



## Research Gap

Regardless of purpose or industry, there is an inevitable need and a growing interest to optimize energy use at a global scale in order to maintain future energy demand as well as to reduce the amount of greenhouse gases released into the atmosphere; which in a grander scale is the main contributor towards global warming. This does not only apply to developed countries, but to developing countries too. Many developing countries, especially from the tropical regions, are not energy efficient due to the way they interact with their climate, the lack of essential data to run any kind of assessment, case study or simulation, as well as a shortage in research that could pave the way towards a more efficient technique of utilizing energy and balancing out peak loads of energy demand that energy providers would have to meet. This thesis will look into creating the needed data to build a multi-objective optimization program that can be used to optimize energy in relation to tropical climate scenarios, by observing energy usage trends in Kuala Lumpur, Malaysia.

## Research Aim

The identified aim for this research is to understand and monitor the relationship between weather, energy use, occupant behavior and building technology; in order to optimize energy usage in buildings and to shift peak energy demand to deliver a balanced low carbon electricity grid, in a tropical climate context.

## Research Approach (Methodology – Stage 1)

The first objective of this research is to develop a significant monitoring system in order to obtain data for energy consumption, temperature, humidity, air quality, precipitation, solar radiation as well as occupant behavior in Malaysia.

*Methodology to address first objective (Stage 1):*

The research will undertake a data collection process to develop an urban morphology, where identified parameter sensing equipment will be installed, to collect data readings over an initial period of one year on 30 residential homes throughout the capital city of Kuala Lumpur, Malaysia.

## Overarching Research Questions

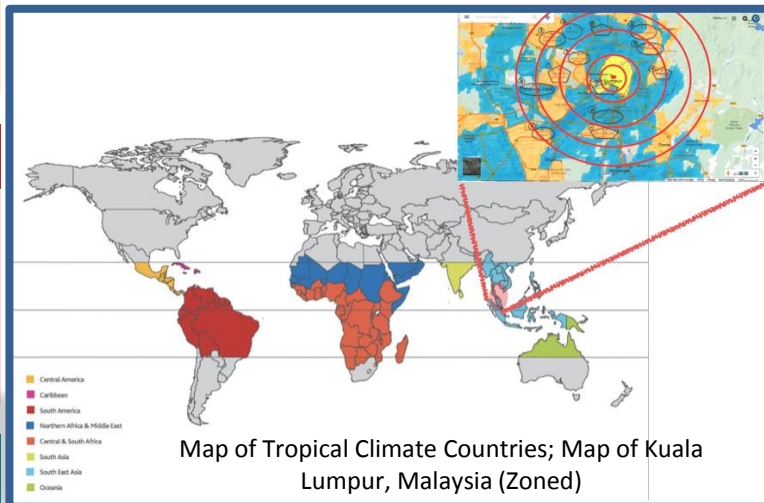
1. How does climate, energy use, and building technology, in a tropical climate context, relate to one another in creating a zero carbon building, as there aren't any database or study on this aspect based on significant monitoring?

1. How flexible are Malaysian homes in shifting peak demand while not sacrificing occupant comfort?

1. How effective is the use of machine learning algorithm in predicting energy consumption and behavioral energy use against a building physics model?

1. What are the methods and considerations to be taken in optimizing energy use in tropical climate countries?

1. How does energy optimization in buildings contribute towards a smart grid and a balanced electrical grid?



## Research outputs (Hypothesis – Stage 1)

1. In Stage 1, this research will be able to contribute towards providing new data for Kuala Lumpur, Malaysia, that has never been available before.

2. This research will be able to utilize the data obtained from Stage 1 to create an optimization model for zero carbon buildings, in a tropical climate context.

3. By using the temperature and air velocity data, this research will be able to develop an urban heat island profile for the entire city of Kuala Lumpur.

## Thesis Title

“Model Based Optimization for Zero Carbon Buildings Incorporating Weather Forecasting & Renewable Energy Systems in Tropical Climate Countries”

## Supervisors

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