

**DEVELOPMENT OF PERFORMANCE BENCHMARK  
FOR ELECTRICITY CONSUMPTION IN HIGH-RISE  
APARTMENT BUILDINGS IN SRI LANKA**

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the degree of Master of Science in Building Service Engineering

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## ABSTRACT

Globally, buildings are consuming over 40% of the total global energy consumption and locally buildings are consuming over 60% of energy from the total energy consumption in Sri Lanka. Apartment buildings have become popular as residential buildings all over the world due to urbanization, increased population density and land scarcity. There are a lot of apartment buildings which are currently in operation and also there are a significant number of apartment building construction projects are currently under way in Colombo and suburban areas.

The local regulatory body, Sri Lanka Sustainable Energy Authority (SLSEA) develops energy benchmark systems for different sectors in Sri Lanka. SLSEA has already published benchmarking schemes for tea, apparel, hotel sectors, commercial buildings and other industrial sectors (porcelain, tire, food, cement and concrete etc.). However, there exists a notable gap as neither residential sectors nor specifically apartment buildings have been developed with energy benchmarking standards. This gap is significant considering the rapid rise in popularity of apartment buildings throughout Colombo and its suburban areas due to urbanization, population density and land scarcity. The construction of high-rise apartment buildings has surged, driven by their popularity and commercial viability. Given these circumstances, the objective of this research study is to develop an electricity consumption benchmarking scheme specifically for high-rise apartment buildings in Sri Lanka.

During the research study, the electricity consumption data for the years 2022 & 2023 were collected from 34 apartment buildings. Subsequently, the monthly electricity consumption was analyzed with respective total floor area and net floor area. Accordingly, the electricity consumption benchmarks for high-rise apartment buildings in Sri Lanka were proposed as 29.28 kWh/year/m<sup>2</sup> per total floor area and 39.8 kWh/year/m<sup>2</sup> per net floor area.

**Keywords:** Energy benchmark, High-rise buildings, Apartment buildings, Residential buildings, Building performance

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## LIST OF NOMENCLATURE

| Abbreviation | Description                                              |
|--------------|----------------------------------------------------------|
| BEES         | Building Energy Efficiency Standard                      |
| BPI          | Building Performance Institute                           |
| BREEAM       | Building Research Establishment Environmental Assessment |
| CEB          | Ceylon Electricity Board                                 |
| CIBSE        | Chartered Institution of Building Services Engineers     |
| COP          | Coefficient of Performance                               |
| EPI          | Energy Performance Indicators                            |
| EUI          | Energy Use Intensity                                     |
| GBCSL        | Green Building Council of Sri Lanka                      |
| GDP          | Gross Domestic Product                                   |
| IEA          | International Energy Agency                              |
| IOT          | Internet of things                                       |
| kWh          | kilo Watt hour                                           |
| LECO         | Lanka Electricity Company Limited                        |
| LEED         | Leadership in Energy and Environmental Design            |
| LPG          | Liquefied Petroleum Gas                                  |
| MURB         | Multi- unit residential buildings                        |
| MW           | Mega Watts                                               |
| MJ           | Mega Joule                                               |
| NFA          | Net Floor Area                                           |
| SFA          | Supermarket floor area                                   |
| SLSEA        | Sri Lanka Sustainable Energy Authority                   |
| SLTDA        | Sri Lanka Tourism Development Authority                  |
| TFA          | Total Floor Area                                         |
| UDA          | Urban Development Authority                              |
| VRV          | Variable Refrigerant Volume                              |