Retrofitting of an existing governmental & training building to become smart and partially dependable on renewable energy attaining SDGs

Introduction

According to the International Energy Agency (IEA), buildings account for 39% of global energy use of cities and they are also responsible for about 40% of carbon emissions as well as consuming a significant amount of natural resources. This project research tackles sustainable development and the SDGs implementation through creating sustainable and smart buildings to enhance the built environment to reduce energy consumption, to mitigate carbon emissions and to counterbalance climate change. The building performance is to be evaluated and innovative interventions are used to improve the performance of the building and its urban setting.

Objectives

- 1000 Workers
- Total built up area: 10400 m²
- Operating hours from 07:00 to 17:00
- 4 Floors + Basement
- Type: Governmental & Training building

Theoretical

- Review, calculate & assess
- Review building system
- General info
- Assess activity & patterns

Methodology

- Retrofittng process
  - Approaching SDGs
  - Energy reduction/production
  - Mitigation of CO2 emissions
- Practical
  - Site visit, data gathering & energy audit
  - Surrounding context analysis
  - Climatic & system analysis
  - Envelope & energy audit

Applied solutions

- Smart & green interventions
- Simulations

Site analysis

- 20% Roofs
- 31% Pavements
- 16% Site formation
- 33% Vegetation
- Site urban fabric: to mitigate Urban Heat Island Impact.

Building assessment

- Annual energy consumption: 5.0 - 6.0 MWh
- Annual CO2 emissions: 1.0 - 1.2 kt/year

Applied smart & green technological solutions

- Destination elevator
- One-luminous led light
- Facial recognition
- Wireless locking device
- Surveillance cameras
- Argus sensor
- STR150 temperature sensor
- Lumi-motion
- Radiant cooling
- Thin-film facade
- Solar panels
- Light walls
- Piezo-electric material

3D typical floor plan

Section showing different interventions

Results & conclusion

50% Lowering dependence on artificial lighting
60% Reduction in HVAC loads
50% Decrease in heat gain
68% Reduction in total energy
68% Mitigation of CO2 emissions
56% Renewable energy production

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