Final Year Project Showcase Batch 2019
Year 2023

Department: Civil Engineering	
Programme: Civil Engineering	
1	**Project Title** ENERGY EFFICIENCY ASSESSMENT OF RESIDENTIAL UNITS THROUGH BUILDING ENVELOPE & OCCUPANY USE BEHAVIOUR ASSESSMENT **Project Idea** To assess the building energy performance of residential units with focus on building envelope parameters and occupant's energy use behavior and drive recommendations from it for making houses more energy efficient.
2	**Process** The methodology includes literature review, data collection through energy audits and living lab assessments, data analysis, and analytical validation through energy simulations. This approach aims to identify energy consumption patterns, occupant behavior, and thermal comfort conditions within buildings.
3	**Outcome** The outcomes of this project are as follows: 1. Integrated guidelines for energy efficiency in a building envelope. 2. Improvement measures are offered to the users for increasing their building energy efficiency and responsibly managing the energy consumption pattern to reduce electricity usage and bills for sustainable living.
4	**Evidence (Theoretical Basis)** In Pakistan, the share of energy consumption in buildings is exceptionally high compared to other developed countries, with residential buildings alone consuming 51% of the nation's total electricity. The International Energy Agency in Buildings and Communities Program identifies various factors influencing energy use in buildings, including climate, building exteriors, energy systems, design standards, building operation, maintenance, and occupant behavior. Indoor user comfort also plays a significant role, further affected by environmental indoor parameters. While 80% of a building's energy is consumed during its operation phase, the interplay between energy usage and occupant behavior remains unclear, leading to oversimplifications in modeling and analysis. To address these energy challenges, in this study a comprehensive energy audit and assessment process is proposed. The methodology includes literature review, data collection through energy audits and living lab assessments, data analysis, and analytical validation through energy simulations. This approach aims to identify energy consumption patterns, occupant behavior, and thermal comfort conditions within buildings. Based on the findings and assessment, a set of recommendations is proposed to improve building energy performance and occupant energy use behavior. These recommendations encompass implementing energy standards and codes, enhancing building envelopes performance through TRP LOE glass, providing insulation on both walls and roof and by placing projections on windows, promoting occupant energy-saving practices through use of day light and stick monitoring of occupancy , conducting energy audits and retrofit programs, leveraging insights from living lab observations and energy simulations, integrating renewable energy sources and adopting smart building technologies.

5	**Impact on Sustainability of Urban Regions or SDG-11 "Sustainable Cities and Communities"** More realistic energy simulation inputs leads to more accurate energy analysis of a building, hence, better improvement measures could be recommended in the form of guidelines to follow and make residential buildings more efficient which is one of the target of SDG 11.
6	**Competitive Advantage or Unique Selling Proposition** (Cost Reduction, Process improvement, Attainment of any SDG (Sustainable Development Goal), increase of market share or capturing new market or having superior performance over a competitor. In summary, any striking aspect of the project that compels the industry to invest in FYP or purchase it. Some detailed description is required in terms of how, why when what. You can select one or more from the following dropdown and delete the rest of them). Please keep relevant options, delete the rest of them, and correct the sequence
a	**Attainment of any SDG** (e.g. How it is achieved and why it is necessary for the region) This project is aligned with Sustainable Development Goal 11 namely Sustainable Cities and Communities. The consumption pattern and occupant's behavior were monitored to provide improvement measures to the users in order to know their points of negligence and consume energy responsibly and efficiently, therefore, contributing towards efficient buildings. In our region building energy consumption has a major share, which makes this study significant.
b	**Environmental Aspect** (e.g. carbon reduction, energy-efficient, etc.) In Pakistan, the share of energy consumption in buildings is exceptionally high compared to other developed countries, with residential buildings alone consuming 51% of the nation's total electricity. This study leads to energy efficient houses reducing the energy demand of residential building in Pakistan.
c	**Process Improvement which Leads to Efficiency Improvement of the Whole Process** (e.g. What is the issue is current process and what improvement you suggests) Currently, Use of unrealistic occupancy data as an input of Building Energy Model (BEM) is a major reason behind unrealistic building performance outcomes of simulation. Large discrepancies are being observed between predicted and actual energy performance it ranges between 29.8-43.2% with default occupancy input. The study aims to increase accuracy of simulation by assessing occupant's energy use behavior and metered electricity consumption data.
7	**Target Market** Different individuals have varying preferences for temperature, lighting, and equipment usage. To address these uncertainties, it's important to consider real-time occupancy data, engage with occupants to understand their preferences, behaviors, and needs, and use advanced building energy management systems that can adapt to changing occupancy patterns. Home owners, building energy analysis experts and industries developing smart energy efficient solutions can directly take benefit from the guidelines of this study.
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10	**Pictures (If any)**