

# BCA

# Building

# Energy

## Benchmarking Report

(Statistics and Figures) 2018

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2018

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## Acknowledgement

### **Environmental Sustainability Group**

- Ang Kian Seng [Group Director]
- Jeffery Neng [Deputy Group Director]

### **Green Building Policy Department**

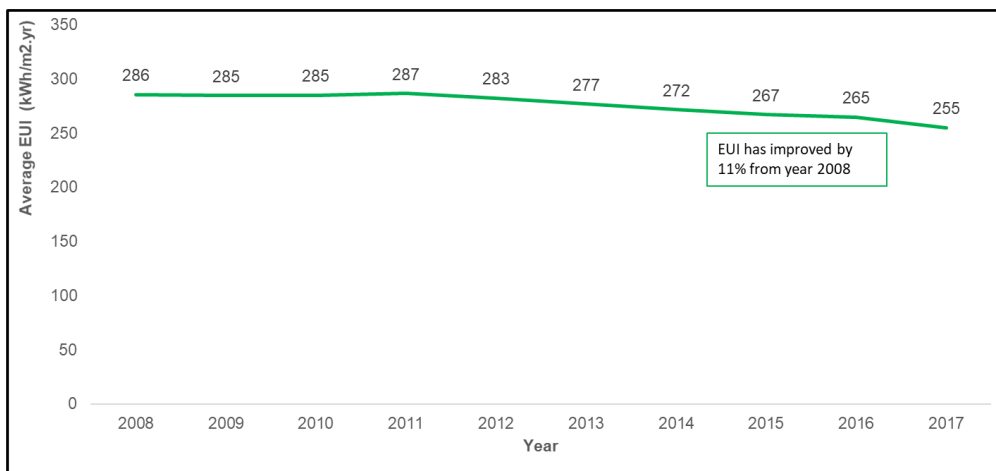
- Chia Yen Ling [Director]
- Koh Joon Hong [Deputy Director]
  - Vinna Tan [Senior Manager]
- Choo See Loke [Senior Manager]
  - Jeremy Hong [Senior Manager]

# Snapshot of BEBR (Statistics & Figures) 2018



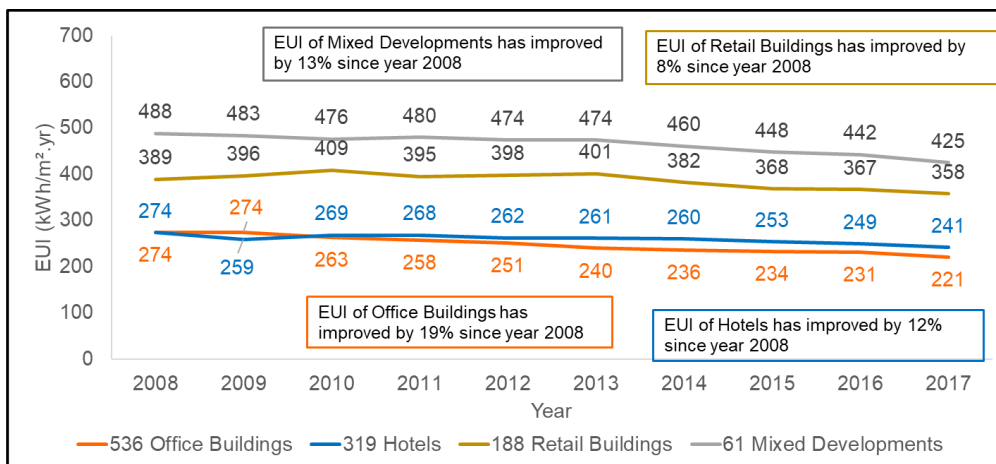
## Overall Performance of Submitted Buildings in 2017

- Based on the submitted data from 1,566 buildings, BCA observed that the overall energy use intensity (EUI) has improved by 11%, with steady improvement over a nine-year period. Electricity consumption stabilised in recent years even with GFA continued to increase by 40%.



Average EUI Trend of Submitted Buildings

- Commercial buildings showed commendable improvement at 14% in EUI since 2008, with all categories achieving more than 8% of improvement.



Average EUI Trend by Commercial Building Types

Voluntary Disclosed Building Energy Performance Data for Commercial Buildings (based on 2017's submission cycle) are publicly available at [www.bca.gov.sg/bess](http://www.bca.gov.sg/bess) and [www.data.gov.sg](http://www.data.gov.sg)

## Section 1

# Singapore's Building Energy Benchmarking

BCA publishes the Building Energy Benchmarking Report (BEBR) annually since 2014, to monitor the building energy performance of Singapore's building stock. This publication is an initiative under the BCA 3rd Green Building Masterplan, which aims to:

- Inform building owners and facilities managers on how well their buildings have performed;
- Spur them to initiate and implement improvements in building energy efficiency; and
- Shape the market through information transparency of buildings' energy performance.

For the 5<sup>th</sup> year, BEBR 2018 continues to be the key outreach medium for building energy performance for the sustainable built environment.



Under the Building Control Act, building owners have been required to submit building related information and energy consumption data to BCA on an annual basis since 2013. The information thus collected was analysed to establish the national building energy benchmarks for Singapore's built environment.

In this year's Annual Mandatory Submission exercise, BCA has covered the following types of buildings:

- Stage 1 (2013/ 2014) ➤ Commercial buildings comprising office buildings, hotels, retail buildings and mixed developments
- Stage 2 (2015/ 2016) ➤ Healthcare facilities and educational institutions
- Stage 3 (2017/ 2018) ➤ Large buildings of civic, community and cultural institutions, sports and recreation centres, and transport facilities

**Section  
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**Overview of 2017's  
Statistics and Figures**

In 2017, commercial buildings, healthcare facilities, and educational institutions were targeted for the annual mandatory submission, together with 3 new building types, namely: large-sized buildings of civic, community and cultural institutions, sports and recreation centres, and transport facilities.

In total, 1,566 buildings, with a combined Gross Floor Area (GFA) of 33.4 million m<sup>2</sup> and total annual electricity consumption at 8,642 GWh, had completed the submission in time for this benchmarking exercise, recording a full compliance for 2017.

Chart 1: Total GFA (million m<sup>2</sup>) by Building Types

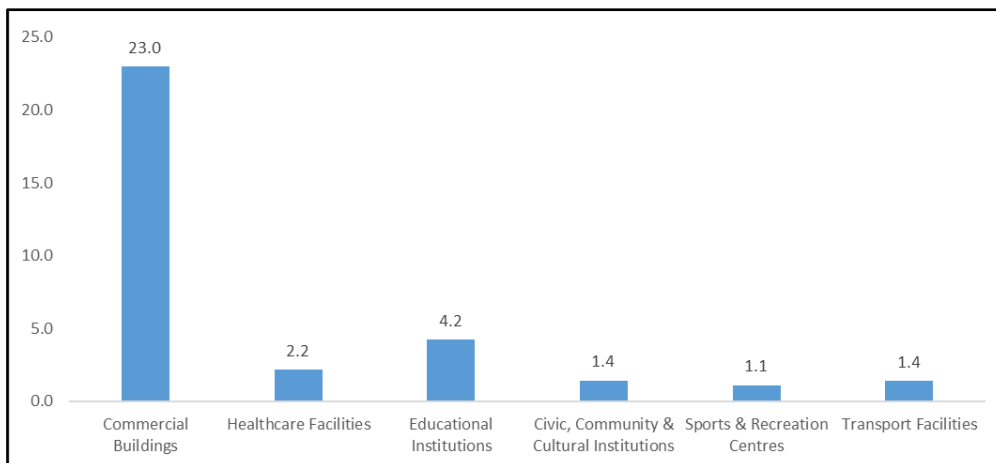
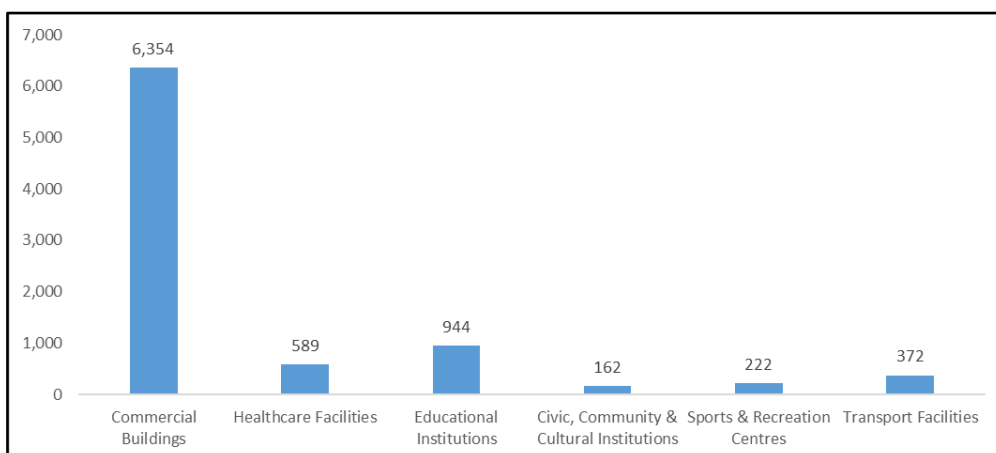


Chart 2: Total Electricity Consumption (GWh) by Building Types

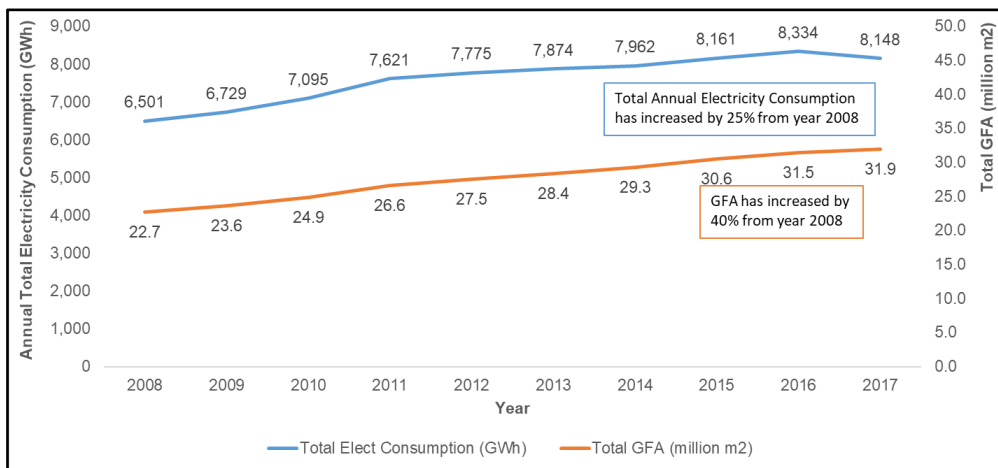


## EUI Trend

As electricity is the main source of energy used in Singapore's buildings, other energy sources were excluded in the computation of energy use intensity (EUI). EUI is measured by the total electricity used within a building in a year, expressed as kilowatt hour (kWh), per gross floor area (m<sup>2</sup>). The total number of submitted buildings trended each year are updated to reflect newly added buildings and existing buildings that have completed major renovation or redevelopment.

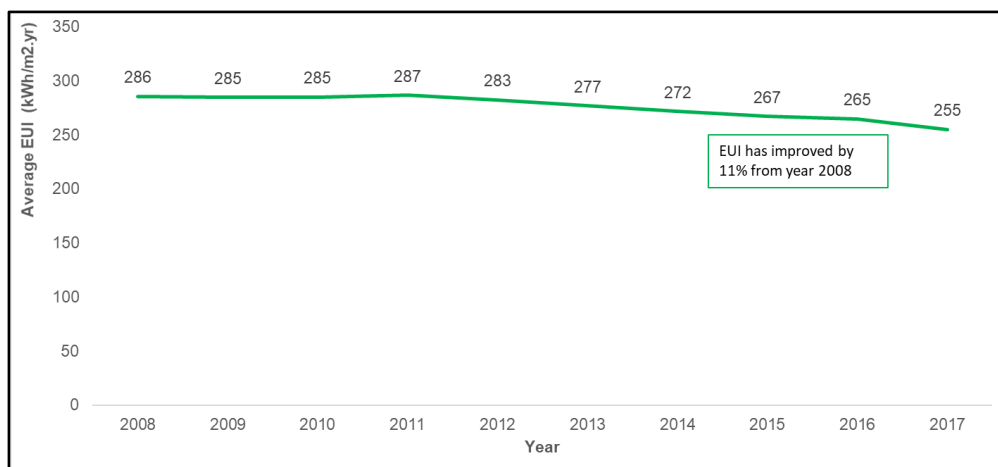
Over the nine-year period from 2008 to 2017, the annual electricity consumption of these 6 building types has increased at a slower rate by 25%, compared with the growth of the GFA at 40%.

Chart 3: Total GFA & Annual Electricity Trend of Submitted Buildings



The overall EUI for the submitted 1,566 buildings has therefore improved by 11%, with steady improvement over this period.

Chart 4: Average EUI Trend of Submitted Buildings



**EUI Trend of Commercial Buildings**

Over the nine-year period from 2008 to 2017, the annual electricity consumption of 1,104 commercial buildings has increased at a slower rate of 22%, compared to the growth of the corresponding GFA at 42%.

The average EUI has improved by 14% since 2008. This could be attributed to energy efficiency improvements in the commercial buildings as:

- About 27% are BCA Green Mark buildings; and
- An additional 9% are non-BCA Green Mark buildings that have undergone upgrading and retrofitting of their air-conditioning systems (chillers; split-units; AHUs and FCUs).

## National Building Energy Benchmarks [EUI (kWh/m<sup>2</sup>.yr)]

In 2017, a total of 938 commercial buildings were included for benchmarking. We omitted newly constructed or retrofitted buildings, buildings on district cooling systems (DCS), and aggregated mixed developments with electricity consumption or shared centralised air-conditioning systems that could not be segregated due to the lack of sub-metering. To facilitate the benchmarking exercise, we have categorised these buildings by type and size.

For the purpose of benchmarking, EUI can be used as an index for building owners and facilities managers to compare their building's annual energy performance against similar building types. EUI is the combined result of energy efficiency and consumption behaviour/pattern of the building.

Table 1: National Building Energy Benchmarks for Commercial Buildings (2017)

Building Type	Size*	No. of Buildings	EUI of the Top 10%	EUI Ranges (kWh/m <sup>2</sup> .yr)			
				Top Quartile (1% - 25%)	2nd Quartile (26% - 50%)	3rd Quartile (51% - 75%)	Bottom Quartile (76% - 100%)
Office Buildings	Large	171	≤120	≤152	152 – 193	193 – 250	>250
	Small	261	≤92	≤133	133 – 188	188 – 259	>259
Hotels	Large	76	≤206	≤228	228 – 268	268 – 323	>323
	Small	215	≤124	≤181	181 – 247	247 – 348	>348
Retail Buildings	Large	76	≤164	≤236	236 – 422	422 – 515	>515
	Small	92	≤147	≤238	238 – 370	370 – 478	>478
Mixed Developments	All	47	≤135	≤201	201 – 269	269 – 345	>345

Table 2: Average EUI Trending for Commercial Buildings

Building Type	Size*	No. of Buildings (in 2017)	Average EUI (kWh/m <sup>2</sup> .yr)		
			2013	2016	2017
Office Buildings	Large	171	235	223	212
	Small	261	311	299	268
Hotels	Large	76	291	278	267
	Small	215	294	278	275
Retail Buildings	Large	76	407	376	366
	Small	92	437	407	392
Mixed Developments	All	47	288	284	274

\*Large: Office, Retail, Mixed Developments of GFA ≥15,000 m<sup>2</sup>; Hotels of GFA ≥7,000 m<sup>2</sup>

\*Small: Office, Retail, Mixed Developments of GFA <15,000 m<sup>2</sup>; Hotels of GFA <7,000 m<sup>2</sup>

### What's next?

Using the benchmarking result, BCA will conduct continuous and customised engagements to identified groups of building owners; and introduce a stronger element of social comparison to nudge energy efficiency improvement actions.



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**Healthcare Facilities**

**EUI Trend of Healthcare Facilities**

Over the nine-year period from 2008 to 2017, the annual electricity consumption of 75 healthcare facilities has increased at a faster rate of 54%, compared to the growth of the corresponding GFA at 42%. It was observed that the average EUI for healthcare facilities has increased by 9% over the period from 2008 - 2017.

Table 3: Average EUI Trending for Healthcare Facilities

Healthcare Type	No. of Buildings (in 2017)	Average EUI (kWh/m2.yr)		
		2015	2016	2017
General Hospital/ Specialist Centre (Public)	17	354	346	345
Private Hospital (Private)	11	351	357	349
Community Hospital	4	198	218	214
Polyclinics	12	159	167	161
Nursing Homes	24	86	93	91

Table 4: Energy Benchmarks of Healthcare Facilities with Bed Spaces

Healthcare Type	No. of Buildings (in 2017)	Average Elect Consumption per Bed Space (kWh/Bed Space)		
		2015	2016	2017
General Hospital (Public)	8	48,004	52,549	51,597
Private Hospital (Private)	9	53,729	54,839	58,983
Community Hospital	4	10,452	11,505	11,310
Nursing Homes	22	3,390	3,815	3,686

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**5**

## Educational Institutions

### Total Electricity Consumption Trend of Educational Institutions

The annual electricity consumption of 52 educational institutions had increased at a lower rate of 30%, compared to the growth of the corresponding GFA at 46% over the period 2008 – 2017. It was observed that the EUI has improved by 10% during this period.

Table 5: Average EUI Trending for Educational Institutions

Educational Institution Type	No. of Institutions	Average EUI (kWh/m <sup>2</sup> .yr)		
		2015	2016	2017
University	5	382	375	358
Polytechnics/ ITE Campus	8	130	132	124
Private Colleges/ Private Schools	39	169	162	156

**Section  
6**

**Newly Targeted Building Types**

The first set of data from two new building types<sup>1</sup> namely civic, community and cultural institutions and sports and recreation centres are reflected below.

Table 7: Energy Benchmarks of Newly Targeted Buildings

Building Type	Sub-categorisation	No. of Buildings	Average EUI (kWh/m <sup>2</sup> .yr)
			2017
Civic, Community and Cultural Institutions <sup>#</sup>	Civic Institutions	19	106
	Community Institutions	71	91

<sup>#</sup>GFA ≥5,000 m<sup>2</sup>

Building Type	Sub-categorisation	No. of Buildings	Average EUI (kWh/m <sup>2</sup> .yr)
			2017
Sports and Recreation Centres <sup>#</sup>	Sports Complexes	11	113
	Recreation Clubs	39	198

<sup>#</sup>GFA ≥5,000 m<sup>2</sup>

<sup>1</sup> Due to the small sample size and diverse nature of operations, data from Cultural Institutions and Transport Facilities are not included for benchmarking purposes.

## Glossary

<b>Average Energy Use Intensity (EUI)</b>	Weighted average of the energy use intensities of buildings is calculated based on electricity consumed using gross floor area as the weightage factor.
<b>Energy Use Intensity (EUI)</b>	Measures the total energy consumed in a building in a year, expressed as kilowatt hour (kWh) per gross floor area (m <sup>2</sup> ).
<b>Gross Floor Area (GFA)</b>	All covered floor areas of a building, except otherwise exempted, and uncovered areas for commercial uses, are deemed the gross floor area of the building. Generally, car parks are excluded from gross floor area computation.
<b>Building Types</b>	<p><b>Office building</b> is a development with premises used as a place of business and for conducting administrative work.</p> <p><b>Hotel</b> is a development used for accommodation purposes on a commercial basis. The predominant use of this development shall be hotel rooms.</p> <p><b>Retail building</b> is a development with premises primarily used for any trade or business where its primary purpose is the sale of goods or foodstuff by retail or provision of services.</p> <p><b>Mixed development</b> is a combination of any of the above three commercial building types.</p> <p><b>Healthcare facility</b> is a development used mainly for medical services, such as hospitals, medical centres, community health centres, nursing homes, clinics (including dental clinics), and clinical laboratories (including x-ray laboratories).</p> <p><b>Educational institution</b> comprises tertiary and private institutions. Tertiary institution is a facility space used for post-secondary education, such as Institute of Technical Education (ITE), Polytechnic and University. Private institution is a privately owned and funded facility/space used for education.</p> <p><b>Civic, community and cultural institution</b> consists of civic, community or cultural facilities. Civic facilities include police station, fire station and prison. Community facilities are mainly community centre/club, and places of worship. Cultural facilities comprise performing arts centre, library, museum and concert halls. (With GFA more than 5,000 m<sup>2</sup>)</p> <p><b>Sports and recreation centre</b> is a development to be used mainly for sports and recreational purpose, such as sports complex, swimming complex and recreation club. (With GFA more than 5,000 m<sup>2</sup>)</p>

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