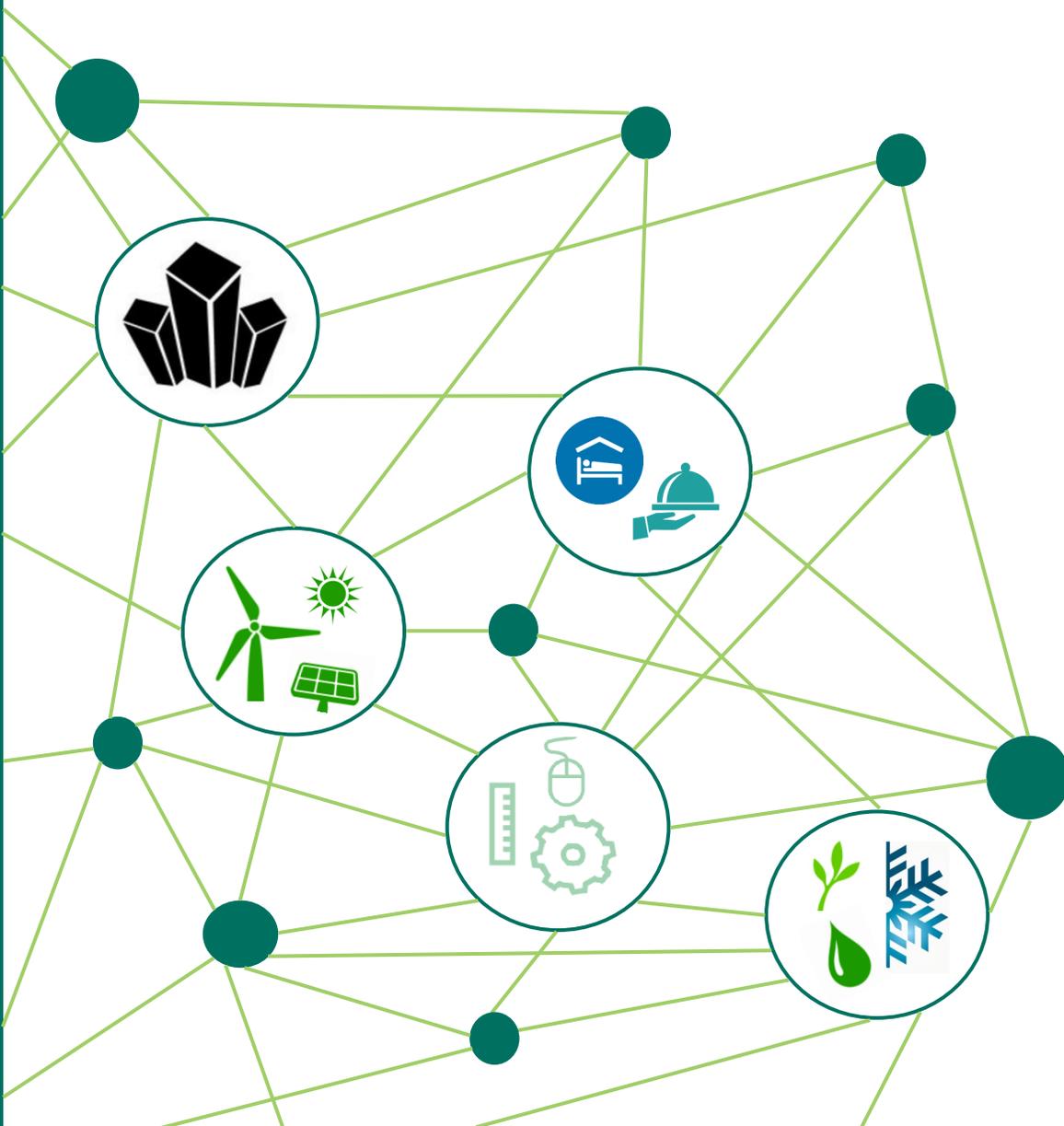


# EmiratesGBC

## Energy and Water Benchmarking for UAE Hotels — 2016 Report



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**Acknowledgments**

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**Emirates Green Building Council** is a business forum based in the United Arab Emirates formed in 2006 with the goal of advancing green building principles. The Council gathers member companies and partners representing a diverse range of stakeholders from within the building industry, government, and academia. EmiratesGBC functions as a common platform for all stakeholders whereby they can meet, discuss, interact, and exchange groundbreaking ideas which help to promote a sustainable built environment in the UAE and the surrounding region.

Since its formation, EmiratesGBC has initiated several programs and events related to improving the operational efficiency of existing buildings. Membership is open to all stakeholders willing to influence a positive change in the country's built environment. The Council facilitates open engagement with its members and conducts quarterly review with its Board Members to devise work plans and programs which promote the Council's mission.

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# Executive Summary

The **EmiratesGBC Energy and Water Benchmarking for UAE Hotels - 2016 Report** aims to support UAE hotel properties to reduce their carbon footprint by improving water and energy performance, education and awareness. The Report's purpose aligns with the ongoing trends towards green and responsible tourism in the region and across the world.

46 hotels took part in the 2016 Benchmarking Project. The hotels were asked to provide information on their property's general, physical, and operational characteristics. Combined with annual energy and water consumption data, EmiratesGBC calculated, normalized and analyzed the Energy Use Intensities (EUIs) and Water Use Intensities (WUIs) to better understand the UAE hotels performance. Furthermore, EmiratesGBC calculated correlation factors and confidence intervals of means to identify key indicators that may influence the hotels' consumption patterns.

## Energy

The Benchmarking Project shows a broad range of energy results and a large difference between the best practice, median and the poor performing hotels which reflects unequal energy performances across the UAE hotels. For instance, poor performing hotels consume 3 times the amount of energy (in kWh/m<sup>2</sup>.year) consumed by the best performing hotels.

- The analysis shows a variation between 104 kWh/m<sup>2</sup>.year and 721 kWh/m<sup>2</sup>.year across the examined hotels, while a median UAE hotel has an average normalized EUI of 283 kWh/m<sup>2</sup>.year.
- Considering annual guest-nights, the median of the normalized EUI per guest-night ranged between 88 and 99 kWh/guest-night.
- In order to report more accurately on overall sustainability and efficient operations, the EUI based on Wh/m<sup>2</sup>.guest-night was also calculated, providing an extra indication of hotels' efficient design, operation and management. The analysis of the EUI based on Wh/m<sup>2</sup>.guest-night showed that a median hotel consumes on average 2.25 Wh/m<sup>2</sup>.guest-night.year.
- The calculated correlation factors indicated no moderate, strong or very strong correlations between the normalized EUI (kWh/m<sup>2</sup>.year) and any of the hotels' characteristics including year built, number of rooms, total floor area, star rating, number of pools, number of restaurants, and number of shops.

## Water

The participating hotels spread over very wide ranges of WUIs which indicates that the water performance varies drastically across UAE hotels. For instance, hotels at the 95th percentile use an average of 7.4 times the water consumed per guest-nights by hotels at 5th percentile.

- The values of WUI per guest-night ranged between 30 to 399 Imperial Gallons (IG)/guest-night.year across the examined hotels.
- A median UAE hotel has an average WUI of 136 IG/guest-night.year.
- The analysis identifies a strong negative correlation between the WUI and the year of build of hotels, which can be related to factors like improper maintenance and/or existing inefficient fittings and fixtures. The study also highlights a significant impact of laundry services and landscaping on the water use intensities.
- Parameters like total property gross area, star rating, and number of restaurants have shown weak level of correlation.

This Benchmarking Report also indicates that the best energy performing hotels were not systematically classified as best practice in water management (and vice versa). Yet, some hotels showed excellent performance in both energy and water management areas. It is speculated that these hotels have put advanced focus on water and energy management (whether in terms of efficient technologies or sustainable operations) compared to others.

Significant savings can be reached by applying retrofit solutions to improve energy and water efficiencies. Furthermore, increasing awareness and education to hotel guests and staff would help improve their operational efficiencies.

## الخلاصة

يهدف تقرير "معايير مقارنة استهلاك الفنادق للطاقة والمياه في دولة الإمارات العربية المتحدة لعام 2016" إلى دعم المنشآت الفندقية في دولة الإمارات العربية المتحدة لتقليل بصمتها الكربونية والحد من انبعاثات غاز ثاني أكسيد الكربون، وذلك من خلال تحسين كفاءة استهلاك المياه والطاقة، ونشر الوعي. ويأتي هدف هذا التقرير منسجماً مع التوجهات الحالية نحو السياحة الخضراء والمسؤولة في المنطقة ومختلف أنحاء العالم.

تضمن التقرير مشاركة 46 فندقاً في دولة الإمارات العربية المتحدة، حيث طُلب منها تزويد معلومات تتعلق بالخصائص العامة والمادية والتشغيلية الخاصة بالمنشأة. وبمصاحبة البيانات السنوية لاستهلاك الطاقة والمياه، قام "مجلس الإمارات للأبنية الخضراء" بحساب وقياس وتحليل كثافات استخدام الطاقة والمياه وذلك لفهم وتقييم أداء الفنادق في دولة الإمارات العربية المتحدة. وبالإضافة إلى ذلك، قام المجلس بحساب عوامل الارتباط ومتوسط نطاق الثقة المطلوب لتحديد المؤشرات الرئيسية المؤثرة على أنماط استهلاك الفنادق.

### الطاقة

أظهر التقرير تفاوتاً واسعاً في نتائج استهلاك الطاقة، ورفقاً كبيراً بين الفنادق التي تتبع أفضل الممارسات في استهلاك الطاقة والفنادق ذات الأداء المتوسط والريء، ما يعكس الاستهلاك غير المتكافئ بين فنادق الدولة. على سبيل المثال، تستهلك الفنادق ذات الأداء الريء 3 أضعاف كمية الطاقة (كيلوواط ساعة/ متر مربع/ سنة) التي تستهلكها الفنادق الأفضل كفاءة.

- أظهر التحليل اختلافاً في كثافة الاستهلاك السنوي للطاقة في الفنادق المشاركة تراوح بين 104 و 721 كيلوواط ساعة/ متر مربع/ سنة، في حين بلغ متوسط قياس استهلاك الفندق المتوسط 283 كيلوواط ساعة/ متر مربع/ سنة.

- وبالنسبة إلى الليالي الفندقية السنوية، تراوح متوسط كثافة الاستهلاك السنوي للطاقة في الفنادق المشاركة بين 88 و 99 كيلوواط ساعة/ليلة فندقية/ سنة.

- لتسجيل تقييم أكثر دقة عن الاستدامة وكفاءة العمليات التشغيلية، قام المجلس بحساب كثافة الاستهلاك السنوي للطاقة بالاعتماد على "واط ساعة/ متر مربع /ليلة فندقية"، ما يوفر دليلاً إضافياً على كفاءة تصميم وتشغيل وإدارة الفنادق. وأظهر التحليل القائم على "واط ساعة/ متر مربع /ليلة فندقية" أن الفندق المتوسط يستهلك متوسط 2.25 واط ساعة/ متر مربع /ليلة فندقية/ سنة.

- أشار حساب عوامل الارتباط إلى عدم وجود أي ارتباطات معتدلة أو قوية أو قوية جداً بين قياس كثافة الاستهلاك السنوية للطاقة (كيلوواط ساعة/ متر مربع/ سنة) وأي من خصائص الفنادق بما في ذلك سنة البناء، وعدد الغرف، وإجمالي مساحة الطوابق، وتصنيف الفندق، وعدد المسابح، وعدد المطاعم، وعدد المحلات التجارية.

### المياه

أشار التقرير إلى توزيع الفنادق المشاركة على نسب متفاوتة جداً في كثافة استهلاك المياه، ما يدل على اختلاف كبير في كفاءة استهلاك المياه بين الفنادق في دولة الإمارات العربية المتحدة. وعلى سبيل المثال، بلغ متوسط استهلاك الفنادق التي جاء تصنيفها المئوي في المركز 95، 7.4 أضعاف كمية المياه المستهلكة لكل ليلة فندقية من قبل الفنادق التي احتلت المركز 5.

- تراوحت كثافة استهلاك المياه في الفنادق المشاركة بين 30 و 399 جالون إمبراطوري/ ليلة فندقية/ سنة.

- بلغ استهلاك الفندق المتوسط 136 جالون إمبراطوري/ ليلة فندقية/ سنة.

- أشار التقرير إلى وجود علاقة سلبية قوية بين كثافة استهلاك المياه وسنة بناء الفنادق مما يكون نتيجة عوامل مثل سوء الصيانة و/أو عدم كفاءة التجهيزات والتركيبات الحالية. كما سلطت الدراسة الضوء على تأثير مهم لخدمات غسل وتنظيف الملابس وري المساحات الخضراء على كثافة استخدام المياه.

- أظهرت مؤشرات مثل المساحة الإجمالية للمنشأة، وتصنيف الفندق، وعدد المطاعم، ارتباطاً ضعيفاً في هذا الشأن.

وأشار التقرير أيضاً إلى أنه لم يتم تصنيف الفنادق التي اعتمدت أفضل الممارسات في مجال إدارة الطاقة بشكل منهجي عن أفضل الممارسات في مجال إدارة المياه (والعكس بالعكس). وفي حين أظهرت بعض الفنادق أداءً متميزاً على كلا المستويين. ويمكن التكهن بأن هذه الفنادق قد أولت اهتماماً كبيراً بمجال إدارة المياه والطاقة سواء من حيث التقنيات الفعالة أو العمليات المستدامة.

ويمكن تحقيق وفورات كبيرة من خلال تطبيق حلول لإعادة تحديث المباني لتحسين كفاءة استهلاك الطاقة والمياه. وعلاوة على ذلك، سوف يسهم نشر الوعي بين نزلاء الفنادق والموظفين وتنقيتهم في تحسين الكفاءة التشغيلية.

## Foreword



Since its inception in 2006, Emirates Green Building Council (EmiratesGBC) has established itself as a leading forum that serves as a catalyst for collaboration and a hub for excellence to promote sustainability of the built environment across various sectors in the UAE. The EmiratesGBC Hospitality Program was its first sector-focused program to support the country's vital hospitality stakeholders.

The UAE has now firmly positioned itself as a regional and global leader in the tourism and hospitality sector with a significant increase expected in the number of hotel rooms in line with the Dubai Tourism Vision 2020 and to support the Expo 2020.

This anticipated growth also underlines the need to promote built environment sustainability in the hospitality sector, which can play a defining role in reducing the carbon footprint of the UAE.

The introduction of green building codes and a number of industry initiatives help in reducing the environmental footprint of hotels and contribute to a more sustainable way of operation.

On our part, EmiratesGBC has launched energy and water benchmarking activities – which are crucial to driving built environment sustainability - to provide the hospitality industry with realistic targets for energy and water efficiency as well as the required data to improve current practice. As the saying goes, “you can't manage what you don't measure”, and we strongly believe that the results of this benchmarking study can greatly assist the hospitality sector in better managing its energy and water consumption.

This report summarizes EmiratesGBC's first Benchmarking Project dedicated to the evaluation of the UAE hospitality sector's performance.

On behalf of EmiratesGBC, I thank all participating hotels for sharing their data, putting their trust in us and in partnering on this industry-defining initiative.

I also extend my appreciation to the members who have contributed their expertise and knowledge to review and support the development of the benchmarking tool and its methodology.

We are confident that the outcomes of the studies will help define the future of sustainable hospitality in the UAE.

Saeed Al Abbar  
Chairman  
Emirates Green Building Council

# Introduction

## Green Trends Worldwide

Globally, tourism contributes to 5% of the global carbon dioxide emissions [1]. The tourism sector has also been identified by the United Nations Environment Program (UNEP) as one of the ten best contributors to the transition towards sustainability. Building up on this contribution, the United Nations declared 2017 as the “International Year of Sustainable Tourism for Development” to promote sustainability and best green practices in the tourism industry.

Aligning with this global movement and focusing on the hotels’ built environment, Emirates Green Building Council (EmiratesGBC) has developed its first Benchmarking Project to provide a relevant and comprehensive overview of the UAE hospitality sector’s energy and water performance and address sustainability trends.

## The EmiratesGBC Benchmarking Report

This project, covering the energy and water consumption of UAE-based hotel properties, aims at supporting hotels to reduce their carbon footprint by improving water and energy performances, education and awareness. The Benchmarking Project is open to all UAE properties (hotels, resorts, apartments/serviced hotels) which are willing to provide their data consumption, irrespective of their location, size, star rating, or hotel group.

Overall, 46 properties across the UAE took part in the 2016 Benchmarking Project by providing energy and water consumption data over a three year period (2013-2015) as well as detailed description of the property and its functions. Participation was free of cost and confidentiality of the data was guaranteed by EmiratesGBC.

Data collection was entirely managed internally by EmiratesGBC, and the methodology in the report has been supported, reviewed and endorsed by qualified professionals from the EmiratesGBC pool of corporate members.

Participating properties were provided with individually tailored benchmarking scorecards that allow them to observe how their property performed overall. This report complements those scorecards and offers further explanation on the methodology that was used, allowing the hotel properties to better understand their performance and sustainability level against other comparable hotels. It is anticipated that the Benchmarking Report and scorecards will support hotel properties in their decision-making and strategic initiatives, whether technical (retrofits, audits) or behavioral (education, trainings).



## Background Information: Benchmarking Tools

Benchmarking is an activity that is used to evaluate by comparison and allows for best practice to be identified and new standards to be set. In this case, the Benchmarking Project serves to inform the participating hotel properties of their overall energy and water performance and scores them against similar properties and national averages. It is a key step in catalyzing cost savings by implementing energy saving measures and by providing incentives for performance improvements. Several building benchmarking tools and rating systems have been developed worldwide to establish accountability and provide building owners, tenants and facility management organizations with accurate measures to report on sustainability.

### Global Examples

The below examples are currently in use throughout the world to benchmark performance of buildings:

- Gigajoule and Energy Intensity Calculator of Natural Resources, Canada;
- EPA's Portfolio Manager and the Benchmarking Utility Consumption and Cost System (BUCCS), USA;
- European Energy Performance of Building Directive (EPBD) Tool, Europe.

Along with the aforementioned building benchmarking tools, several international assessment tools are used to rate buildings, such as LEED and BREEAM. These tools have helped contribute to "greening" the UAE's built environment as complimentary tools to existing standards and regulations. However, these rating systems have not been widely used in the hospitality sector. For instance, according to statistics provided by the U.S. Green Building Council, as of August 11, 2016, seven hotels

achieved certification in the UAE under the LEED green building rating system under the "lodging" space type. Thirty-three hotel and resort projects are registered under the system and will seek certification at a later date.

### Overview in the United Arab Emirates

Over the past years, local governments across the country have been developing regulatory frameworks to ensure new buildings comply with high standards in terms of building design and construction. The Green Building Regulations and Specifications in Dubai (mandated on private buildings since 2014) and the Estidama Pearl Rating System in Abu Dhabi (mandated since 2010) have led the way for other Emirates and provide guidance for new developments from the earliest stages of a project.

The demand for assessing the energy performance on the built stock and for providing regulatory frameworks and technical guidance towards operations and effective retrofit has also grown in recent years in the UAE. For instance, Dubai aims to retrofit 30,000 buildings by 2030. To support this retrofit market, in 2015, EmiratesGBC developed the first Technical Guidelines for Retrofitting Existing Buildings in the UAE. These guidelines feature 31 key retrofit methods under five main categories that can be implemented on existing buildings to improve operational efficiency and achieve cost savings.

Certain factors have challenged the progress towards evaluating building energy performance, including difficulties in accessing comprehensive energy data, the full understanding of occupant behavior, the impact of extreme climatic conditions and the influence of different local building regulations.

### Hospitality Eco-certifications

To complement existing tools and rating systems directed to assess the performance of the built environment, certification schemes dedicated to award hotels for their operations and environmental performances are available in the UAE, including amongst others:

- Green Globe (41 UAE certified properties in 2015)
- Green Key (25 UAE certified properties in 2015)
- Earth Check (4 UAE certified properties in 2015)

The above-mentioned eco-certifications are based on the voluntary commitment of a hotels' management and staff to implement and document best operational practices in the areas of energy management, water management, waste management, F&B, housekeeping, communications to guests and staff, and CSR.

### Why develop the EmiratesGBC Benchmarking Report?

In 2013, Emirates Green Building Council launched its Hospitality Program aimed at reducing the sector's carbon footprint.

That same year, EmiratesGBC became the UAE's National Operator of the Green Key eco-certification. With the strength and experience from these two programs, the Benchmarking Project summarized in this report was the next logical step in EmiratesGBC's ongoing efforts to reduce the footprint of the country's hospitality sector. It also aims to address feedback received directly from hoteliers over the past years, including:

- The high cost of existing for-profit benchmarking tools and the low value-for-money of the received deliverables,
- The lack of benchmarking tools' differentiation between different hotels' profiles, market positioning and identities (in terms of branding and type of operations),
- The lack of relevant indicators used to compare properties against each other, leading to inaccurate benchmarking results.



Chapters of *EmiratesGBC Technical Guidelines for Retrofitting Existing Buildings*:

1. Energy
2. Water Management
3. Air Quality
4. Materials and Waste
5. Innovation and Management

For more information, check [www.emiratesgbc.org](http://www.emiratesgbc.org)

# Data Collection

## Overall Process

Between December 2015 and May 2016, EmiratesGBC reached out to 78 hotel properties in the UAE to obtain energy and water consumption data for years 2013, 2014 and 2015. Local tourism authorities were also invited to share a call for participation in the Benchmarking Project with hotel properties within their respective Emirate. Ajman Tourism Development Department, for instance, shared information on the project with their hotel contacts, while Sharjah Commerce and Tourism Development Authority invited EmiratesGBC to present its hospitality-related programs to hoteliers during a workshop on green hospitality.

Out of the contacted hotels, 46 volunteered to participate in the Benchmarking Project and submitted complete sets of consumption data. This Report covers their contribution. Some of the properties that declined to participate informed EmiratesGBC that they were already enrolled in other benchmarking initiatives or that they were not allowed on their corporate level to disclose data.

## Data Collected

To complement the energy and water data, hotels were asked to also provide information on their general, physical, and operational characteristics, allowing EmiratesGBC to understand their respective profiles and identify key factors that may influence their consumption patterns.

The requested data included:

- Monthly energy consumption (in kWh) for years 2013-2015;

Nb: Overall reference:

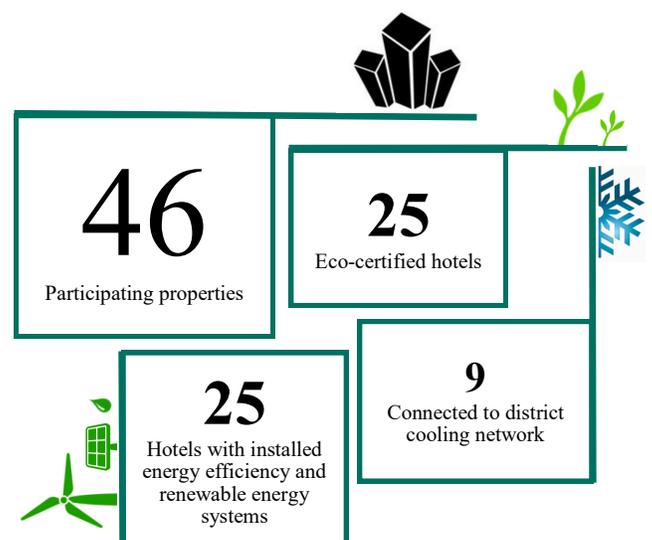
- "energy" in this document refers to "electrical energy"
- "hotels" refer to "participating properties" unless notified as a type

- Monthly chilled water consumption (in Refrigerant ton) for years 2013- 2015 for hotels connected to district cooling network;
- Monthly water consumption (in Imperial gallons - IG) for years 2013-2015;
- Monthly guest-night and monthly occupancy for years 2013-2015.

### Collected Profile Data

- General details: contact details, type of property (tower, resort, hotel, hotel apartment), year built, star rating
- Rooms: total number, number by category and size
- Size: total built up area, gross floor, common spaces area
- Facilities in operation: restaurants, laundry, pools, shops, conference facilities, gym, spa, landscaping, staff accommodation
- Number of staff
- Energy and water management: Connection to district cooling network, solar water heating, solar photovoltaic system, LED lighting, grey water treatment system
- Certifications and Audits: Eco-certification, ISO certification, energy audit, indoor air quality audit

Figure 1: General figures of the participating properties



### Overview of the participating hotels

Out of the participating hotels, more than half have a 5-star rating or more (refer to Figure 2). In terms of services provided, 91% of the participating hotels have conference facilities while 67% manage staff accommodation (refer to Figure 3).

It was also observed that a median hotel has a floor area of 31,011 m<sup>2</sup> and 0.8 guest-rooms per 100 m<sup>2</sup> of floor area. Furthermore, 95% of the participating hotels have a floor area less than 114,844 m<sup>2</sup> and number of guest rooms less than 2.2 per 100 m<sup>2</sup> (refer to Table 1).

Along with the other collected characteristics, these parameters have been used to assess their impact on hotels' water and energy consumption (refer to Parameters Influencing Consumption Intensities section, page 21).

### Limitations and Preliminary Assumptions

Data were provided by the hotels directly and have not been verified on site by EmiratesGBC. A preliminary review of information however was conducted internally in order to spot obvious discrepancies and errors to be corrected by the participating properties.

Figure 2: Breakdown of properties by star rating

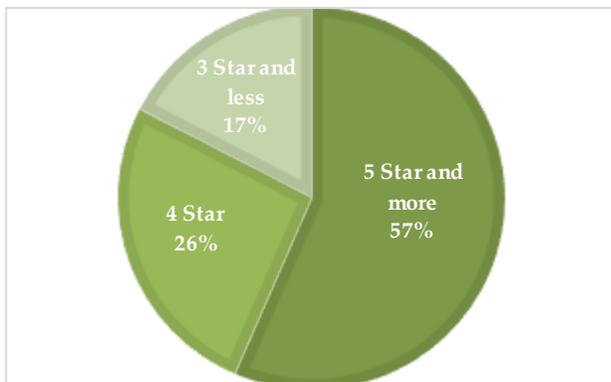
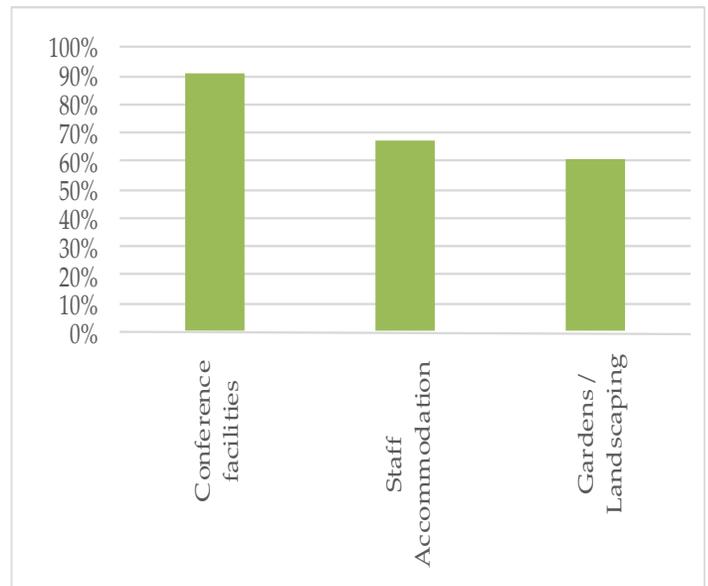


Figure 3: Breakdown of properties by general services



Factor	5th percentile	Median	95th percentile
Floor Area (m <sup>2</sup> )	12,002	31,011	114,844
Guest Rooms/ 100 m <sup>2</sup>	0.39	0.80	2.20

Table 1: Ranges of floor area and number of guest rooms per 100 m<sup>2</sup> among the participating hotels

## Methodology and Preliminary Calculations

As part of the data analysis, the below calculations were made to ensure the accuracy of the exercise by normalizing data received.

### Climate Factor

To ensure accurate energy benchmarking, the annual energy consumption values were adjusted to normalize the difference between the climates of each Emirate within the UAE. Generally, the climate of the UAE is very hot and humid, thus the energy required for air-conditioning is considered as the major contributor to a building's total energy consumption. For that reason, normalization was done using the Cooling Degree Days (CDD) of the different Emirates. For this calculation, a Climate Factor (CF) was created which normalizes the average cooling degree days of any Emirate to that of Abu Dhabi, the country's capital.

$$CF = \frac{CDD(Emirate)}{CDD(Abu Dhabi)}$$

The website "Degreedays.net" was used to calculate the CDD for each Emirate [2]. The base temperature considered was 18.5 deg C. Ajman's climate factor was assumed as 1 as data was not available for this Emirate on the website. Table 2 shows the average CDD and CF.

### District Cooling Efficiency

As per a recent market and efficiency cooling study by Dubai Regulatory and Supervisory Bureau (RSB), the average efficiency (kW/ton) of district cooling systems in Dubai is 0.92 [3]. This efficiency was used in this Project to convert the chilled water consumption to electrical energy for hotels connected to district cooling network using the formula below.

$$Electrical\ Energy\ (kWh) = 0.92 * Chilled\ Water\ Consumption\ (RT)$$

Emirate	Cooling Degree Days			Climate Factor (CF)
	2014	2015	Average	
Abu Dhabi	3650	3677	3663.5	1.000
Dubai	3865	4146	4005.5	1.093
Fujairah	3629	3668	3648.5	0.996
Sharjah	3723	3745	3734	1.019
Ras Al Khaimah	3538	3557	3547.5	0.968
Ajman	-	-	-	1

**Table 2: Cooling Degree Days and Climate Factor of Emirates calculated using "Degreedays.net" website**

Nb: 2013 data has not been considered because the "Degreedays.net" website could not entirely provide the CDD for 2013 at the time of analysis.

## Energy Analysis and Results

UAE hotels rank among the top energy consuming hotels worldwide. For instance, a recent survey showed that Dubai five-star hotels consume up to 225% more energy compared to their five-star counterparts in Europe [4].

Addressing the hotels' energy consumption require better understanding of the top energy contributors and potential energy saving measures. For instance, HVAC systems have been identified as a major contributor to hotels' energy consumption where, generally, 35 to 50% of total consumption is used for cooling in hotels situated in hot and humid climates [5]. In the UAE, this percentage is even higher and was estimated to reach 70% in a typical four-star hotel [6].

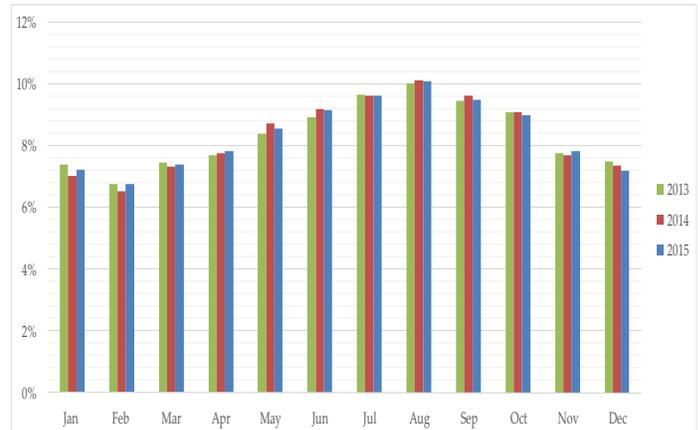
The results of the Benchmarking Project, based on statistical analysis, have allowed EmiratesGBC to identify the overall energy consumption profiles of the participating hotels and the Energy Use Intensities (EUIs) per unit area and guest nights. Based on the hotels' respective profiles, it has been possible also to evaluate the relationship between energy consumption patterns and the hotels' individual characteristics (refer to Parameters Influencing Consumption Intensities, page 21)

This information can be used by the participating properties to complement the tailored benchmarking scorecards they have received from EmiratesGBC, in order to better understand their profile and positioning against their peers.

### Energy Consumption Profile

To examine the seasonal and monthly variations of energy consumption, an analysis of the energy consumption profile was performed for years 2013, 2014 and 2015. Figure 4 shows the monthly breakdown of the average annual energy consumption of the participating hotels in 2013, 2014 and 2015. As illustrated in Figure 4, the profile is uniform across years and it highlights higher consumption during summer months.

**Figure 4: Average monthly energy profile for years 2013, 2014 and 2015**



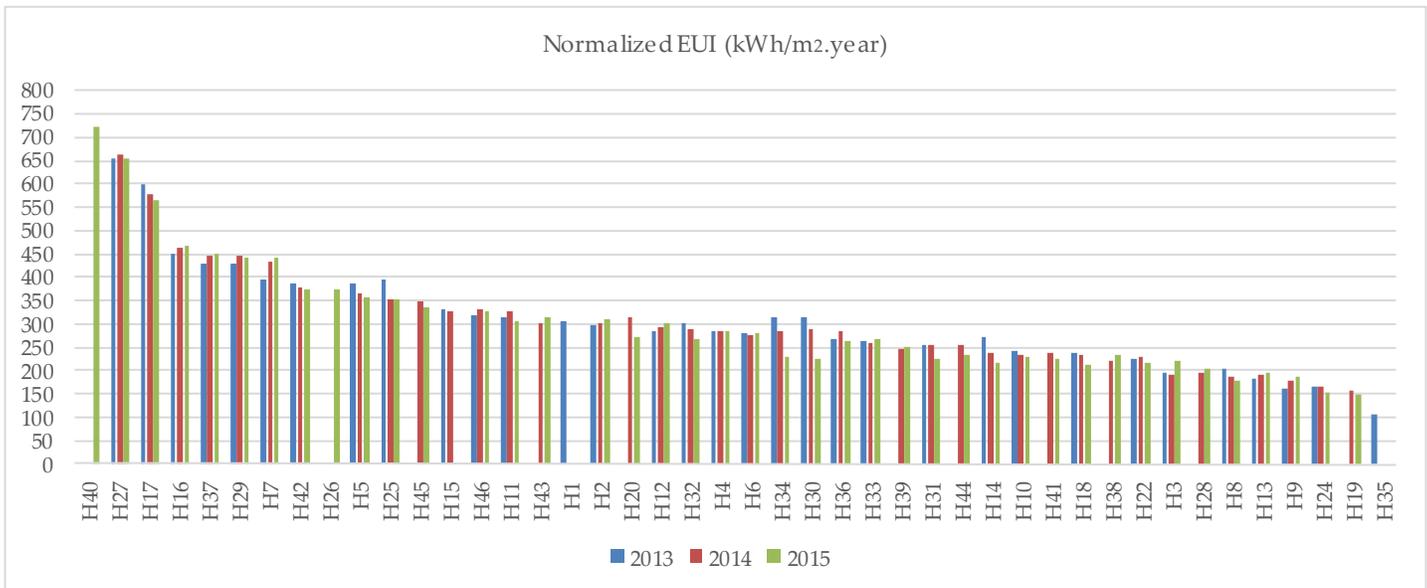
This higher consumption is attributed to the higher demand for air conditioning during summer in the UAE. Even though the energy consumption of hotels is typically weather-dependent in the UAE, winter months have also shown a relatively high contribution to the overall consumption. It is speculated for instance that this is due to higher occupancy rates during winter months compared to summertime.

### Normalized EUI (kWh/m<sup>2</sup>.year)

The Energy Use Intensity per unit of floor area is the total annual energy consumption (in kWh) divided by the total conditioned area (in m<sup>2</sup>) of the property under consideration.

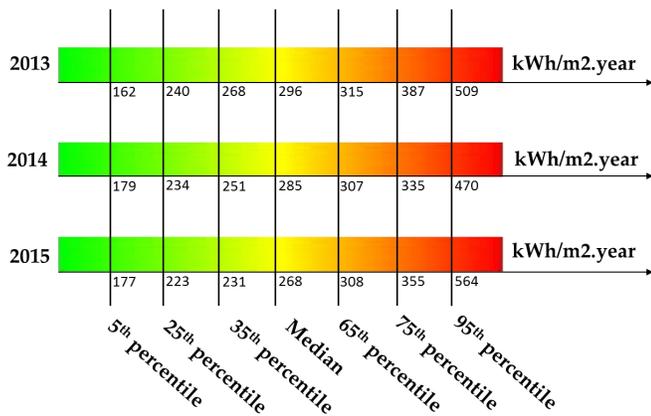
Energy Use Intensity (kWh/m<sup>2</sup>.year) is an internationally acceptable norm for benchmarking the energy performance of buildings. For this Project, data collected from hotels were evaluated to calculate the annual EUIs in 2013, 2014 and 2015. The EUI values were then normalized using the predefined climate factor. Figure 5 shows the variation of the annual normalized EUI per unit area for the participating hotels.

Figure 5: Annual normalized EUI per unit of floor area (kWh/m<sup>2</sup>.year) for participating hotels in 2013, 2014 and 2015



NB: the number of shown bars per hotel depends on the availability of data and the year of operation start of some hotels. For example, the EUI values of H21 and H23 have not been shown because H21 hasn't provided the chilled water consumption data and H23 has started operation since mid of 2015.

Figure 6: Percentile values of the EUI per unit area



The results show a variation of the normalized EUI (kWh/m<sup>2</sup>.year) between 104 kWh/m<sup>2</sup>.year and 721 kWh/m<sup>2</sup>.year across the examined hotels. A median UAE hotel has an average normalized EUI of 283 kWh/m<sup>2</sup>.year (average of the median values in Figure 6). Other percentile values of the EUI per unit area data were calculated and represented in Figure 6.

Figure 7: Distribution of participating properties as function of EUI (kWh/m<sup>2</sup>.year) in 2015

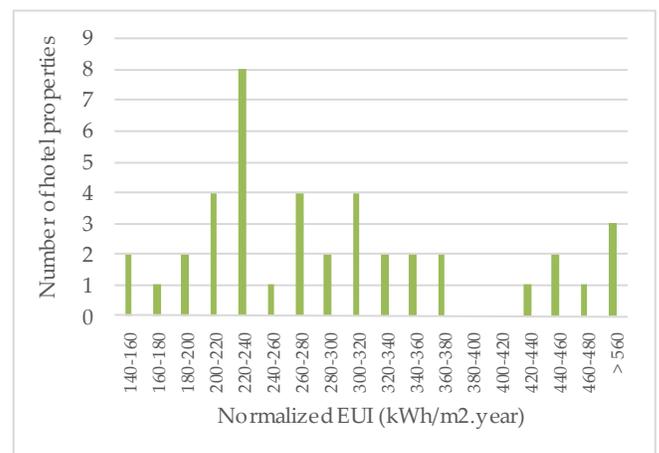


Figure 7 shows the distribution of participating properties as function of EUI (kWh/m<sup>2</sup>.year) in 2015. As observed, the hotels spread widely over various ranges of normalized EUIs indicating unequal energy performance of UAE hotels.

**Key Observations:**

- Low annual variation of EUI per unit area values
- Hotels spread widely across the EUI values
- Hotels at the 95<sup>th</sup> percentile use an average of 3 times the energy consumed per unit area by hotels at 5<sup>th</sup> percentile

As observed, 82% of the participating hotels have an energy consumption higher than 200 kWh/m<sup>2</sup>.year, which is relatively high compared to worldwide benchmarks. Furthermore, 16% of these hotels have EUIs higher than 400 kWh/m<sup>2</sup>.year which necessitates critical energy performance improvements. Based on the fact that EUI per unit area generally reflects the spatial efficiency of the building, retrofits must focus on reducing the energy demand and increasing the energy efficiency.

Some of these retrofit solutions include, among others: LED lighting replacements, proper maintenance of HVAC equipment, replacement of existing HVAC systems with more efficient ones, adding insulation, ensuring adequate building airtightness and installation of building automation systems.

**Normalized EUI (kWh/guest-night.year)**

The Energy Use Intensity per guest-nights is the total annual energy consumption (in kWh) divided by annual guest-nights of the hotel under consideration.

The same procedure was followed to calculate the Energy Use Intensity per guest-nights. Collected data were filtered, analyzed and normalized for years 2013, 2014 and 2015. Figure 8 shows the variation of the annual EUI per guest-night within the participating hotels.

The percentile values of the EUI per guest-night data were calculated and are represented in Figure 9.

**Figure 8: Annual normalized EUI per guest-nights for participating hotels in 2013, 2014 and 2015**

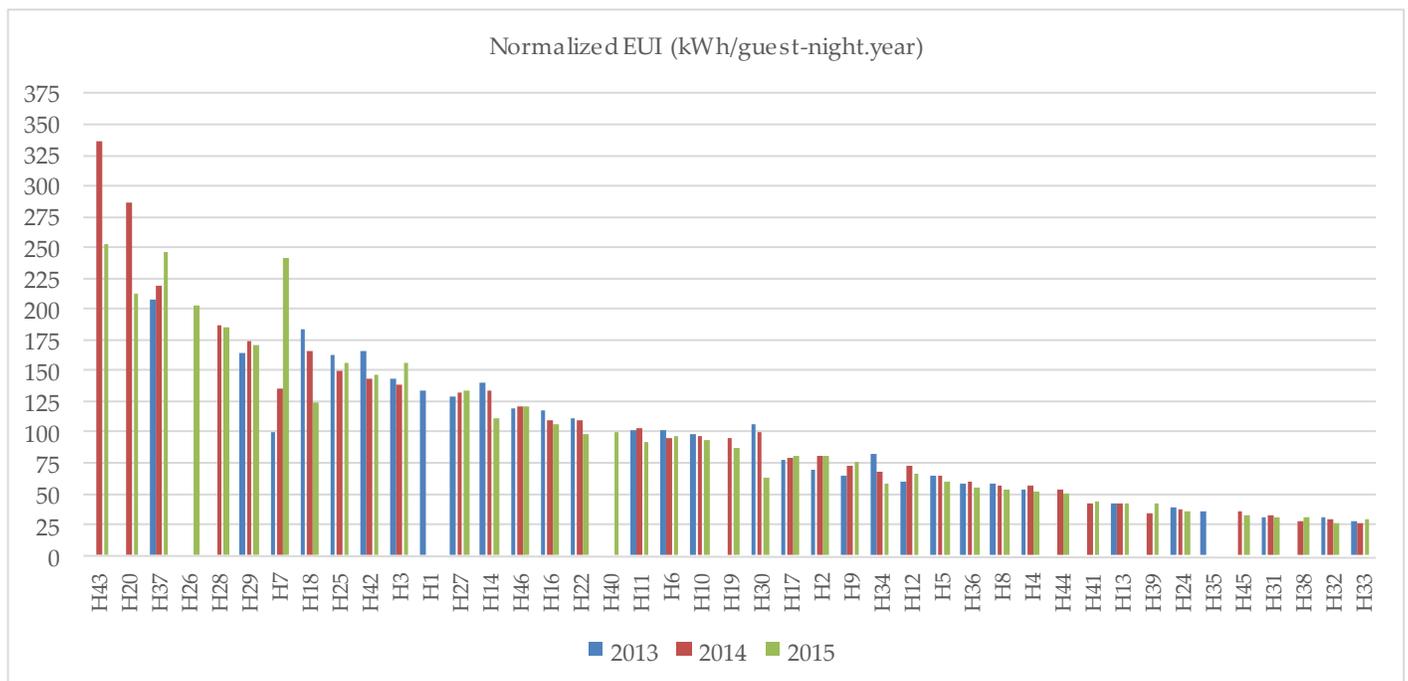
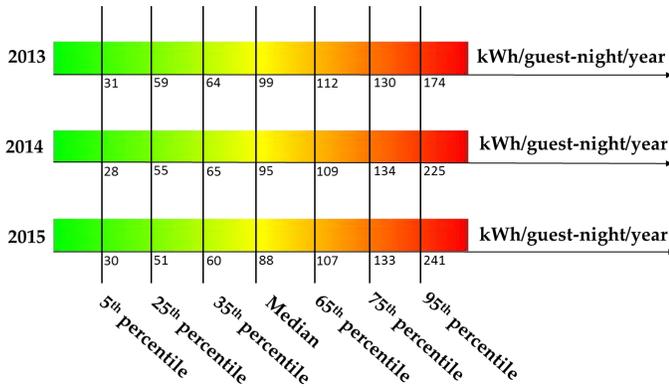


Figure 9: Percentile values of the EUI per guest-night



**Key Observations:**

- The values of the normalized EUI per guest-night ranged between 26 to 336 kWh/guest-night.year across the examined hotels
- A median UAE hotel consumes on average 94 kWh/guest-night.year
- Hotels at the 95<sup>th</sup> percentile use an average of 7.2 times the energy consumed per guest-nights by hotels at 5<sup>th</sup> percentile

72% of the participating hotels have an energy consumption higher than 50 kWh/guest-night.year with 26% of them more than 150 kWh/guest-night.year. To address these high energy intensities, emphasis on the operational efficiency of the hotel is required. Efficiencies can be improved through viable solutions such as the installation of demand controlled cooling and ventilation, timers, occupancy sensors, and improved staff and guests’ education.

**Choosing the right benchmarking metric**

According to the International Institute for Energy Conservation, benchmarking using annual

EUI per unit of hotel floor area has been considered more useful than benchmarking based on EUI per guest-night [5].

This metric has also been used in recent research where 19 hotels in the UAE were classified based on their energy performance against their built years. A key finding from this recent research paper indicated that hotels constructed after 2003 were considered to have implemented “best practice” if their energy consumption was lower than 241.5 kWh/m<sup>2</sup>.year, reflecting the implementation of high standards of energy efficiency [7].

This benchmarking approach does not reflect however the operational efficiency of buildings, i.e. it does not look into the variation of consumption at different usage or occupancy levels. The annual variation of the EUI per guest-night on the other hand indicates how efficiently the building operates at different occupancies.

As per the data collected and following the above-mentioned calculations, hotels with the highest EUI per unit of hotel floor area do not specifically have the highest EUI per guest-night, and vice versa (refer to Figures 5 and 8). Therefore, in order to report more accurately on sustainability and efficient operation of the participating properties, the EUI based on Wh/m<sup>2</sup>.guest-night was calculated. This factor evaluates the portion of energy consumed per guest-night out of the EUI per unit of floor area.

It reflects both spatial and operational efficiency and can be understood as an indication of efficient design, operation and management of a hotel. Benchmarking using the EUI per floor area per guest-nights aligns also with the concerted focus on “well-designed and well-managed tourism” expressed during the UN Conference on Sustainable Development (Rio+20) [8].

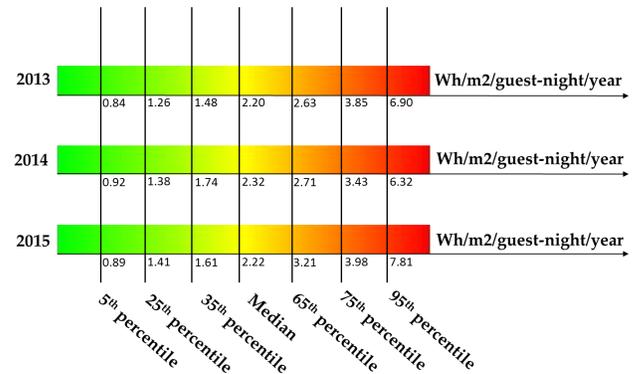
### Normalized EUI (Wh/m<sup>2</sup>.guest-night)

The Energy Use Intensity per unit of floor area per guest-nights is the total annual energy consumption (in kWh) divided by annual guest-nights and total conditioned area of the hotel under consideration.

Figure 11 shows the variation of the annual EUI per unit area per guest-nights within the participating hotels. It was noticed that hotels with significant variations in the annual guest-night values showed the most significant variations in the annual EUIs per guest-night.

The percentile values of the EUI per unit area per guest-night data were calculated and are represented in Figure 10.

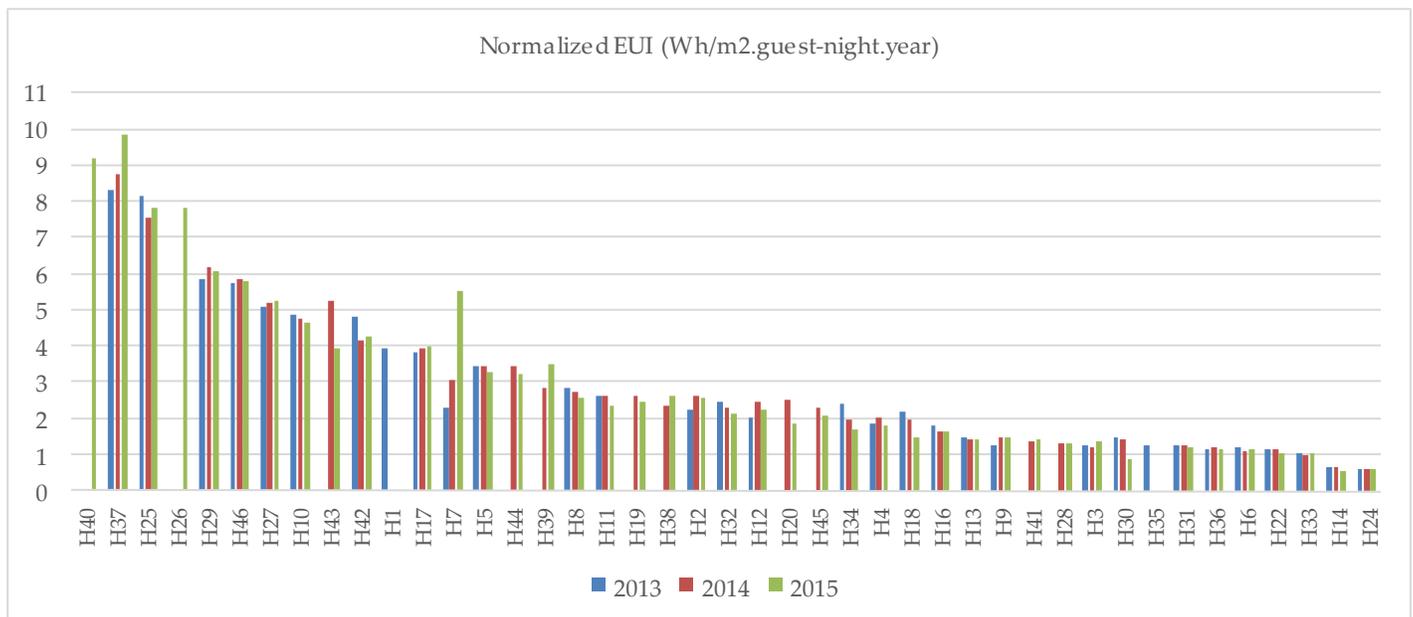
Figure 10: Percentile values of the EUI per unit area per guest-night



#### Key Observations:

- The values of the normalized Wh/m<sup>2</sup>.guest-night ranged between 0.53 to 9.83 Wh/m<sup>2</sup>.guest-night.year across the examined hotels
- A median UAE hotel consumes on average 2.25 Wh/m<sup>2</sup>/guest-night

Figure 11: Annual normalized EUI per unit area per guest-nights for participating hotels in 2013, 2014 and 2015



NB: H15, H21, and H23 data have not been shown in the EUI per unit area per guest-night graph for the same reasons mentioned before.

# Water Analysis and Results

Globally, water demand is rapidly increasing due to growing world population with expectations of higher living standards. In the UAE, energy demand is also largely affected by the high energy consumption required for water desalination. UAE hotels are often considered as intensive water consumers due to several water consuming services and luxurious standards adopted by most of them. But, based on direct communications with professionals of the UAE hospitality industry, the reduction of water consumption is not just a local priority; it also aligns with the UAE government’s vision and targets for sustainable development as well as with corporate objectives many hotel chains have in place globally.

The proactive implementation of water reduction measures and strategies does not come without challenges however, whether related to financial constraints, staff and guests’ awareness or continuous operational obligations. Deciding on relevant and standardized targets can also be difficult considering the hotels’ differences in terms of size, location, services and landscaping needs.

Similar to the energy analysis, participating hotels were asked to submit information on the existence and number of restaurants, laundry, pools, shops, conference facilities, gym, spa, landscaping, staff accommodation under their direct management. Combined with monthly occupancy and year built, these services are generally seen as the water-intensive areas of a property. The calculations aimed to identify which, out of these factors, would have the highest impact and would thus help identify areas in need for corrective measures to improve efficiencies (refer to Parameters Influencing Consumption Intensities section, page 21).

## Water Use Intensity

Occupancy is as a major influencing parameter for the water consumption in hotels.

For this reason, Water Use Intensity per guest-night (WUI) was considered an accurate metric for water benchmarking. Figure 14 shows the variation of the annual WUI per guest-night within the participating hotels in 2013, 2014 and 2015. The percentile values of the WUI per guest-night data were calculated and represented in Figure 12. The analysis shows that a median UAE hotel has an average WUI of 136 IG/guest-night.year (average of the median values in Figure 12).

Figure 13 show the distribution of the participating hotel properties based on the water intensities in 2015. As observed, the participating hotels spread over wide ranges of the WUIs which indicates that the water performance varies drastically across UAE hotels.

Figure 12: Percentile values of the WUI

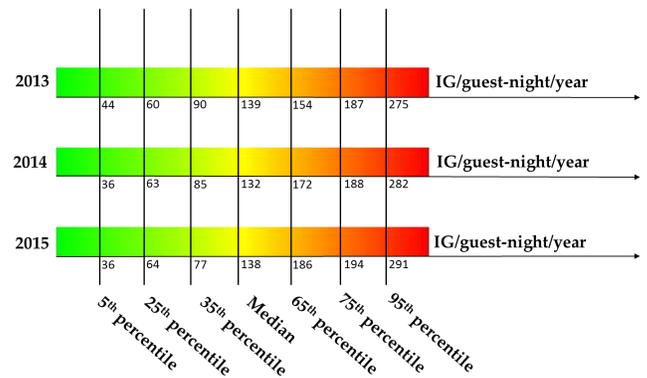


Figure 13: Distribution of participating properties as function of WUI (IG/guest-night.year) in 2015

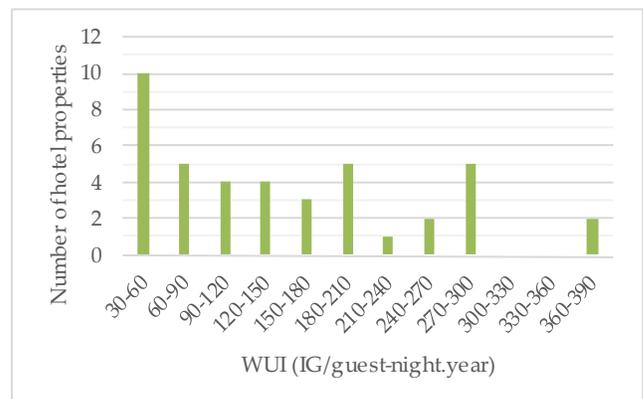
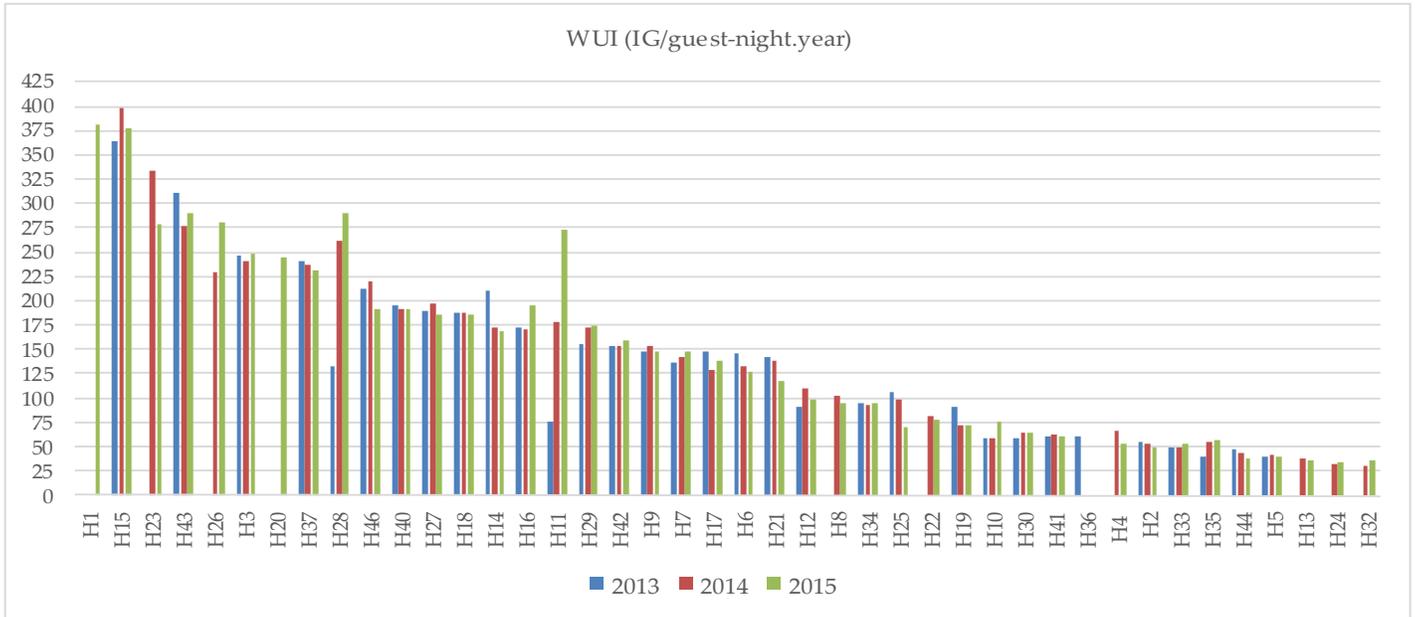


Figure 14: Annual WUI (IG/guest-night.year) for participating hotels in 2013, 2014 and 2015



NB: Some hotels data have not been shown in the WUI graph due to the non-availability of data and the year of operation of some hotels.

**Key Observations:**

- The values of the WUI per guest-night ranged between 30 to 399 IG/guest-night.year across the examined hotels
- A median UAE hotel has an average WUI of 136 IG/guest-night.year
- Hotels at the 95<sup>th</sup> percentile use an average of 7.4 times the water consumed per guest-nights by hotels at 5<sup>th</sup> percentile

Benchmarking results indicate that 17% of the participating hotels have a water consumption higher than 250 IG/guest-night.year, which is considered relatively high. Improvement of the WUI values requires proper water management, efficient irrigation, proper maintenance of water fixtures and fittings, sub metering and using gray water or condensates to reduce potable water usage.

# Hotels Energy and Water Performance

As part of its Benchmarking Project, EmiratesGBC has classified the participating hotels based on the percentile ranges of their respective energy and water intensities. The EUI per unit area per guest-night was chosen as the metric for the energy classification considering both spatial and operational efficiencies, while the WUI per guest-nights was used for evaluation of water performance (refer to Table 4). Hotels with an EUI (Wh/m<sup>2</sup>.guest-night.year) less than 5th percentile have been considered as “best practice” in terms of energy consumption while hotels with WUI (IG/guest-night.year) less than 5th percentile of the water data were considered “best practice” in water management.

The analysis showed that best energy performing hotels were not systematically classified as best performing in water management (and vice versa). For example, H14 was classified as best practice in terms of energy consumption and unsatisfactory for the water management (refer to Table 3).

Yet, some hotels showed excellent performance in both energy and water management, for example, H31, H33 and H35. It is speculated that these hotels have put advanced focus on sustainability and water and energy efficiencies compared to others.

On the other hand, some hotels underperformed on both energy and water levels. For example, H7, H26, H27 and H37 hotels have either poor or unsatisfactory energy and water performances.

These properties should consider implementing critical retrofit work in order to drastically improve their performance.

	Energy Performance	Water Performance
Data not provided	H15, H21, H23	H1, H15, H23, H43
Poor ★	H25, H26, H37, H40	H3, H20, H26, H37
Unsatisfactory ★★	H1, H7, H10, H17, H27, H29, H42, H43, H46	H7, H11, H14, H16, H18, H27, H28, H40, H46
Fair ★★★	H5, H8, H39, H44	H9, H17, H29
Average ★★★★	H2, H4, H11, H12, H16, H18, H19, H20, H32, H34, H38, H45	H6, H8, H10, H12, H19, H21, H22, H25, H30, H34, H42
Good ★★★★★	H9, H13	H4, H36, H41
Excellent ★★★★★	H3, H6, H22, H28, H30, H31, H33, H35, H36, H41	H2, H5, H13, H24, H31, H32, H33, H35, H44, H45
Best Practice ★★★★★	H14, H24	H38, H39

Table 3: Participating hotels classifications based on their energy and water performance

Hotels	Less than 5 <sup>th</sup> percentile	Between 5 and 25 <sup>th</sup> percentiles	Between 25 and 35 <sup>th</sup> percentiles	Between 35 and 65 <sup>th</sup> percentiles	Between 65 and 75 <sup>th</sup> percentiles	Between 75 and 95 <sup>th</sup> percentiles	Greater than 95 <sup>th</sup> percentile
Hotels Energy Classification Based on normalized EUI (Wh/m <sup>2</sup> .guest-night.year)	Best Practice	Excellent	Good	Average	Fair	Unsatisfactory	Poor
Hotels Water Classification Based on WUI (IG/m <sup>2</sup> .guest-night.year)	Best Practice	Excellent	Good	Average	Fair	Unsatisfactory	Poor

Table 4: Classification of hotels based on their energy and water intensities

# Parameters Influencing Consumption Intensities

## Numeric Parameters

Based on the profile information provided by the participating properties (see Data Collection section, page 9), correlation statistical method was used to analyze and better understand if and how key numeric parameters such as building age, star rating, and facilities in operation may affect the energy and water consumption.

The **Correlation factor**, Pearson correlation  $r$ , determines how strong the relation is between two variables. The values of “ $r$ ” vary between  $-1$  and  $1$ . Negative factor means negative correlation and zero shows no correlation.

To describe the strength of a correlation, the Report considers Evans (1996) method [9] where the level of correlation is evaluated based on the ranges of the absolute value of “ $r$ ” as mentioned below.

- $0.00 < |r| < 0.19$  → very weak correlation
- $0.20 < |r| < 0.39$  → weak correlation
- $0.40 < |r| < 0.59$  → moderate correlation
- $0.60 < |r| < 0.79$  → strong correlation
- $0.80 < |r| < 1.0$  → very strong correlation

The values in Table 5 show the correlation factors between each of the normalized EUI (kWh/m<sup>2</sup>.year), WUI (gallons/guest-night.year) and some of the hotels’ characteristics.

On the energy management side, the calculated correlation factors indicated no moderate, strong or very strong correlation between the normalized EUI (kWh/m<sup>2</sup>.year) and any of the hotels’ characteristics mentioned in Table 5.

However, certain parameters like total floor area, star rating, and number of shops have shown minor correlation (even if weak) with the normalized EUI.

On the water management side, the results suggest strong correlation between the WUI and the year of build of hotels. This can be related to factors like improper maintenance and/or existing inefficient fittings and fixtures. Other parameters like number of pools and number of shops have shown moderate correlation with the WUI, whereas parameters like total gross area, star rating, and number of restaurants have shown weak correlation.

## Non-numeric Parameters

In order to assess the impact of the non-numerical parameters, the data was divided into different groups and the analysis was carried on each group separately to estimate the median, mean and 95% confidence interval of the mean. The groups considered within this Benchmarking Project are mentioned below:

- Type of properties: hotel, hotel apartment, resort
- Location: city, beach, airport
- Laundry services: yes or no
- Conference facilities: yes or no
- Watering of gardens: yes or no
- Golf: yes or no
- Gym and/or spa: yes or no

	Year Built	Number of Rooms	Total Floor Area (m <sup>2</sup> )	Star Rating	Number of Pools	Number of Restaurants	Number of Shops
Correlation Factors with EUI	-0.21	-0.17	-0.24	0.34	0.04	0.20	0.33
Correlation Factors with WUI	-0.62	0.04	0.29	0.36	0.44	0.35	0.45

**Table 5: Correlation factors between the normalized EUI (kWh/m<sup>2</sup>.year), WUI (IG/guest-night.year) and some numeric hotels’ parameters**

It is recommended to use the statistical “Student’s t-distribution” to estimate the 95% confidence interval (CI) of the mean when the sample size is less than 30 and the variable is normally or approximately normally distributed [10]. This approach was used to evaluate the CIs of the means of energy and water intensities within the considered groups because of their small sample sizes. The groups with less than five hotel properties have not been considered in the study to avoid obtaining very wide confidence intervals (for example, hotel apartment category, conference facilities category, golf category, and gym/spa category). Figures 15-18 show the median and the 95% CIs of the means of both normalized EUI and WUI for each group. The “n” value represents the number of properties in each group that varies depending on the availability of data and the considered characteristic or service.

In regards to the property type, hotels have lower median value of 266.54 kWh/m<sup>2</sup>.year than resorts whose median value is 344.13 kWh/m<sup>2</sup>.year. The CIs of the means of WUIs for resorts and hotels overlap which indicates no significant difference between them in the area of water management (refer to Figure 15).

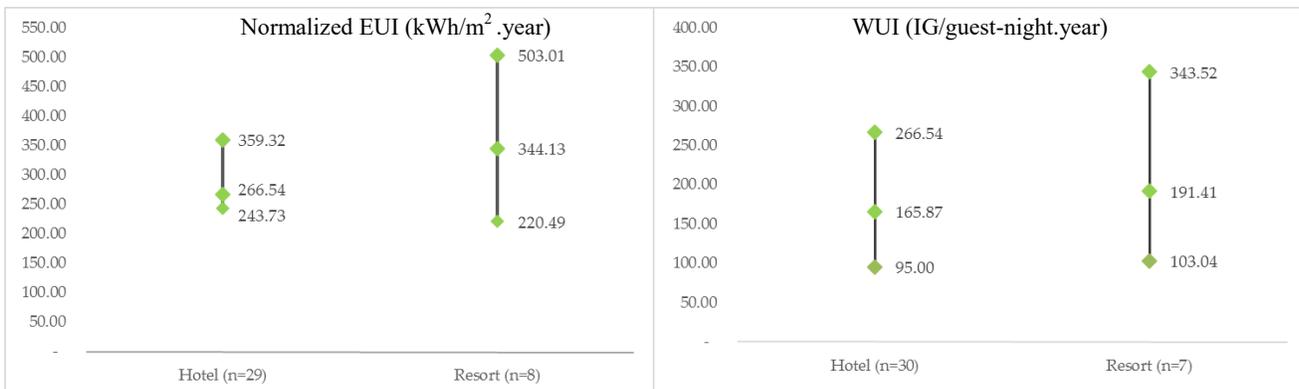
Considering the location of the properties, the CIs of means of the WUIs and EUIs for hotels located in cities or on beaches slightly overlap, whereas the median values for city hotels is lower than

beach hotels. For instance, the median WUI of beach hotels is 183.09 IG/guest-night.year while it is 122.03 IG/guest-night.year for city hotels (refer to Figure 16).

The analysis also highlights a significant impact of laundry services on water use intensity, while showing only a slight influence on the energy use. The CIs of the means of WUIs do not overlap, and hotels with laundry services have significantly higher median values of 174.77 IG/guest-night.year than 53.35 IG/guest-night.year for hotel properties that do not provide laundry services (refer to Figure 17).

Even though electrical energy is required for the operation of watering systems (pumps, filters, treatment systems), analysis indicated that watering of gardens and landscaped areas has more significant impact on WUI than on normalized EUI. For instance, the CIs of the means of the EUIs overlap for hotels with or without watering of gardens with slight difference in median values. On the other hand, the median of WUI for hotels that provide watering of landscaped area (186.2 IG/guest-night.year) is significantly higher than hotels that do not have any landscaped areas (94.41 IG/guest-night.year) (refer to Figure 18).

**Figure 15: The 95% interval plots and medians of the normalized EUI and WUI data for different hotel property types**



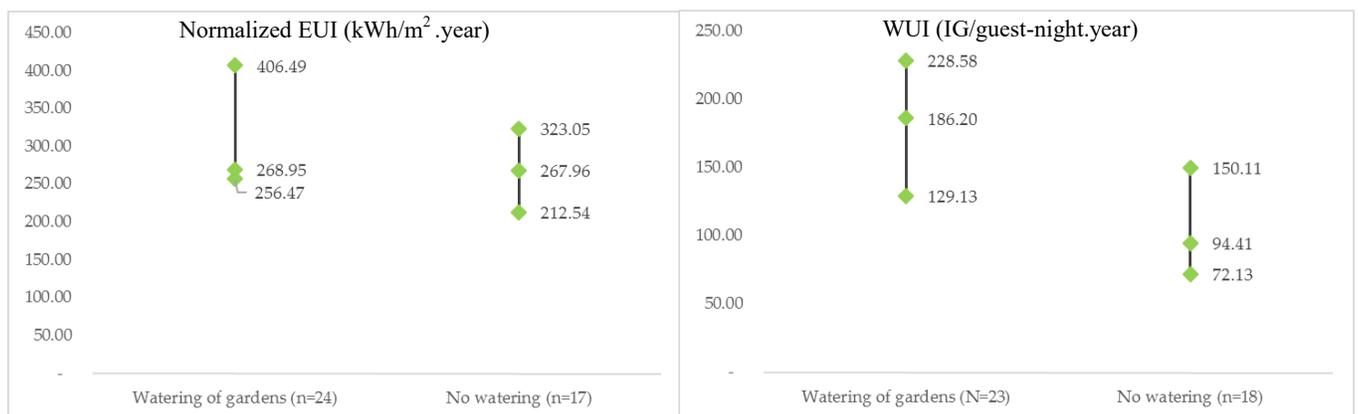
**Figure 16: The 95% interval plots and medians of the normalized EUI and WUI data for different hotel locations**



**Figure 17: The 95% interval plots and medians of the normalized EUI and WUI data for hotels that provide laundry facilities and hotels that do not**



**Figure 18: The 95% interval plots and medians of the normalized EUI and WUI data for hotels based on watering of landscaped areas**



## Lessons Learned

### Poor performances – Strong potential for change

Calculations carried out in this Project have indicated a strong potential for improvements in the areas of hotels' energy and water management. One hotel out of four is considered underperforming (unsatisfactory and poor) on both energy and water levels. It was also noticed that the poorest performers consume seven times more energy (kWh/guest-night.year) and water (IG/guest-night.year) than the best; such observations should be addressed by the properties themselves as well as by the tourism authorities as a priority.

The Benchmarking Project also demonstrates that good energy performing hotels do not necessarily have good performance with water (and vice versa). Moreover, it highlights that participating hotels spread widely across the ranges of normalized EUIs and WUIs. This unequal performance of UAE hotels necessitates further action from government bodies and tourism authorities in terms of codes, standards and efficiency initiatives.

### Time to retrofit

Analysis of correlations has highlighted a negative relationship between the age of a hotel and the overall hotels' performance especially in the area of water management.

Most recently built hotels not only benefit from newer technologies and efficient design; they also comply with more stringent regulations, codes and specifications mandated by the local authorities. Older properties on the other hand need to deal with the aging of their infrastructures which can come with high financial investments and heavy preventive maintenance plans to maintain, if not improve, their performance. This is also often the case for buildings that have been turned into hotels but whose design and construction were not originally planned for hospitality-related operations.

This emphasizes the need to focus on reducing the footprint of the already-built environment and to a large extent encourages the industry to consider retrofit as a solution. This approach complements the already-existing strategies from the UAE tourism authorities to include more stringent environmental criteria within classification methodologies and licensing processes.

### Data is key – “if you can't measure it you can't improve it”

The results of this Benchmarking Report come with limitations due to the number of participating properties itself, but it is a clear first step in addressing the hospitality industry's energy and water performance. The accuracy of future reports will continue to improve with increasing number of participating hotel properties and as the methodology is refined with new and updated criteria.

## Next Steps

The EmiratesGBC Energy and Water Benchmarking for UAE Hotels - 2016 Report has addressed energy and water consumption in UAE hotel properties and provided individual and industry-wide references and benchmarks that show a high potential for improvement in terms of performance and environmental impact.

The findings of this report should be used by government entities, tourism authorities and hotel decision makers to better understand the current performance of the local hospitality sector and to assist them in developing and implementing innovative policies that advance the efficiency of the sector.

The EmiratesGBC Energy and Water Benchmarking for UAE Hotels - 2016 Report is the first of its kind developed by Emirates Green Building Council. Based on the response from the Council's members, tourism authorities and hoteliers, and based on the findings presented in this Report, the Benchmarking Project will be updated, fine-tuned and repeated on an annual basis to assess the state of green hospitality in the country over an extended period. Hotel properties will be invited to submit their updated data covering energy and water consumption, and new participating hotels will be welcome to take part in the next phase of the project. EmiratesGBC looks forward to continuing this Project with a larger number of participating, which will add value and improve accuracy of future benchmarking results.

Complementing this Project, EmiratesGBC offers support to build the technical capacity and awareness of hospitality stakeholders by offering tailored training modules dedicated to industry professionals, irrespective of their current level of technical understanding on sustainability and green hospitality. These modules cover key sustainability and hospitality-specific topics that will assist staff, hoteliers and tourism professionals in understanding and implementing best operational practices to reduce environmental impact and allow the UAE to position itself strategically on the global stage of sustainable tourism.

For more information on the **EmiratesGBC Hospitality Program**, contact Emirates Green Building Council: +971 4 346 82 44 – [info@emiratesgbc.org](mailto:info@emiratesgbc.org) / [www.emiratesgbc.org](http://www.emiratesgbc.org)

Participation in the next phase of the Benchmarking Project is free of cost and open to hotel properties in operation in the UAE, irrespective of location, type and star rating. Data collection and analysis remain confidential and hotel data will not be shared without the property's prior consent.

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**Emirates Green Building Council** is a business forum based in the United Arab Emirates formed in 2006 with the goal of advancing green building principles. The Council gathers member companies and partners representing a diverse range of stakeholders from within the building industry, government, and academia. EmiratesGBC functions as a common platform for all stakeholders whereby they can meet, discuss, interact, and exchange groundbreaking ideas which help to promote a sustainable built environment in the UAE and the surrounding region.

Since its formation, EmiratesGBC has initiated several programs and events related to improving the operational efficiency of existing buildings. Membership is open to all stakeholders willing to influence a positive change in the country's built environment. The Council facilitates open engagement with its members and conducts quarterly review with its Board Members to devise work plans and programs which promote the Council's mission.