insufficient Data
Athens, GA			1.11	Insufficient Data	Insufficient Data				Insufficient Data	Insufficient Data
Atlanta, GA	1.52	1.54	1.54	1.4%	0.2%		1.37	1.82	Insufficient Data	33.0%
Auburn-Opelika, AL		2.45	1.26	Insufficient Data	-48.6%			1.56	Insufficient Data	Insufficient Data
Augusta, GA		1.70	2.03	Insufficient Data	19.6%			1.24	Insufficient Data	Insufficient Data
Austin, TX	1.70	2.07	1.36	-19.7%	-34.1%			1.60	Insufficient Data	Insufficient Data
Arizona State Non-Metropolitan Areas		1.56	1.21	Insufficient Data	-22.4%				Insufficient Data	Insufficient Data
Bakersfield, CA		1.35	1.94	Insufficient Data	43.9%			1.20	Insufficient Data	Insufficient Data
Bali				Insufficient Data	Insufficient Data			2.66	Insufficient Data	Insufficient Data
Baltimore, MD	2.00	2.75	2.24	12.0%	-18.2%			2.18	Insufficient Data	Insufficient Data
Bangkok		1.21		Insufficient Data	Insufficient Data		1.86	1.64	Insufficient Data	-11.8%
Barcelona		1.04	1.37	Insufficient Data	31.3%			1.42	Insufficient Data	Insufficient Data
Baton Rouge, LA		1.54	1.69	Insufficient Data	10.0%			1.40	Insufficient Data	Insufficient Data
Beaumont-Port Arthur, TX		1.89		Insufficient Data	Insufficient Data			1.23	Insufficient Data	Insufficient Data
Beijing		2.12	3.41	Insufficient Data	61.0%		1.71	1.85	Insufficient Data	7.6%
Bend, OR			1.04	Insufficient Data	Insufficient Data				Insufficient Data	Insufficient Data
Bengaluru				Insufficient Data	Insufficient Data		2.34	2.87	Insufficient Data	22.6%
Berlin				Insufficient Data	Insufficient Data		1.53	1.40	Insufficient Data	-8.6%
Bern				Insufficient Data	Insufficient Data			1.65	Insufficient Data	Insufficient Data
Birmingham, AL	1.64	1.75	2.14	30.7%	22.1%			1.37	Insufficient Data	Insufficient Data

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