Pre-Design Study of Balai Warga Kelurahan Taman Sari’s Building for Optimization Building Performance and Design Efficiency Strategies on Material Specification

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Abstract. Building performance simulation is being increasingly deployed beyond the building design phase, pre-design phase to support building operation. Specifically, the predictive feature of the simulation-assisted building systems control strategy provides distinct advantages in view how the design on building works. Strategies can be done in the pre-design phase by optimizing the energy efficiency by using the building performance simulation with several criteria such as construction materials, indoor materials, sizes of openings, air conditioning system, water management system, number of equipments used, the lighting systems, and many more. Optimization building performance and energy efficiency strategies that are evaluated through thermal performance simulating of a design are the preparatory stages that need to be carried out before the design realized. This phase is required in this project because the priority is optimization and efficiency energy though this paper using software in the pre-design design stage. The container for an activity needs to be specifically cleared and material specifications need to be detailed from roofs to floor until shading and the pre-design get the right strategy on pre-design study phase. "In this paper, we use the Sefaira plugin in the sketch-up modeling application. This application can calculate the total energy used by buildings in a year. Items that affect the total calculation (of energy) simulation are the (criteria mentioned above) material, window area, and the climate of the environment (By changing the material, window area, we are trying to improve the optimization of the energy used in this building within one year.

1. Introduction
It is important in this era where architects must think about optimization and energy efficiency in design to contribute to environment by creating a sustainable design. Energy efficiency in architecture [1]: An overview of design concepts and architectural interventions; Energy Efficiency The Latest Architecture and News when schools, public spaces and many of design building have to calculate and manage the strategy of design to optimize lower building energy consumption. Buildings nowadays contribute to serious environmental problems because of excessive consumption of energy and other natural resources. The close connection between energy use in buildings and environmental damage arises because energy intensive solutions sought to construct a building & meet its demands for heating, cooling, ventilation & lighting cause severe depletion of invaluable environmental resources. However, buildings can be designed to meet occupant’s need for thermal and visual comfort at reduced levels energy & resources consumption. Energy resource efficiency in new constructions can be effected by adopting an integrated approach to building design. The mainly steps approach would be to: [2]
Design energy-efficient lighting and HVAC systems (ventilation and air-conditioning). Once the passive solar architectural concepts are applied to a design, the load on conventional systems (HVAC and lighting) is reduced. Further, energy conservation is possible by judicious design of the artificial lighting and HVAC system using energy efficient equipments, controls and operation strategies to arrange this first step we need to calculate every details of ventilations and windows spot at pre-design phase to makes an easy start.

Use renewable energy systems (solar photovoltaic systems/solar water heating systems) to meet a part of building load. The pressure on the earth’s nonrenewable resources can be alleviated by judicious use of earth’s renewable resources (i.e., solar energy). Use solar energy for meeting electrical needs for a building can further reduce consumption of conventional forms of energy.

Use low energy materials and methods of construction and reduce transportation energy. An architect also should aim at efficient structural design, reduction of use of high energy building material (glass, steel etc.) and transportation energy and use of low energy buildings materials.

As mentioned above, with the application of some energy efficient methods, in the developed countries such as Netherland, Germany, Canada, Australia and Singapore, 30 - 90% saving in energy consumption has been made in the constructions in the last decade. From the experiences in the USA, a well-designed building that has the same area and is using solar energy, comparing to conventional buildings, with 5-10% first additional investment, makes about 50% energy saving (Çakmanus I, Böke APassive Solar heating and cooling of buildings, Building Magazine, 235, (2001), 83–88). Therefore the choices of material constructions in a building is crucial to the energy consumption due to its distinct needs for different activities and climate region. Therefore the choices of material in the pre-design step of a building is very crucial to achieve the lowest value of energy consumption. Hence the selected material construction of a building is done in the pre-design step, we need to figure out which materials worked best in the climate region where the building will be built by calculating the total energy consumption per year in Sefaira Plugin in Sketch-up software.

This paper approach the three step and try to figure it out the pre-design phase that can manage this steps even better. Pre-Design Study for Optimization Building Performance and Design Efficiency Strategies Taman Sari Citizen Hall Building will be included all indicators related. Define a heuristic static knowledge base of templates of the influential parameter inputs to the detailed simulation model, which will depend on the specific building and system type to find out optimization and efficiency strategy of building. The list, though tailored to the building type and HVAC system used, has to be generic and may contain more parameters than those that will turn out to be strong for any specific circumstance. Carroll and Hitchcock (1993) used 23 influential input parameters, though they point out that reducing this number would be advisable. Note that the parameters can be either discrete or continuous. This element would involve: [3]

- Developing consistent simulation input templates generic to a building type and HVAC system using audit information.
- Isolating/separating influential and non-influential variables, both discrete and continuous, depending on the particular circumstance. For electricity use and demand, and gas use, different types of systems may have different strong and weak variables, static heuristic templates have to be specific to the specific case considered.
- Defining preferred or base-case input values for influential variables involves assigning lower and upper ranges (or minimum and maximum values) to numerical values. It is for the continuous variables and specific values for discrete variables (for example, diurnal lighting schedule code).

2. Page layout (headers, footers, page numbers and margins)
Defining The Energy Saving Potential of Architectural Design explained that is recognized that architectural and construction design decisions have an important effect on environmental and energy performance of buildings [4]. Architecture should be inspired by biology for a definition of the measure and purpose of comfort requirements; by engineering sciences for a rational solution and execution till of any kind of design solution in this nowadays efficiency energy issue. Using the findings from other sciences and applying them to four distinct climate regions, temperate, cool, hot-arid, and hot-humid, that showed how we can arrive at new interpretations and exactness in architectural theories of orientation, shading, building form, air movements, site location, and effects of materials. We formulate Design Efficiency Strategies on Pre-design phase is to minimize unnecessary element on design proses.

2.1. Formatting the title Project Study Information (Prototype)
The object of study is a hydroponic study building center and a community hall that serves the daily needs of Krukut Taman Sari residents, starting from hydroponic plant training / workshops to recreational functions by providing gymnastic rooms and futsal fields on the rooftop of the building. The hydroponic development center building and futsal field have 3 levels of building floors with 2 building masses that are separated due to the space requirements needed by the residents of Krukut, Taman Sari. This building description is written to provide detailed information so that in this study the results can be used by various types of buildings with similar types.

| Programs                              | Size (m²) |
|---------------------------------------|-----------|
| 1. Guard Post (5 people)              | 16        |
| 2. Multipurpose Room (50 people)     | 224       |
| 3. Management Room (2 people)        | 19        |
| 4. Toilet (3 people / room)           | 6         |
| 5. Communal Kitchen (30 people)      | 180       |
| 6. Toilet (4 people / room)           | 8         |
| 7. Rockwool nursery room              | 34.5      |
| 8. Rockwool Rejuvenation              | 34.5      |
| 9. Futsal Field (14 players)          | 135       |
| 10. Futsal players room               | 57        |
| 11. Floating Engineering Nursery room | 34.5      |
| 12. Floating Engineering Rejuvenation room | 34.5 |
| 13. Terrace                           | 100       |
| Total Circulation                     | 100       |
| Total Building Area                   | 999       |

References: author, 2020
The vegetation around the site is on the north side of the building which is a shade tree and is existing or pre-existing. But in the future there’s will be as well as more vegetation planting on the south, east, and west sides of the building to improve air quality around the building, also door the hydroponic plant are in the 2nd floor. The location of the study object is planned in a tropical climate, with Relative Humidity in the range 60% to 80%. For wind speed in the range 1.6-6.3 m / s. For air temperature in the range 26 ° C - 31 ° C [2]. Design Ideas. Using a porous facade material with the dominance of the rooster brick walls, as well as the eaves of the facade which serves as a place for planting hydroponic plants on several sides of the building façade.

2.2. Optimization & Strategies
The method in this paper is to simulate the thermal comfort indicators and calculate the values in the simulation to be described and related to the design aspects both inside and outside the building. By considering mitigation strategies and related building elements, it is hoped that it can provide a rough direction for the designers to consider the angle and placement to use the most ideal material. Table 1 below shows energy use due to several factors, including projected energy use by electronics per square meter (equipment dominated), overall energy used in buildings (EUI), the percentage of light entering the building (mostly lit), and energy use by cooling system on building elements so that energy is wasted and energy needed due to sun exposure, building leaks, conduction in glass elements.

| Indicator                        | Value       |
|----------------------------------|-------------|
| Total Area Floor                 | 1.013 m²    |
| Energy Use Intensity (EUI)       | 150 kWh/m²/yr|
| Equipment Dominated              |             |
| Cooling:                         | 5395 kWh/yr |
| Lighting:                        | 20223 kWh/yr|
| Equipment:                       | 50557 kWh/yr|
| Equipment       | Energy Consumption (kWh/yr) |
|-----------------|-----------------------------|
| Fans            | 15,191                      |
| Pump            | 2,732                       |
| Mostly Lit     |                             |
| Under Lit:      | 15                          |
| Well Lit:       | 28                          |
| Over Lit:       | 57                          |

References: author, 2020

It can be seen from the EUI in Table 2 that the overall energy used is 150 kWh / m2 / yr. Energy Consumption Intensity (IKE) Electricity is a term used to state the amount of energy consumption in buildings and has been applied in various countries (ASEAN, APEC), expressed in units of kWh / m2 per year. As "Target", the amount of electricity IKE for Indonesia, using the results of the research conducted by ASEANUSAID in 1987 whose new report was issued in 1992 with the following details:

- IKE for offices (commercial): 240 kWh / m2 per year.
- IKE for shopping centers: 330 kWh / m2 per year.
- IKE for hotels / apartments: 300 kWh / m2 per year.
- IKE for hospitals: 380 kWh / m2 per year

Table 3. Indonesia Room Temperature Standard

| Criteria                  | With AC (KWh/m²/month) | Non AC (K WH/m²/month) |
|---------------------------|------------------------|------------------------|
| very efficient            | 4,17 – 7,92            | 0,84 – 1,67           |
| efficient                 | 7,92 – 12,08           | 1,67 – 2,5            |
| quite Efficient           | 12,08 – 14,58          | -                     |
| quite wasteful            | 14,58 – 10,17          | -                     |
| wasteful                  | 19,17 – 23,75          | 2,5 – 3,34            |
| very wasteful             | 23,75 – 37,75          | 3,34 – 4,17           |

References: Ikhsan, 2016 [5]

Both of them show roughly the same energy consumption targets. Accordance with the target of the Sefaira guideline that the recommended energy use in office buildings is 79 kWh / m2 / yr, and the Indonesian Ministry of National Education (2004) Energy Audit Classification target 7,92 – 12,08 kWh/m2/yr, so we have to cut the energy consumed around 71 kWh / m2 / yr, then based on the data in Table 2, the amount of energy that dominates is equipment at 5,022 kWh/yr; followed by lighting at 20,223 kWh / yr. This value is much different from the use of energy in cooling and fans. An alternative that can be done to reduce the load on the cooling system is to reduce the amount of glass from the facade, in order to provide shading, shade, or change the coefficient of the window to get good window performance in order to reduce the solar heat gain coefficient.
| Indicator      | Mostly Lit | Under Lit: | Well Lit: | Over Lit: | East Solar | West Solar | North Solar | South Solar | Wall Conduction | Roof Conduction | Flat Roof Conduction | Floor Conduction | Infiltrations |
|----------------|------------|------------|-----------|-----------|------------|------------|-------------|-------------|-----------------|----------------|------------------|-------------------|---------------|
|                |            | 15         | 28        | 57        | 5.057 kWh/yr | 6.788 kWh/yr | 3.100 kWh/yr | 4.347 kWh/yr | 16.267 kWh/yr (Gains) | 2.082 kWh/yr | 877 kWh/yr        | 82 kWh/yr          | 492 kWh/yr |
|                |            |            |           |           | 58.507 kWh/yr (Loses) |           |             |             |                 |               |                   |                   |               |

References: author, 2020

Pre-design recommendation relies on building elements that affect the overall performance of the building and must adopt strategies that reduce impacts. Table 3 shows the building elements and acceptable strategies to improve the performance of the building. Then the following are design recommendations for buildings that have been analyzed.

**Table 5. Building Element and Design Recommendations**

| Building Element   | Pre- Design Recommendations                           |
|--------------------|------------------------------------------------------|
| Wall / roof / floor condition | Using responsive building facades to the climate     |
|                     | Using a double roof to reduce heat on the building.  |
|                     | Using interior materials that can reduce heat on building |
|                     | Using minimum 2.8m ceiling height                     |
Increase insulation on windows
Add shade or cover to windows
It is advisable to open windows when the weather and temperature outside are cool.

Control the entry of light during the day on side and top areas of buildings
Add more shading at windows
Control the solar heat gain on the window (preferably using U-Factor)

Reduce leakage (it's part of the detail issue, and this is it dealing with leakage values at Sefaia Application)

Selection of lighting fixtures, using crass ventilation principle to gain some parallel lighting & Circulation ideal formulas.
Using windows of various types (single-sided and multi-sided recommended)

Use mechanical heating ventilation again (HRV), ventilator energy return (ERV), that is using an air exhaust, for condition clean air.
Recommendations for placing furniture so as not to obstruct the rate of indoor air ventilation

Use layering technic of glass (especially tall windows) fortunately reduced the entry of that light excessive and reduce over temperature.
It is recommended to pay attention to an inclination of less than 450 to avoid direct sun exposure

References: author, 2020
**Table 6.** Shows the comparison of the energy standard values used as a reference for analysis energy use in building

| Indicator                  | Energy Standards       | Standard Changes Energy |
|----------------------------|------------------------|-------------------------|
| HVAC Type                  | Fan Coil Units and Central Plant | Fan Coil Units and Central Plant | ASHRAE 90.1 - 2013 | ASHRAE 90.1 – 2013 |
| Baseline                   |                         |                         | 2                  | 2                  |
| ASHRAE Climate Zone        |                         |                         | 2                  | 2                  |
| Wall Insulation            | 0.86 W/m² - k          | 0.34 W/m² – k           |
| Floor Insulation           | 0.61 W/m² - k          | 0.4 W/m² – k            |
| Roof Insulation            | 0.22 W/m² - k          | 0.22 W/m² – k           |
| Glazing U-Factor           | 2.27 W/m² - k          | 1.65 W/m² – k           |
| Visible Light Transmittance| 0.42 %                 | 0.73 %                  |
| Solar Heat Gain Coefficient | 0.25 SHGC              | 0.17 SHGC               |
| Infiltration Rate          | 7.2 m³/m²h              | 5.17 m³/m²h             |
| Ventilation Rate           | 15 L/S                 | 7 L/S                   |
| Equipment                  | 25 W/m²                | 8.2 W/m²                |
| Lighting                   | 10 W/m²                | 5.9 W/m²                |

**References:** author, 2020

For the HVAC Type, Baseline, and ASHRAE Climate Zone there are no changes, because these indicators have become application references so it is not recommended to make changes [6]. However, the indicators above are carried out so that there are analysis results that can reduce energy use. These indicators relate to the use of materials and material specifications that will be applied to buildings.

**Table 7.** Shows Various Energy Changes That Occur in the Object of Study

| Indicator                  | Energy Standards       | Standard Changes Energy |
|----------------------------|------------------------|-------------------------|
| HVAC Type                  | Fan Coil Units and Central Plant | Fan Coil Units and Central Plant | ASHRAE 90.1 - 2013 | ASHRAE 90.1 – 2013 |
| Baseline                   |                         |                         | 2                  | 2                  |
| ASHRAE Climate Zone        |                         |                         | 2                  | 2                  |
| Wall Insulation            | 0.86 W/m² - k          | 0.34 W/m² – k           |
| Floor Insulation           | 0.61 W/m² - k          | 0.4 W/m² – k            |
| Roof Insulation            | 0.22 W/m² - k          | 0.22 W/m² – k           |
| Glazing U-Factor           | 2.27 W/m² - k          | 1.65 W/m² – k           |
| Visible Light Transmittance| 0.42 %                 | 0.73 %                  |
| Solar Heat Gain Coefficient | 0.25 SHGC              | 0.17 SHGC               |
References: author, 2020

Various indicators show the value of the energy change related to the type of material and material specifications of each building element that will be used, the energy change value of each building element has decreased substantially. This is holistic analysis for Pre-Design Study for Optimization Building Performance and Design Efficiency Strategies of The Taman Sari Citizen Hall Building.

| Indicator            | First Score | Second Score (Changes) | Explanation |
|----------------------|-------------|------------------------|-------------|
| **Total Area Floor** | 1.013 m²    | 1.013 m²               | Stable      |
| **Energy Use Intensity (EUI)** | 150 kWh/m²/yr | 77 kWh/m²/yr | Decreased   |
| **Cooling**          | 5395 kWh/yr | 2546 kWh/yr            | Decreased   |
| **Lighting**         | 20223 kWh/yr| 11931 kWh/yr           | Decreased   |
| **Equipment**        | 50557 kWh/yr| 16583 kWh/yr           | Decreased   |
| **Fans**             | 15191 kWh/yr| 7440 kWh/yr            | Decreased   |
| **Pumps**            | 2732 kWh/yr | 1574 kWh/yr            | Decreased   |
| **Mostly Lit**       |             |                        |             |
| **Underlit:**        | 15          | 2                      | Decreased   |
| **Well Lit:**        | 28          | 38                     | Increase    |
| **Overlit**          | 57          | 60                     | Increase    |
| **East Solar**       | 5.057 kWh/yr (Gains) | 1.309 (Gains) | Decreased   |
| **West Solar**       | 6.788 kWh/yr (Gains) | 1.757 (Gains) | Decreased   |
| **North Solar**      | 3.100 kWh/yr (Gains) | 802 (Gains) | Decreased   |
| **South Solar**      | 4.347 kWh/yr (Gains) | 1.125         | Decreased   |
| **Glazing Conduction** | 427 kWh/yr (Gains) | 509 kWh/yr (Gains) | Increase   |
|                      | 11.760 kWh/yr (Loses) | 10.781 kWh/yr (Loses) |             |
| **Wall Conduction**  | 16.267 kWh/yr (Gains) | 19.847 kWh/yr (Gains) | Increase   |
|                      | 58.507 kWh/yr (Loses) | 44.965 kWh/yr (Loses) |             |
| **Roof Conduction**  | 2.082 kWh/yr | 1.725 kWh/yr (Gains)  | Decreased   |
|                      | 6.779 kWh/yr | 6.949 kWh/yr (Lostes) |             |
| **Flat Roof Conduction** | 877 kWh/yr | 877 kWh/yr (Gains) | Stable     |
| **Floor Conduction** | 82 kWh/yr   | 85 kWh/yr (Gains)      | Increase    |
|                      | 7.002 kWh/yr | 7.230 kWh/yr (Loses)  |             |
The results of the analysis can be seen from table 6 that the building design has experienced a change in the value of Energy Use Intensity (EUI) by almost 50% from the previous value, namely 150 kWh m²/yr to 77 kWh m²/yr from the target recommended by the standards in 2030. Also closely related to the dominance of the previous heating load which was very high, which amounted to 51590 kWh/yr to 35170 kWh/yr. As a result of changes in types and specifications of materials in building envelopes, namely walls, types and materials of windows, doors, floors, and others, they are changed with materials that do not produce and require very large energy. The aspect of the level of lighting in the room area increased in the well-lit category from 28% to 38%, decreasing with the underl lit category from 15% to 2%. It's just that the level (over lit) also increases because the top floor becomes 60% from 57% which is a futsal field without a roof, so the sun exposure is not filtered at all. An alternative action that can be taken is to erect a roof on the futsal field area to reduce excess light exposure.

### 2.3. Optimization & Strategies Summaries

It is so important to pre-design phased recognized that architectural and construction design decisions have an important effect on environmental and energy performance of buildings. How architecture should be inspired by biology for a definition of the measure and purpose of comfort requirements [7]: by meteorology for a precise description of the existing climatic conditions and by engineering sciences for a rational solution and execution. Using the findings from other sciences and applying them to four distinct climate regions, temperate, cool, hot-arid, and hot-humid, how we can arrive at new interpretations and exactness in architectural theories of orientation, shading, building form, air movements, site location, and effects of materials.

The sustainable design of cooling, and lighting systems in buildings could be more easily accomplished by understanding the logic of a three-tier approach. The first tier consists of architectural and structural design decisions of buildings. If all the right decisions are made for the sake of minimizing energy consumption, up to 60 percent reduction of the cooling and lighting energy demand is achievable. The second tier involves the use of natural energy sources through such methods as passive heating, passive cooling, and daylighting systems. Proper decisions taken at this point can reduce the energy demand by a further 20 percent. The strategies in tiers one and two, both purely architectural, can reduce the energy demand of buildings by up to 80 percent. Building energy simulation was at its inception, simulation allowed for a small number of simulations with simplified building models. The aim of this research is to verify the climatic design opportunities effectiveness with state-of-the-art computing technology and building performance simulation tools [8]. On this confirm of well-known literature we can be measuring formulated aspect;

|                         | Infiltration | HVAC Heating | HVAC Cooling |
|-------------------------|--------------|--------------|--------------|
|                         | 492 kWh/yr   | 15.808 kWh/yr (Gains) | 25.113 (Gains) |
|                         | 334 kWh/yr (Gains) | 18.608 kWh/yr (Gains) | 20.965 kWh/yr (Gains) |
|                         | Decreased    | Decreased    | Decreased    |
|                         | 14.338 kWh/yr | 82.564 kWh/yr (Loses) | 11.659 kWh/yr (Loses) |
|                         | 10.860 kWh/yr | 59.821 kWh/yr (Loses) | 9.762 kWh/yr (Loses) |

Table 9. Description of the simulation variables Pre-Design Study Formulas
Building performance simulation tools are conventionally used to predict the future performance of
the building designs. More recently, however, the potential for the deployment of simulation in the
building’s operation phase is being explored Needless to say, the quality of any simulation-based
building operation system greatly depends on the reliability of the deployed simulation model [9]. Thus,
to ensure that predictions are dependable, applied simulation models must be calibrated. Moreover,
given the dynamic nature of building operation, some input parameters of the model may have to be
subjected to calibration on a recurrent basis [10]. This circumstance implies that the calibration task
cannot be approached as an ad hoc or one-time activity. Rather, it needs to be conducted on a systematic
basis. Consequently, the entire calibration process should be preferably automated to ensure efficiency
and consistency [11]. Given this background, the present contribution reports on a case-study of
monitoring-based optimization-aided thermal performance model calibration is the phase after this pre-design phase.

It was found that, depending on the climate, some of the variables may have the opposite effects on
the objectives. For example, WWR (Window Placement to Wall Ratio) and shading types may have
opposite effects on seasonal energy demand, because increasing indoor solar heat gains in winter may
be lead to overheating problems during summer time. Therefore, the used genetic optimization finds the
best solution that compromises among seasons. One major advantage of the optimization consists in
dealing with the interaction between variables to reach the best design alternative.

- **Building Geometry [12]**
  High compactness (4.15 m³/m²) is efficient for the Sub-artic climate, whereas for other
  climates a value of 2.3 m³/m² is called. Low WWR is proposed for warmer climates (Very Hot
  Humid, Hot Dry, Warm Marine): small windows minimize solar heat gains. High values of
  WWR are proposed for Mixed Humid climate. For Cold Humid climates a 90 percent WWR
  for south façade contributes to passive heat gains accumulation. In sub artic areas low WWR
  minimizes heat losses.
- Glazed systems. [13]
  Which corresponds to a median value, is suggested for Mixed Humid, Very Cold and Sub-artic climates, a value of 0.3 is proposed in Warm climates. Window VT is optimized by the objective function of lighting, therefore sky illuminance local conditions and solar angles are an impacting factor. A VT of 0.8 could be found in different types of climates (Very Hot Humid, Warm Marine, Mixed Humid, cold Humid, Very Cold and Sub-Artic). In Hot Dry and Warm Marine climates a U-value of 1.8 W/K m² is optimal. A U value 0.8 W/K m² is proposed for Cool Humid, Cold Humid, Very Cold, Sub Artic. 1.3 W/K m² is proposed for Mixed Humid climate and Very Hot Humid climate. Overhangs are optimal in Very Hot Humid, Mixed Humid, Cool Humid, and Cold Humid climates with a tilt angle of 45°. Horizontal overhangs are the optimized option for Cool and Cold Humid. No shading is suggested for Very Cold and Sub-Artic climates.

Opaque Walls [14]
Optimization trends were towards reducing the U-values of both the walls and the roof for all buildings at all selected locations in order to decrease conduction losses. A solar absorptance of 0.9 is optimal for Cool, Cold and Sub-Artic climates. An insulation thickness of 0.09 m is proposed for Very Hot Humid climate and the highest insulation (0.30 m) for Subartic. Thicknesses vary from 0.15 m for the Very Cold climate to the 0.24 m shown in Cool and Cold Humid climates. Thermal mass thicknesses fluctuate between 0.15 m in Sub-Artic and Warm Marine climates and 0.30 m in Cool Humid and Cold Humid cases. 0.20 and 0.25 complete the range by being associated to Very Hot, Mixed Humid climates, and Hot Dry and Very Cold. Thermal mass is influenced by the seasonal and daily variations that determine the need for thermal resistance and mass of the building structure. Accordingly, insulation is more critical in climates with extreme seasonal variations and small daily variations, while the thermal mass of the building plays a more significant role in balancing the indoor temperatures in climates with large diurnal ranges.

The experiment provides, for given locations, set of architectural solution also need to be prepared before design phased and construction design to best fit. It was found that proposed solutions are aligned with rules of thumb proposed in books such as “Design with Climate” and “Heating, Cooling and Lighting” [12]. Conventional design approaches often ignore opportunities for innovations with wind that could condition buildings at a lower cost, while providing higher air quality and an acceptable thermal comfort level, by means of passive cooling or natural ventilation [15]. Based on that, for formulated Optimization building performance and energy efficiency strategies we need to fill the gap between design and construction, and it is pre-design phase.

3. Conclusion
This paper confirms and simulating related indicators assertions regarding the climate-based architectural pre-design strategies and energy saving potential. This step can be achieved by using an extensive and systematic approach in analyzing a large amount of data, in order to compares the results with the references on building elements and mitigation strategies to find basic logic principle that prototype on phase of pre-design to be checked. We found the energy saving potential of architectural design decisions varies from 63 to 76 percent depending on the climate and it can be solved at placement, degrees of shaded windows, indoors materials, layering & responsive facade, mechanical heating ventilation again (HRV), ventilator energy return (ERV), till Infiltration Ventilation rate calculated. It was found that the maximum impact could be achieved by strategizing the building elements such as orientation, form, opening, sun shading devices and materials according to Olgyay and Lechner findings. The indicators analysis of the current set of data can be used on prototype similar building on pre-design phase.

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