# Chapter 5

# Commercial Sector

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# Chapter 5
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## 1. Energy Efficiency Indicators in the Commercial Sector

Energy efficiency indicators (EEIs) in the commercial sector are intensities, presented as a ratio between yearly energy consumption (measured in energy unit, kWh) and gross floor area (measured in square metre). This ratio is referred to as building energy intensity (BEI) in this chapter. For meaningful comparison, the BEI values are compared only amongst the same building sub-sector or building category. In other words, the BEIs of office buildings, retail buildings, hotels, hospitals, etc. are compared within the same category or type of building. Therefore, BEIs are computed at the sub-sectoral level and are computed as follows:

$$Building\ Energy\ Intensity = \frac{Yearly\ energy\ consumption}{Gross\ floor\ area}$$

Where:

1) Yearly energy consumption is the total energy usage in a building in one year.

2) Gross floor area is the gross build-up area of a building including common areas such as reception area, corridors inside buildings, etc. but excludes any covered carpark area.

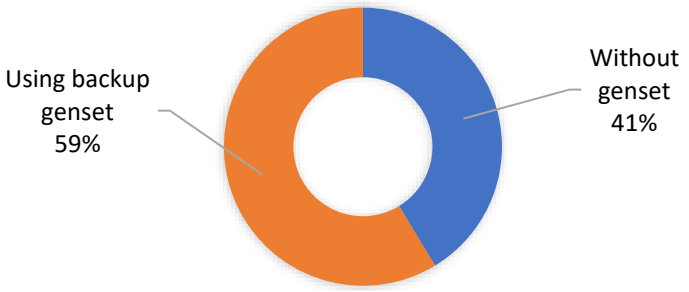
## 2. Effective Samples

Amongst the 200 survey data collected from the commercial sector, four survey s questionnaire had insufficient data. The remaining 196 survey questionnaires were considered valid samples for analysis. The heat energy usage was estimated using a calculation method. The segregation of electricity usage by appliance was not considered in this study.

## 3. End-Use of Energy of Sub-sectors

All business entities involved in the survey are mainly connected to the central power grid and most entities use backup power from gensets, which use diesel fuel.

**Figure 5-1 Share of Generator Set Installations as the Commercial Sector's Backup Energy Source**




Source: MEEI.

In total, 59% of the entities used a backup power source, and only 41% entirely relied on electricity from the centralised network.

Table 5-1 shows the consumption of different types of energy – electricity, heat, diesel, and gas – used in the commercial sector (Table 5-1).

**Table 5-1. Energy Consumption of Each Sub-sector (kWh)**

| Type of Energy | Restaurant | Hotel | Office | Shopping Mall | Hospital |
|---|---|---|---|---|---|
| Electricity | 2,296,885 | 23,929,114 | 43,241,914 | 75,633,432 | 14,656,147 |
| Diesel generator | - | 303,610 | 269,660 | 122,899 | 793,363 |
| LPG | 7,379,789 | - | - | - | - |
| Heat | 8,801,068 | 43,645,983 | 359,783,676 | 79,467,285 | 30,774,046 |
| **Total energy consumption** | **18,477,743** | **67,878,708** | **403,295,251** | **155,223,616** | **46,223,557** |

LPG = liquefied petroleum gas.
Source: MEEI.

The percentage breakdown of energy sources for each sub-sector is shown in Table 5-2. It should be highlighted that liquefied petroleum gas (LPG), which takes up about 40% of the total energy consumption in this sub-sector, is mainly used in restaurants for cooking.

**Table 5-2. Percentage Share of Energy Sources, by Subsector**

| Type of Energy | Restaurant, % (22 samples) | Hotel, % (23 samples) | Office, % (108 samples) | Shopping Mall, % (23 samples) | Hospital,% (24 samples) |
|---|---|---|---|---|---|
| Electricity | 12 | 35.3 | 10.7 | 48.2 | 34.1 |
| Diesel (for generators) | - | 0.4 | 0.1 | 0.1 | 2 |
| LPG | 40 | - | - | - | - |
| Heat (space heating) | 48 | 64.3 | 89.2 | 51.2 | 63.9 |
| **Total energy consumption** | **100** | **100** | **100** | **100** | **100** |

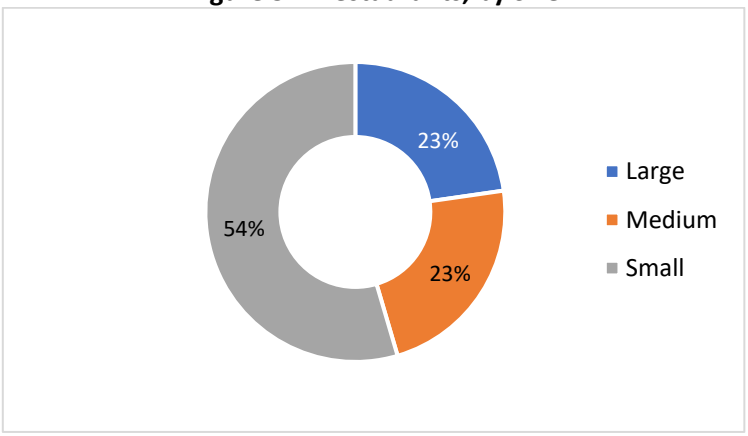
LPG = liquefied petroleum gas.

Source: MEEI.

### 3.1. Restaurant

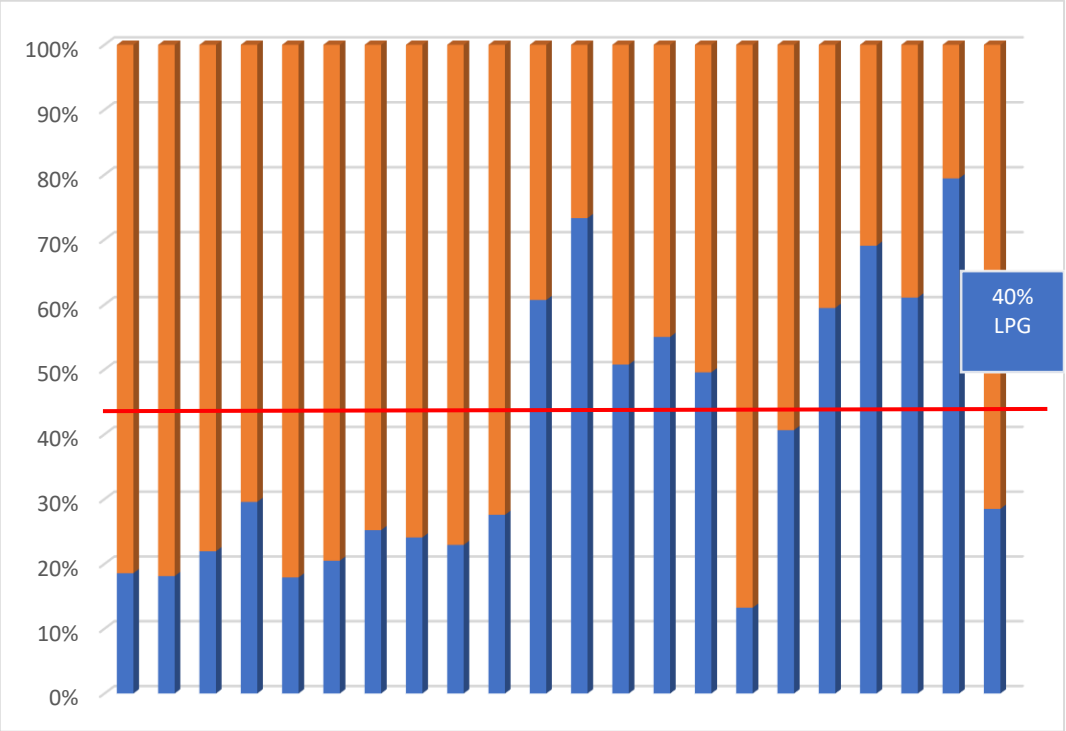
Businesses entities in this sub-sector use substantial LPG for cooking. About 54% of the surveyed entities are small restaurants; the other 23% are medium, and the remaining 23% are large restaurants, including large banquet halls.

**Figure 5-2 Restaurants, by Size**




Source: MEEI

**Figure 5-3 Percentage Share of LPG vs Other Energy Sources Used in Restaurants**




LPG = liquefied petroleum gas.

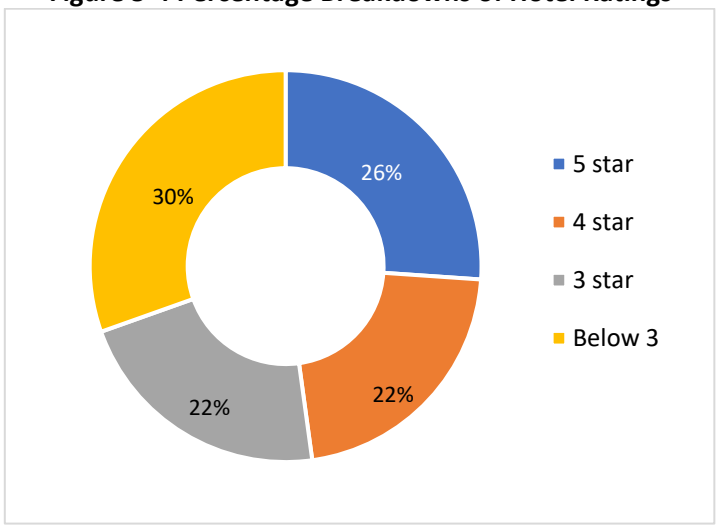
Source: MEEI.

According to the survey, 40% of the energy consumption of restaurants and banquet halls come from LPG (Table 5-2 and Figure 5-3).

### 3.2 Hotel

The majority of hotels are three stars or above, and the remaining 30% are smaller hotels. All these smaller hotels operate in the countryside and do not use any power source and LPG. Large hotels use backup energy sources and most of them operate in Ulaanbaatar Figure 5-4).

**Figure 5-4 Percentage Breakdowns of Hotel Ratings**

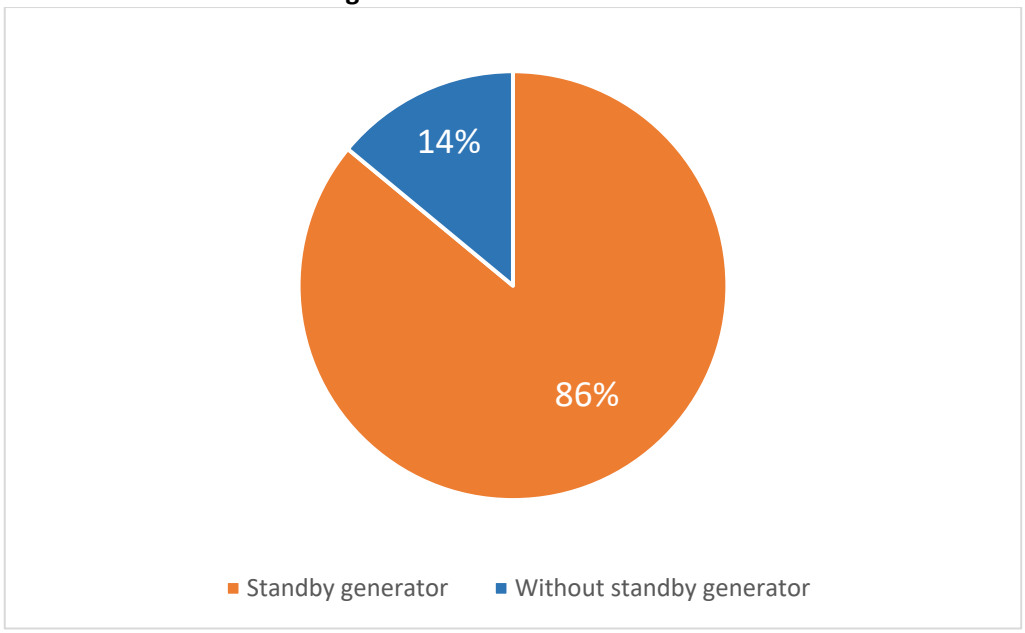



Source: MEEI.

### 3.3 Office

Most of the surveyed entities do not use any additional backup power source; only 14% use an additional backup source of energy.

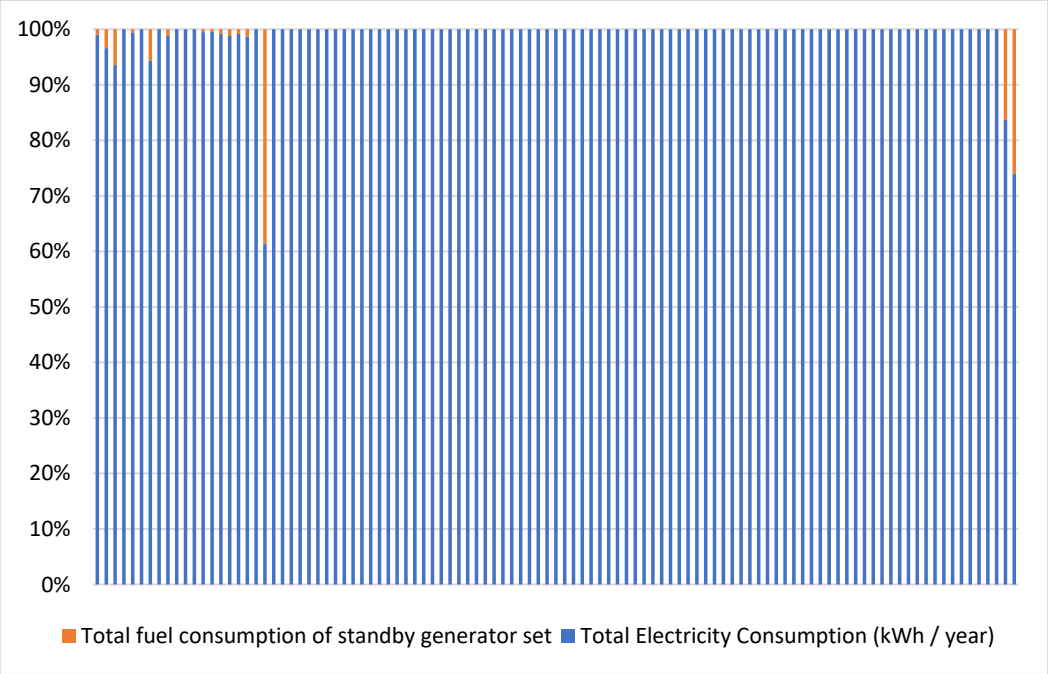
**Figure 5-5 Use of Power Source**




Source: MEEI.

Companies use backup energy generators for an average of only 10% per year ().

**Figure 5-6 Percentage Share of Electricity Consumption vs Fuel Energy Source Used in Office Buildings**

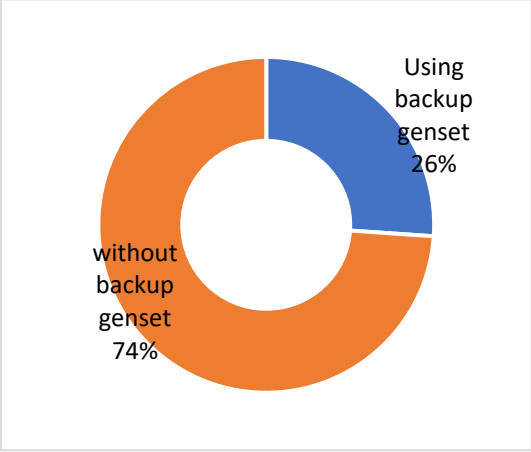



Source: MEEI.

### 3.4 Shopping mall

About 26% of the shopping malls involved in the survey use backup diesel generators

**Figure 5-7 Use of Backup Gensets in Retail Stores and Shopping Centres**

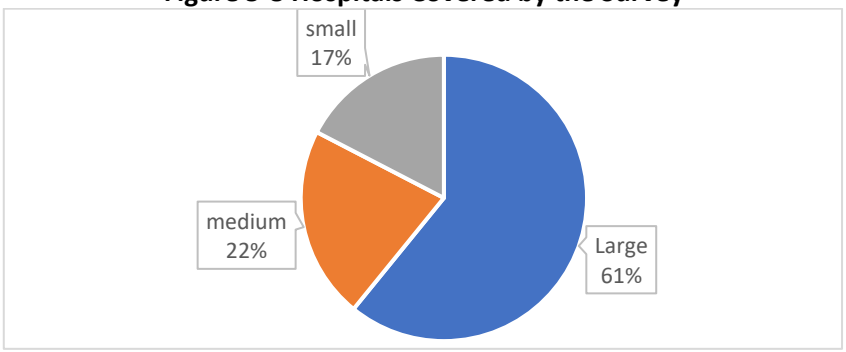



Source: MEEI.

### 3.5 Hospital

Sixty-one percent of the sample survey was obtained from large hospitals, and all hospitals involved in the survey use backup power sources, as illustrated in Figure 5-8.

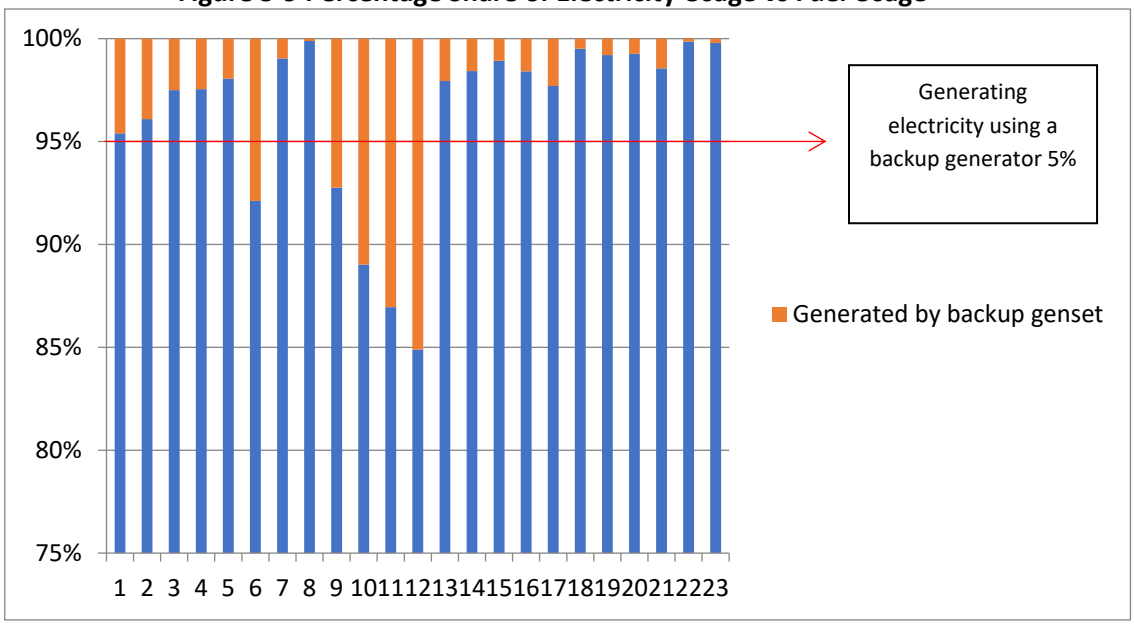
**Figure 5-8 Hospitals Covered by the Survey**




Source: MEEI.

Figure 5-9shows that hospitals covered in the survey had 5% of the total electricity consumption relying on a backup power source.

**Figure 5-9 Percentage Share of Electricity Usage vs Fuel Usage**




Source: MEEI.

## 4. Building Energy Intensity

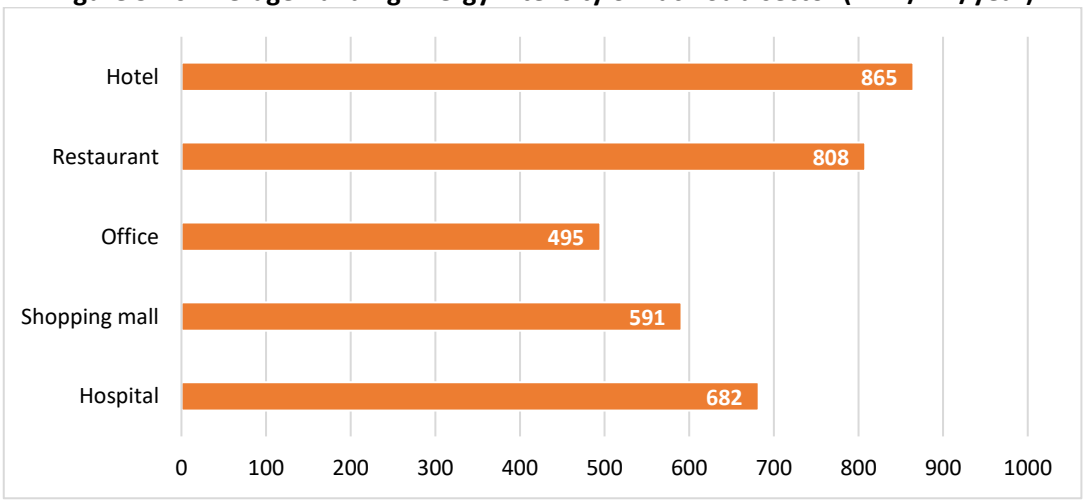
Calculation of the BEI of the commercial sector is based on total yearly energy consumption divided by gross floor area, which is expressed in kWh/m$^2$/year. The average energy intensity of each sub-sector calculated from the survey data is shown in Table 5-3. It should be highlighted that the values of the average BEIs derived from this survey for the various sub-sectors are only indicative. For more accurate establishment of BEI values, continuous effort to collect quality data is necessary. A larger pool of data with updated review and analyses would improve the accuracy of BEI values that would provide more accurate information on the energy performance of the respective sub-sectors.

**Table 5-3. Average Building Energy Intensity**

| Sector | Average BEI (kWh/m$^2$/year) |
|---|---|
| Hotel | 865 |
| Restaurant | 808 |
| Office | 495 |
| Shopping mall | 591 |
| Hospital | 682 |

Source: MEEI.

**Figure 5-10 Average Building Energy Intensity of Each Sub-sector (kWh/m2/year)**



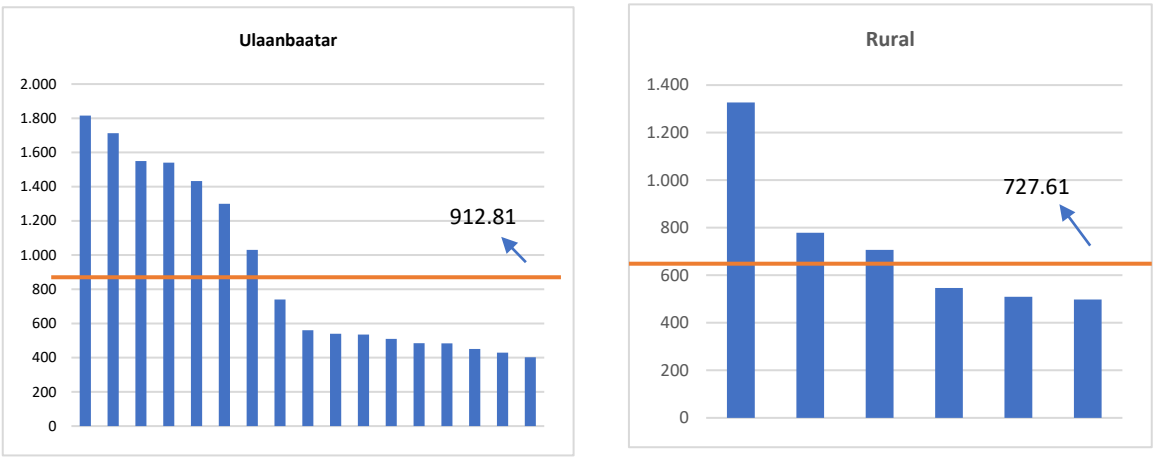

Source: MEEI.

The survey found that the average BEI of hotels is the highest whilst the office sub-sector has the lowest level of energy intensity at 495 kWh/$m^2$/y. However, it is not correct to compare the BEI of hotels and offices because they are different sub-sectors and their functions are different. First, the operating hours are different: hotels operate 24 hours per day throughout the year compared with 8–10 hours per day during working days for office buildings. Second, hotels have more energy-intensive facilities and services than office buildings. In other words, the comparison of BEIs should be confined to buildings within the same sub-sector or building category.

It is interesting to note that the average BEI for restaurants at 808 kWh/$m^2$/y is higher than that of shopping malls at 591 kWh/$m^2$/y although both sub-sectors are expected to have similar operating hours. The difference in this case is possibly due to the large consumption of LPG reported in the restaurant sub-sector. However, more data are required in the future for further validation and verification.

The average BEI of each sub-sector in Ulaanbaatar and rural areas was analysed. Companies operating in Ulaanbaatar consume more energy than rural entities. Comparing the EEIs in both urban and rural areas (Figure 5-11 to Figure 5-15, the average BEI for hotels, offices, hospitals, and restaurants in urban (Ulaanbaatar) areas are generally higher than their respective sub-sectors in rural areas.

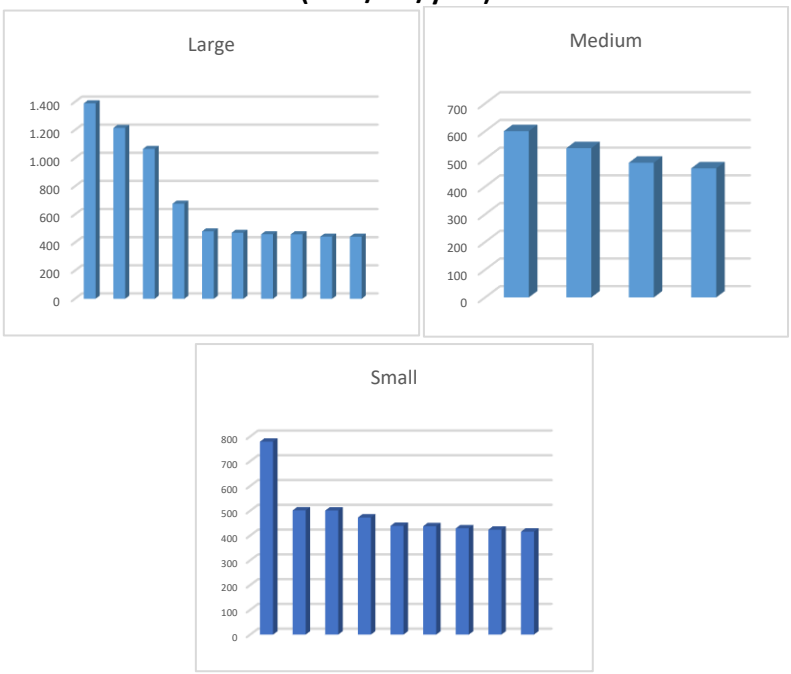
**Figure 5-11 Average Building Energy Intensity of hotels (kWh/m2/year)**




Source: MEEI.

Figure 5-15 5-11shows that hotels in urban areas generally consume more energy than that of rural areas. This is expected because hotels in urban areas are usually equipped with more energy-intensive facilities and services. Figure 5-12 shows the comparison of the average BEI of large, medium, and small retail buildings. In general, large retail buildings are more energy intensive, compared with medium and small retail buildings. It should be noted that the sampling size of the survey of medium-sized retail buildings is insufficient to make a conclusive statement about their energy performnce. However, based on the data available, the their average energy intensity seems to be marginally higher than that of small retail buildings.

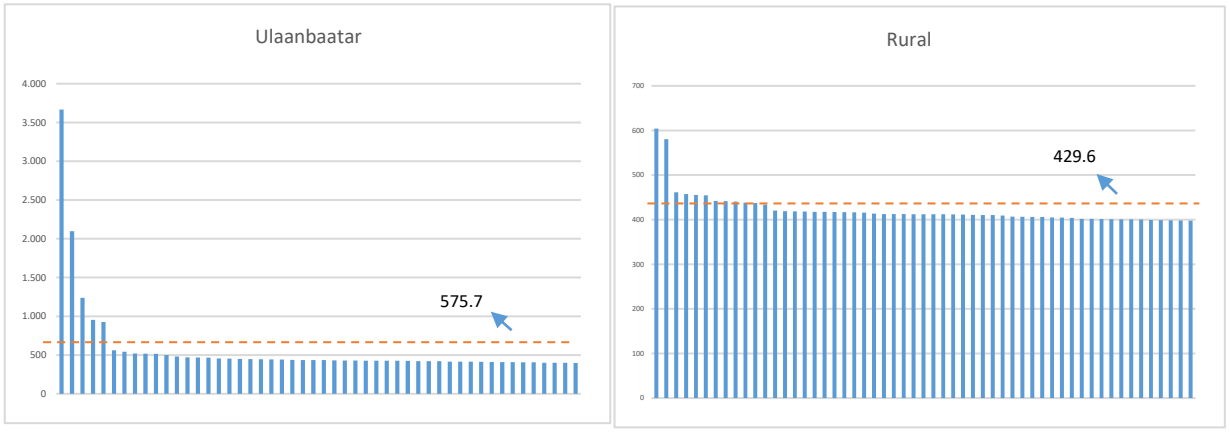
**Figure 5-12 Average Building Energy Intensity of Shopping Centres and Stores (kWh/m2/year)**




Source: MEEI.

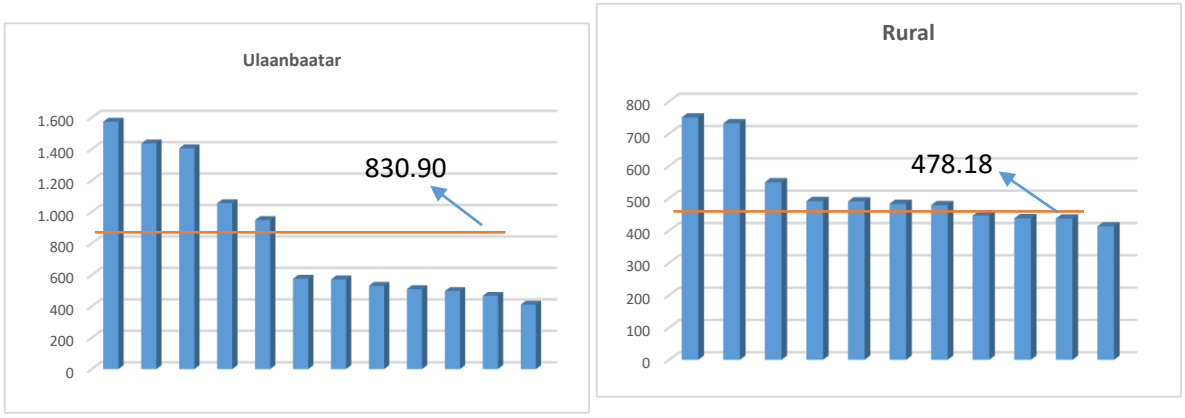
Figure 5-13compares office energy performance between urban and rural areas. The average BEI of urban office buildings is higher than rural office buildings. Similarly, the average BEI of hospitals in urban areas is much higher than that in rural areas, as shown in Figure 5-14. This is likely due to the difference in the range of hospital services in urban areas, compared with that of rural area hospitals. Figure 5-15compares the average BEIs of restaurants in urban and rural areas.

**Figure 5-13 Average Building Energy Intensity of Office Buildings (kWh/m2/year)**



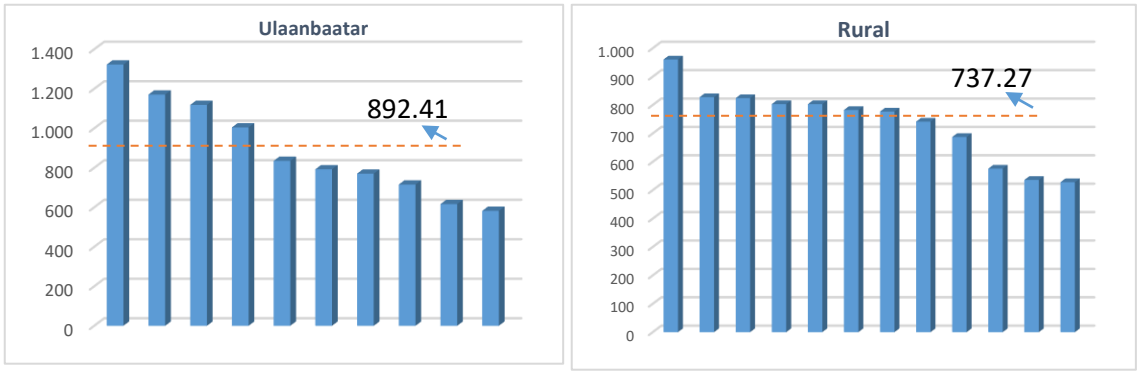

Source: MEEI.

**Figure 5-14 Average Building Energy Intensity of Hospitals (kWh/m$^2$/year)**




Source: MEEI.

**Figure 5-15 Average Building Energy Intensity of Restaurants (kWh/m$^2$/year)**




Source: MEEI.