Evaluate The Effect of Urban Spaces Elements On Thermal Comfort for Humans

Dr. Marwa Mohamed Abbas

Lecturer Department of Architecture Engineering Modern Academy Maadi

Miroda2020@Gmail.Com

Dr. Ayah Mohamed Ezzat

Lecturer Department of Architecture Engineering Modern Academy Maadi

Ayahezzat54@Gmail.Com

Abstract:

The elements of space have an important role in the formation of thermal comfort within the urban space and the formation of a visual image of it. Therefore, the study aims to determine the elements of urban space and the effect of each element on thermal comfort and the formation of an appropriate thermal image for it using various practical experiments, in addition to studying the role of trees in thermal performance and creating a suitable climate for it and knowing the best raw materials for use within the urban space. This study relied on the use of the experimental method by conducting an experiment in the city of Alexandria (Muhammad Naguib Square) to find out the effect of the different materials used in the voids on their thermal performance.

The experimental phase was carried out using Design builder, a simulation engine that uses Energy Plus, and many passive cooling solutions were tested in the reference building through testing the types of materials for glass and walls proposed to be used, through which appropriate thermal and visual comfort can be achieved in the urban space ,the cooling energy used in the reference building can be reduced by 60%.

Furthermore, the study demonstrates the potential of the design options examined by calculating the amount of thermal comfort that each alternative might achieve.

Keywords:

Urban spaces; Visual pollution; Thermal comfort; Energy consumption.

ملخص البحث:

تلعب عناصر الفراغ العمرانى دورًا مهمًا في تكوين الراحة الحرارية داخل الحيز العمرانى وتشكيل صورة بصرية لها، لذلك تهدف الدراسة إلى تحديد عناصر الفراغ العمرانى وتأثير كل عنصر على الراحة الحرارية وتكوين صورة حرارية مناسبة لها باستخدام التجارب العملية المختلفة، بالإضافة إلى دراسة دور الأشجار في الأداء الحراري. - ومعرفة أفضل الخامات لاستخدامها داخل الحيز العمراني، واعتمدت هذه الدراسة على استخدام الطريقة التجريبية من خلال إجراء تجربة في مدينة الإسكندرية (ميدان محمد نجيب) لمعرفة أثر ذلك المواد المختلفة المستخدمة في الفراغات العمرانية على أدائها الحراري. (٢٦ و٢٧)

تم تنفيذ المرحلة التجريبية باستخدام برنامج Design builder ، وهو محرك محاكاة يستخدم Energy Plus ، وتم اختبار العديد من حلول التبريد السلبي على نموذج الدراسة الذى تم اختيار وحده لمبنى سكنى داخل منطقه الدراسة وتم تنفيذ اختبارات أنواع المواد للزجاج والحوائط المقترح استخدامها - حيث أوضحت النتائج انه من خلال استخدام مواد مختلفه

على واجهات المباني الوصول الى تحقيق الراحة الحرارية والبصرية المناسبة في الفراغ العمرانى و تقليل طاقة التبريد المستخدمة في المبنى المرجعي بنسبة ٦٠٪, علاوة على ذلك ، توضح الدراسة إمكانات خيارات التصميم التي تم فحصها من خلال حساب مقدار الراحة الحرارية التي قد يحققها كل بديل.
استخدم الباحثون تجارب واقعية لتقييم عناصر الفراغ العمرانى وتأثيراتها على الراحة الحرارية والبصرية للإنسان، بهدف تحديد أفضل المواد التي تساعد على تحقيق أفضل النتائج للراحة الحرارية والبصرية في الفراغ.
تم استخدام مبرمج تصميم المبنى بمحاكاة الطاقة بالإضافة إلى اختبار قدرة المواد المستخدمة ومقارنتها بالمواد الجديدة الموصى باستخدامها لزيادة الراحة الحرارية في منطقة البحث. تم اختيار ميدان محمد نجيب بالإسكندرية كمنطقة دراسية

الكلمات المفتاحية:
الفراغ العمرانى، التلوث البصري، الراحة الحرارية، الطاقة

1. Introduction:

Thermal and visual comforts are two types of humane comfort, and urban space features play a significant part in the production of thermal and visual comfort within the city.
The researchers used realistic experiments to evaluate the elements of urban space and their effects on human thermal and visual comfort, with the goal of determining the best materials that help deliver the greatest outcomes for thermal and optical comfort in a vacuum.
The design building programmer with the energy plus simulation engine was used to examine the capacity of the materials used and compare them to the new materials recommended to be used to increase the thermal comfort in the research area. Mohamed Naguib Square in Alexandria was chosen as a study area. [1]

2. Research Problem:

Designers in previous decades have prioritised maximising the amount of land available for construction at the price of expanding urban space for streets and squares , while using the ground floors of building facades for commercial purposes and billboards, and without employing materials that give thermal comfort for building facades without considering how to achieve visual and thermal comfort for people within the city, as a result of the vacuum's decreased efficiency, the person raced to seek shelter in the interior spaces of buildings, which were harmed by the city's poor thermal comfort. The unavoidable answer was to use industrial means to ameliorate the temperature by employing air conditioners and refrigeration systems, resulting in the creation of new additional sources to raise the temperature of the spaces and the occurrence of global warming and pollution, in addition to the excessive use of electrical energy and its influence on the national economy, the researcher was prompted to establish a scientific technique for proposing answers and a methodology for improving the visual and thermal efficiency of urban places.

<u>The problem addressed by the research can be based on the following:</u>

1- The significant expansion in the utilization of mechanical air conditions has resulted in high energy consumption rates for cooling. Furthermore, climate change has resulted in an increase in summer temperatures, which has been reflected in the cooling energy.

A further issue is the lack of afforestation on Muhammad Naguib Street, which has a severe impact on the street's aesthetic appeal.

2- Failure to use thermally insulating materials on building faces and windows.

3- Ignoring the square's greening and instead adorning it with various colors to give it a pleasing appearance

3. Objectives:

The study's major goal is to create a suitable thermal and visual image for humans by measuring the effect of urban area features on thermal and visual comfort, finally, the building's energy consumption should be reduced.

3.1. Sub-goals

Determine the best materials for building facades that provide the most comfort, the best aesthetic, and the best visual for the urban environment. The influence of afforestation in establishing the best possible climatic conditions within the urban space and the best possible idea of plantation is being studied and measured.

4. Research Content:

The first section is theoretical, with definitions explaining the significance of various parts of urban spaces and their components, as well as identifying visual and thermal comfort in the urban environment. The second analytical section conducts a research study and urban analysis of the study area "Sidi Bishr in Alexandria" by looking into the reasons for selecting the area and its boundaries, as well as the elements of urban space that affect human comfort (thermal and visual comfort) in urban buildings, movement paths, squares, and elements of formation and beautification.

5. The Theoretical Part:

5.1. Definition of urban spaces

The urban spaces are those outdoor spaces that are among the buildings and allow communication, transit and social interaction of the inhabitants within the city.

Roads, traffic paths, green spaces, and service areas constitute most of the urban spaces where the designer selects the appropriate locations for buildings and spaces to achieve the coherence and harmony that create a strong visual relationship between the buildings and spaces as shown in figure 1. [2]

Fig. 1: Corvine Pedestrian Street, Kerekerdő street. [3]

5.2.Components of the Urban Spaces Elements of the City

- Elements that affect the thermal comfort of the outer space

Long-term climate change mitigation and adaptation methods that span physical scales, jurisdictions, and electoral periods should be incorporated into urban planning and urban design. As a core performance outcome, these activities must provide a high quality of life for urban residents, as well as climate change benefits. [4]

As shown in figure 2: (1) reducing waste heat and greenhouse gas emissions through energy efficiency, transit access, and walkability; (2) changing the form and layout of buildings and urban districts; (3) using heat-resistant construction materials and reflective surface coatings; and (4) increasing vegetative cover are some of the strategies used by urban planners and urban designers to facilitate integrated mitigation and adaptation in cities.

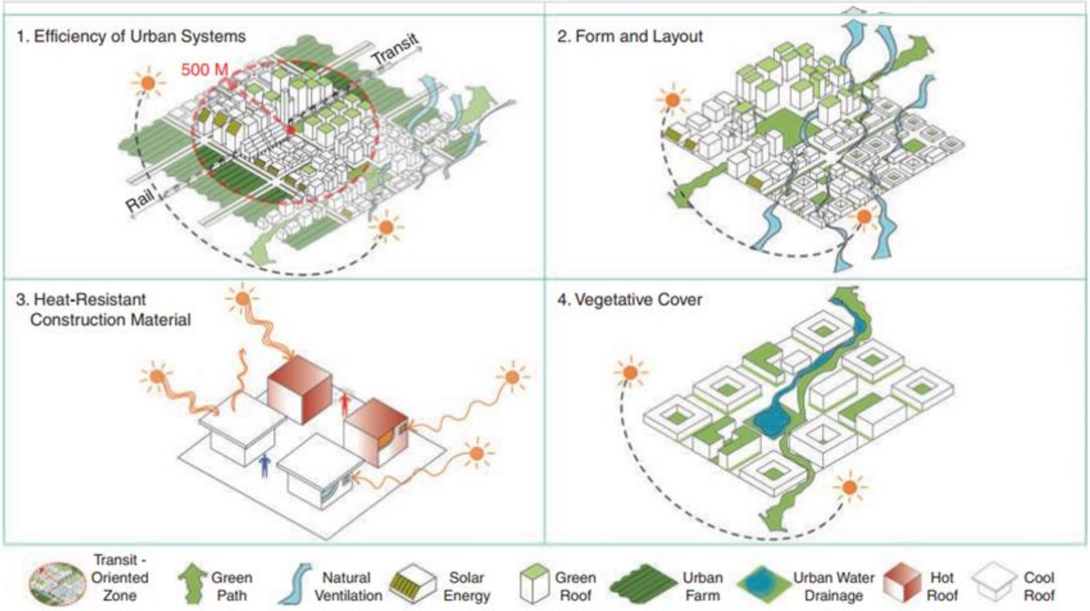


Fig. 2: Elements that affect the thermal comfort of the outer space. [5]

- <u>The urban spaces are formed into:</u>

<u>Walls:</u> They are the vertical levels that define the shape, size, and qualities of the space. The space's defining walls can be natural, such as trees, or physical, such as walls and building facades, and they influence the psychological perception of the space as well as controlling movement and seclusion.

<u>The Bishop:</u> It defines the vacuum from above, and the sky is made in the wide areas.

<u>Terrain topography:</u> it comes out that flat land is where movement is simple and clear to be viewed in different directions, and the moving elements are also defined by safety, but movement in lower inclination directions requires less effort than movement in upward inclination directions. [6]

As shown in figure 3, urban spaces are formed by the integration of urban buildings consisting of residential and service buildings in a system that is accessed by main roads and pedestrian paths and is beautified by natural elements (afforestation, green spaces, or industrial elements) in a system that is accessed by main roads and pedestrian paths and is beautified by natural elements (afforestation, green spaces, or industrial elements). [7]

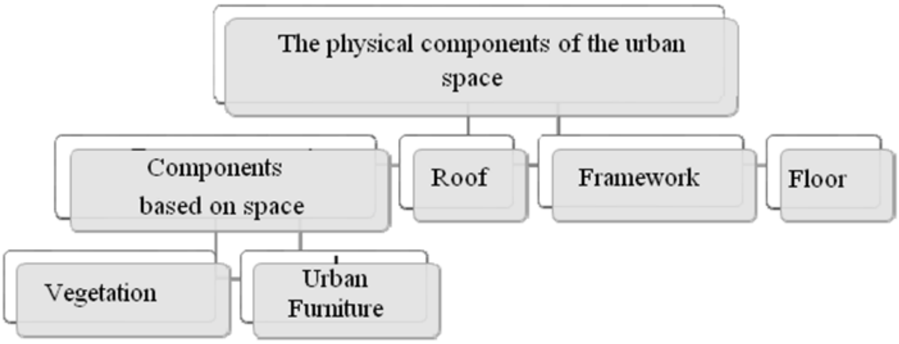


Fig. 3: Components of urban spaces. [8]

6. Thermal Comfort:

As illustrated in Figure 4, many factors can influence outdoor thermal comfort, and they can be classified as direct or indirect. [9] Factors that have a direct impact on outdoor thermal comfort as illustrated in Figure 2, several factors can influence outdoor thermal comfort, and they can be classified as direct or indirect. Factors that have a direct impact on outdoor thermal comfort. **[10]**

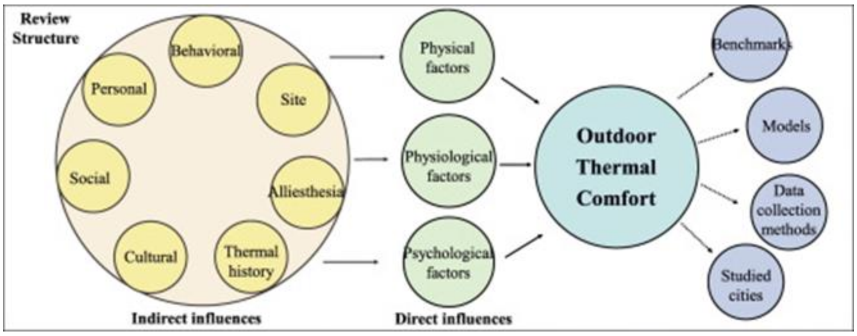


Fig. 4: Direct and indirect influences on outdoor thermal comfort [11]

6.1. Achieving thermal comfort in urban spaces:

One of the most important goals of architectural design is to provide the best possible thermal comfort for building inhabitants, which is difficult to quantify because human comfort is not only determined by physiological states that can be assessed in a variety of ways. Temperature, relative humidity, air movement, and sun radiation are the most important elements that have a direct impact on human thermal comfort. **[12]**

6.2. Climate control strategy for urban spaces:

Controlling air temperature and relative humidity: Controlling air temperature and relative humidity can be done in a variety of ways, including Keeping the required humidity while cooling the environment: The following water elements are used: Water components are regarded as one of the most important and influential variables that serve to create thermal comfort conditions related to the thermal environment in hot, dry countries by enhancing relative humidity inside the urban space. **[13]**

The use of trees to reduce temperature is considered one of the simplest and least harmful to the environment, as it works to reduce heat and equalize relative humidity in urban spaces, which leads to a sense of comfort, and we find that shaded areas create pressure differences due to different temperatures and thus work to draw air inside the spaces, in addition to preventing overheating. [14]

The use of thermally comfortable materials on building facades, as well as double glazing for windows, to achieve the best possible thermal comfort for the urban space. [15]

7. Visual Comfort

As shown in Figures 5 and 6, urban visual pollution is defined as one of the forms of deformation and environmental degradation resulting from heterogeneous and inconsistent urban landscapes that lack good planning and cause viewers' discomfort due to a lack of artistic taste and disappearance of the public scene's aesthetic image. [16]

Fig. 5: pollution in street. [17]

7.1. Forms of Visual Pollution of the Urban Spaces:

As depicted in figure 6, the visual pollution of the urban vacuum can be seen clearly in old cities and districts, as well as, unfortunately, in slums where no construction codes exist. [18]

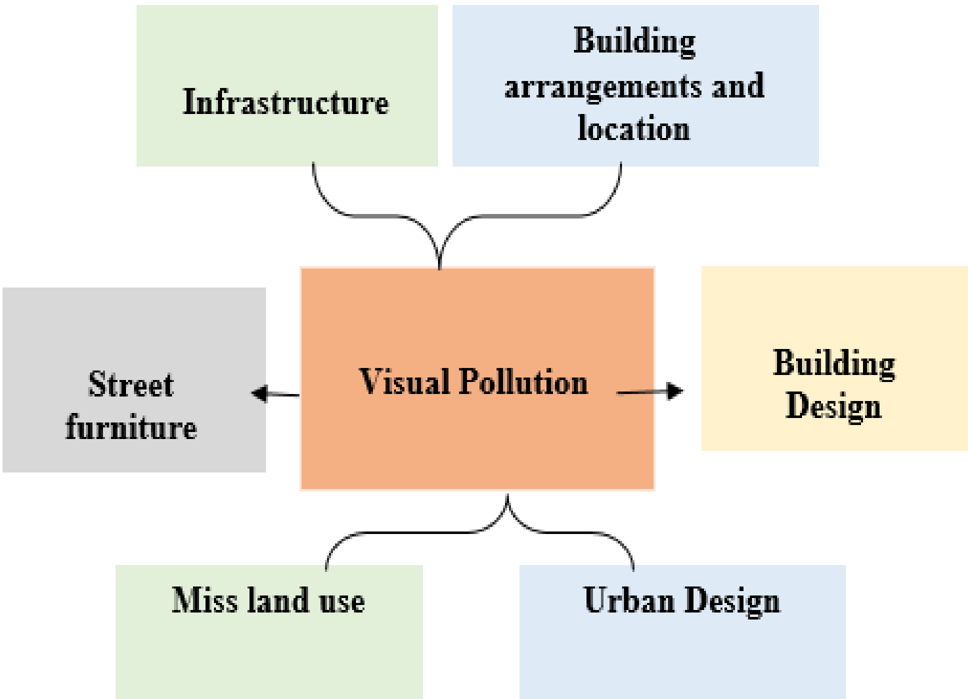


Fig. 6: Visual pollution in urban areas in various forms. [19]

8. Analytical Part:

-Location, Area Boundaries and Street Patterns:

Mohamed Naguib Square is located on the shoreline of Sidi Bishr district in Alexandria Corniche. Street Patterns: The streets take a radial pattern where the main streets are branched out, the most important of which are Khalid Bin Al Waleed Street extends east, Najib Street extends west and Al Essawi Street extends in the south east direction and 29 Street extends in the west direction and from the north the square opens on Alexandria Corniche as shown in figure· 7·

Fig. 7: A figure showing the map of Mohamed Naguib Square
Source: Google maps & Researchers.

<u>8.1 Models of form for visual pollution in urban buildings</u>

Table 1: Common façade design compatibility problems in the study area.

Building equipment	**Color selection**
 The figure shows the difference in heights of buildings, which creates an inconsistency in the visual image.	 As shown as figure: Inconsistency of colors for buildings, it creates a dispersal color image for the visual dimension of the viewer.
Visual clutter	**Signage**
 As shown in the figure: The urban space contains visual distortion and inharmonious formations.	 The figure shows the presence of posters on buildings that pollute the aesthetic image

8.2 Models of urban design elements affecting the quality of thermal comfort in urban spaces

Table 2: Designing building façades for the urban rebuilt environment

● The Red circle key means (available) - ○ The White circle means (unavailable)

Façade Permeability				Physical Comfort in street		
Walls	**Windows**	**Roofs**	**Traffic jams**	**Shade elements**	**Streets & square as a garage**	**Afforestation and greening**
● ○○	●●○	○○○	●○○	○○○	●○○	●○○

As shown in the figures, the use of traditional materials and paints on the facades of the building that contribute to global warming &use of single-glass windows were used in residential buildings.


The figures show that the roofs of buildings are not green.


The figures show that the square and street are not afforestation


The figures show the traffic jams & street occupations.


The figures show the lack of use of elements to shade the streets and the spread of garbage in the streets.


8.3.Alexandria's Climate Condition:

Alexandria has a hot desert climate (Köppen climatic classification: BWh). The Mediterranean Sea moderates the city's temperatures, resulting in variably rainy winters and fairly hot summers that can be quite humid at times.

Alexandria weather data are valid from the Department of Energy (DOE 2011d) according to weather data reports exported using the software (Climate Consultant 5) utilizing Alexandria. The hot season lasts from June 6 to October 10, with daily high temperatures averaging over 28°C. August 5 is the hottest day of the year, with an average high of 30°C and a low of 24°C. The cold season, on the other hand, lasts from December 10 to March 21, with an average daily high temperature of less than 20°C. February 2 is the coldest day of the year, with an average low of 9°C and a high of 18°C. [20]

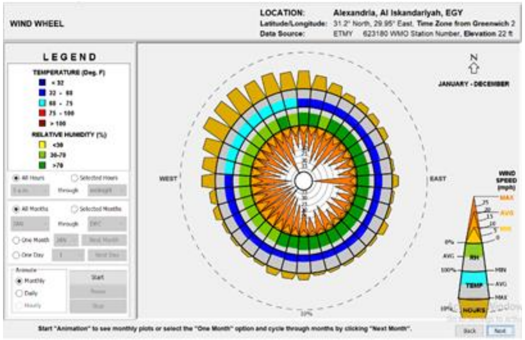
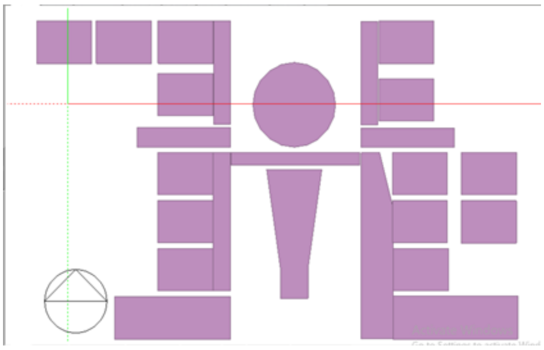


Fig. 8: a) Prevailing Winds – Wind Frequency, Alexandria, Egypt 31.2º, 30.0º - exported from Weather Manager. [21]



b) Master plan for the case study. Source: The Researchers

9. Methodology:

This paper is part of a bigger investigation of the effects of building construction on energy use. Create Builder with the Energy Plus simulation engine was used to design a naturally ventilated structure because it is one of the most efficient software tools.

It also has the ability to choose a building site and analyses hourly meteorological data for that region. Using its day lighting and energy modelling capabilities, the intended building's energy consumption will be correctly evaluated with and without Natural Ventilation, allowing for comparison study.

The research hypothesis is straightforward. In addition to the annual power consumption of passively designed chalets, ecologically friendly solutions are installed. The research approach is built on the following steps:

- Bioclimatic Site Analysis
- Month-by-Month Electric Demand Analysis
- Environmental Strategies Implementation

9.1. Base-case building:

The model was chosen as a typical freshly constructed second-Class apartment with apartment areas ranging from 140 to 150 m^2, as illustrated in Figure 10, which is a popular form of Jordanian residential buildings seen in Alexandria. Residential structures in Alexandria are typically four to twelve floors tall and are designed to be rectangular or square in shape. As a result, its dimensions are (12 m (W) x 22 m (L) x 2.5 m (h) and it has 22 residential units (2 units each level) with a total size of 140-150 m^2. [22]

9.2. Materials and methods

The tested simulation model was created with the Design builder simulation tool, and then a yearly energy simulation for the baseline and retrofitted models were performed in a hot desert climate, resulting in specific energy consumption and thermal comfort production. [23]

The current study's energy simulation uses data-driven modelling to identify and complete the simulation input settings by Design Builder simulation software, which is an advanced building energy simulation program. The first step estimates the energy consumption of a typical common traditional material's residential unit with a south orientation in order to compare its energy performance to a traditional model and the reduction in thermal comfort. [24]

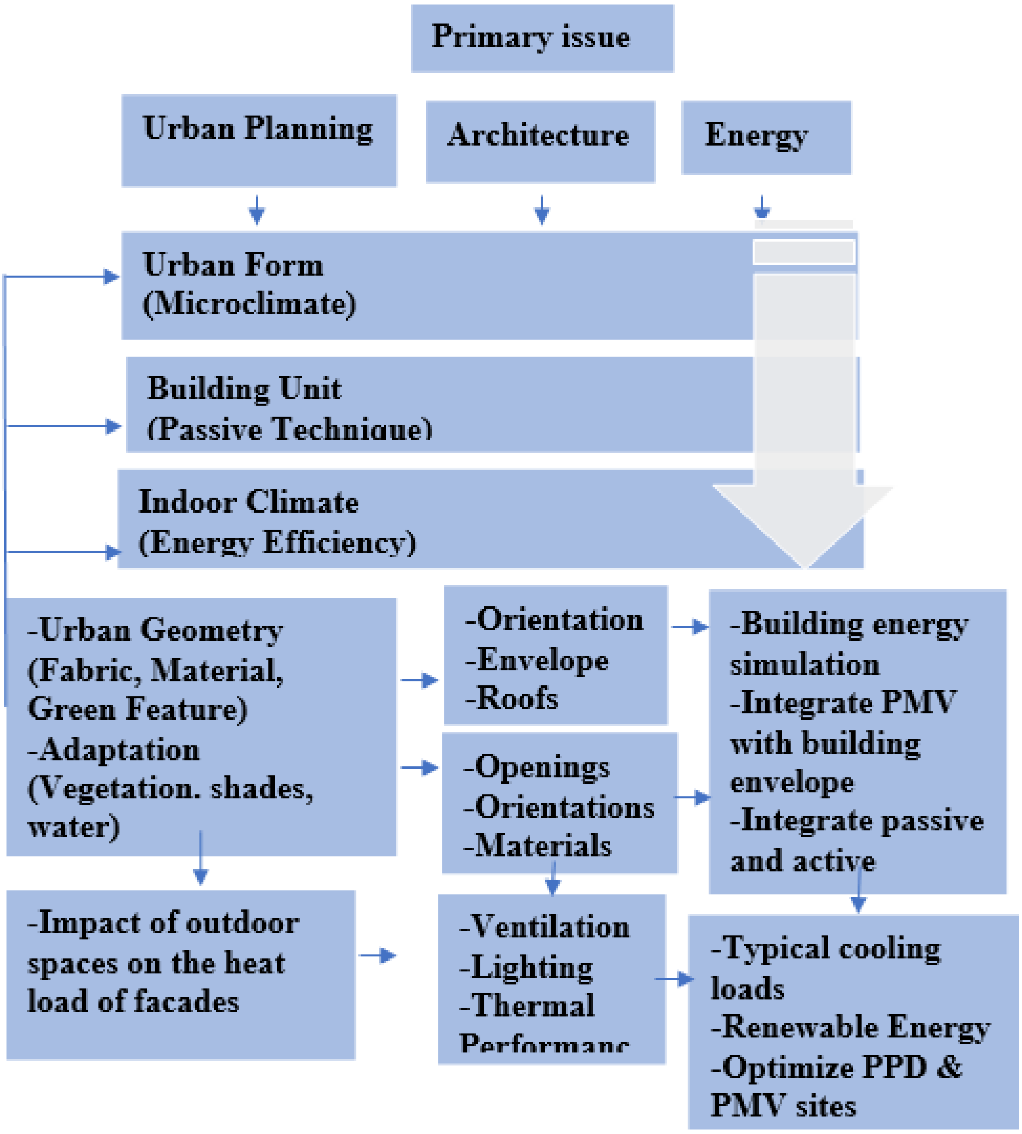


Fig. 9: Evaluate the product adaptation to the climate change of simulation structure. Source: The Researchers

9.3 Using the simulation program to determine the materials that give the best results to achieve thermal comfort for urban spaces.

Energy simulations are a primary method of optimizing buildings, energy performance and so the presence of a local digitalized construction and material database minimizes the potential for inaccuracies and makes the input of constructions in energy simulation programs as simple as selecting the specific material configuration and setting dimensions and orientation.

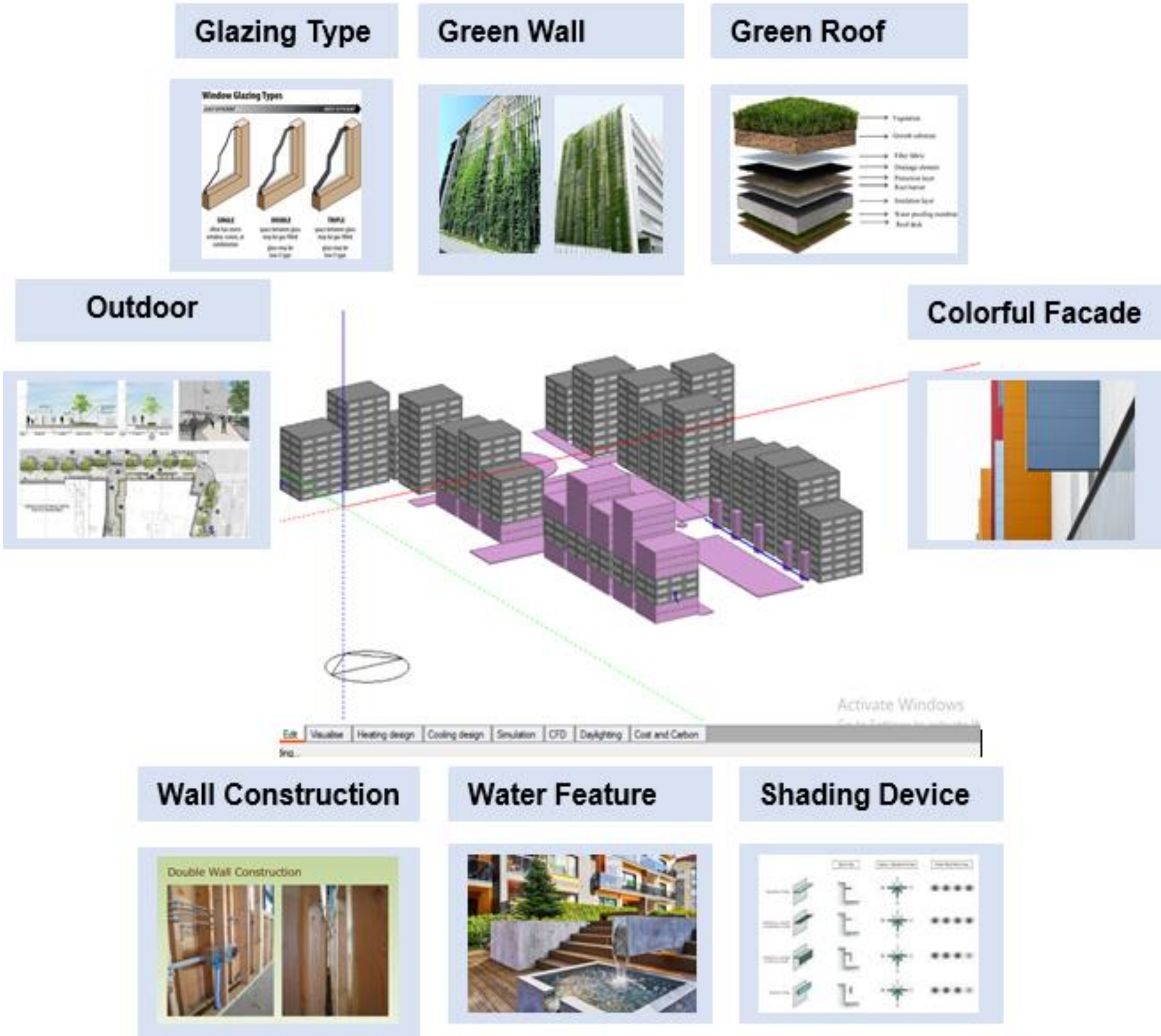


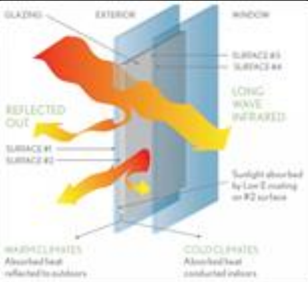
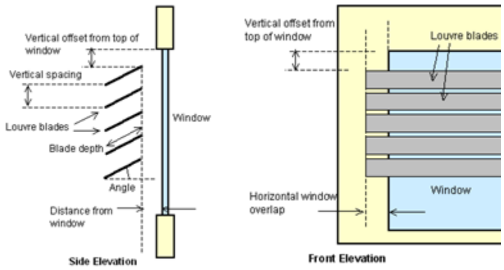
Fig. 10: The graphical strategies of simulation model of the case study
Source: Design builder & Researchers

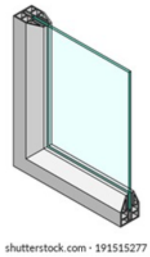
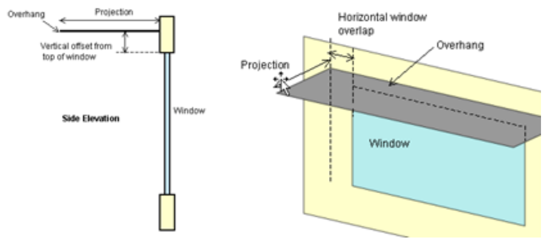
9.4.First Phase: Glazing and Shading type

A typical residential project is used to evaluate the glazing and shading systems. This project for residential buildings will have five to five stages. The residential building has a total area of about 250 m^2. Split air conditioning is utilised to cool the residential building.

The technical drawings are used to determine the residential building's construction materials. The software includes all external walls, below-grade walls, roofs, and internal partitions. Figure 9 shows a more complete explanation of the external wall. Table 3 contains information on the remaining components. For the analysis of the different glazing types and shadings for façade, several types of glazing and shading were chosen. Table 3 shows glaze types and how the residential building is shady. Total energy used per square meter (kWh/m^2) and heating energy per square meter (kWh/m^2) were computed for all combinations of glass types and shadings to compare. The combinations are made up of one glazing type and one shading.

Table 3: Types of glazing system for the building façades of the urban rebuilt environment [25]

<table>
<tr><th>Glazing Types</th><th>Shading’s strategies</th></tr>
<tr><td>Double LoE Clr 6mm/13mm Air</td><td>0.5m projection Louvre</td></tr>
<tr><td></td><td>
</td></tr>
<tr><td>Single Clr 3mm</td><td>0.5m Overhang</td></tr>
<tr><td>


</td><td>
</td></tr>
</table>

To obtain its rate, the analysis of the three types of glazing and shading types comparing their thermal behaviors in the loads exerted on the building is examined in the coldest month of the year, as we know, the peak load values can be used to select glazing types of air and shading strategies to reduce energy consumption, and as we know, the peak load values can be used to select glazing types of air and shading strategies to reduce energy consumption, and to obtain its rate, the analysis of the three types of glazing and shading types comparing their thermal comfort.

10.Results

10.1: Type of glazing system results:

Simulators like Design Builder Energy Plus can reveal a lot about a building's environmental conditions and occupant comfort levels. For your convenience, the following outputs are provided: In the Energy Plus Background Section, you may find full information regarding Fanger, Pierce, and Kansas State University Thermal Comfort Prediction Algorithms: Monthly results of comfort range for Single Clear glazing (3mm) without shading device. Source: (Design Builder screen shot)

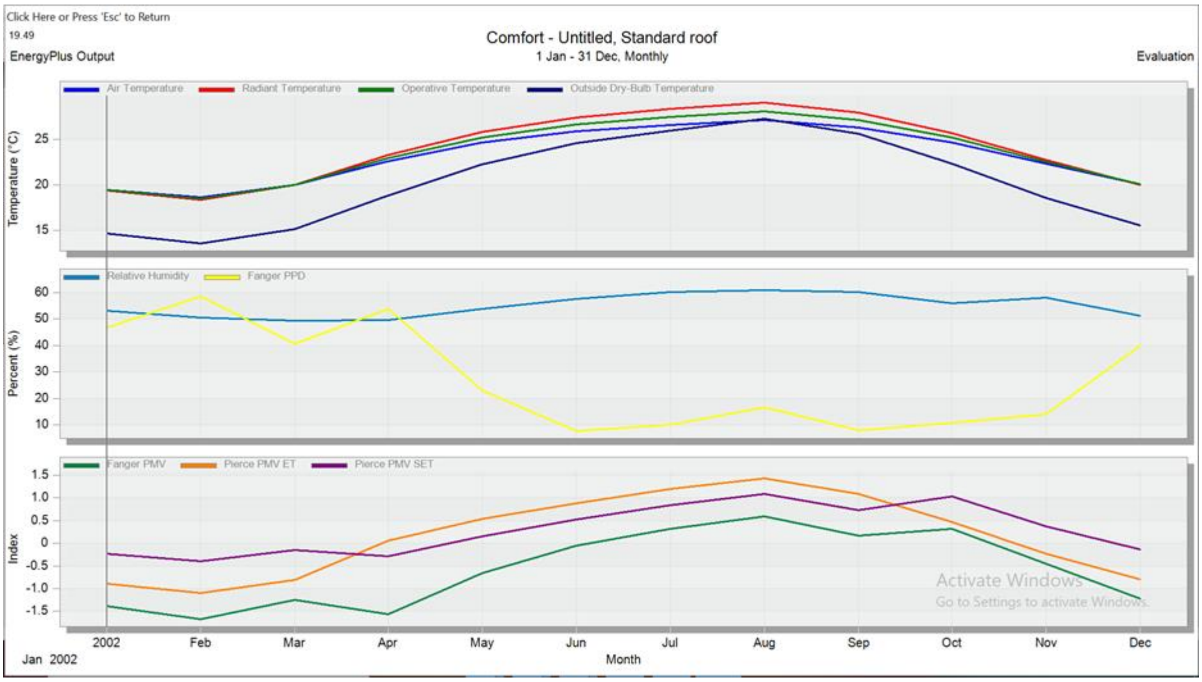


Fig. 11: Monthly results of comfort range for Double Low-E Clear (6mm/13mm) Air with 0.5m projection Louvre. Source: (Design Builder screen shot)

Internal Gains:

Partially cooling design outcomes are detailed in the 'Evaluation' section (displayed as a line graph by default). Zone Sensible Cooling is the sensible cooling impact of any air brought into the zone via the HVAC system on the zone. Any 'free cooling' caused by the entrance of comparatively cool outside air is included. In the findings, cooling always shows up as a negative heat gain. It's preferable to think of it as a component of the zone heat balance.

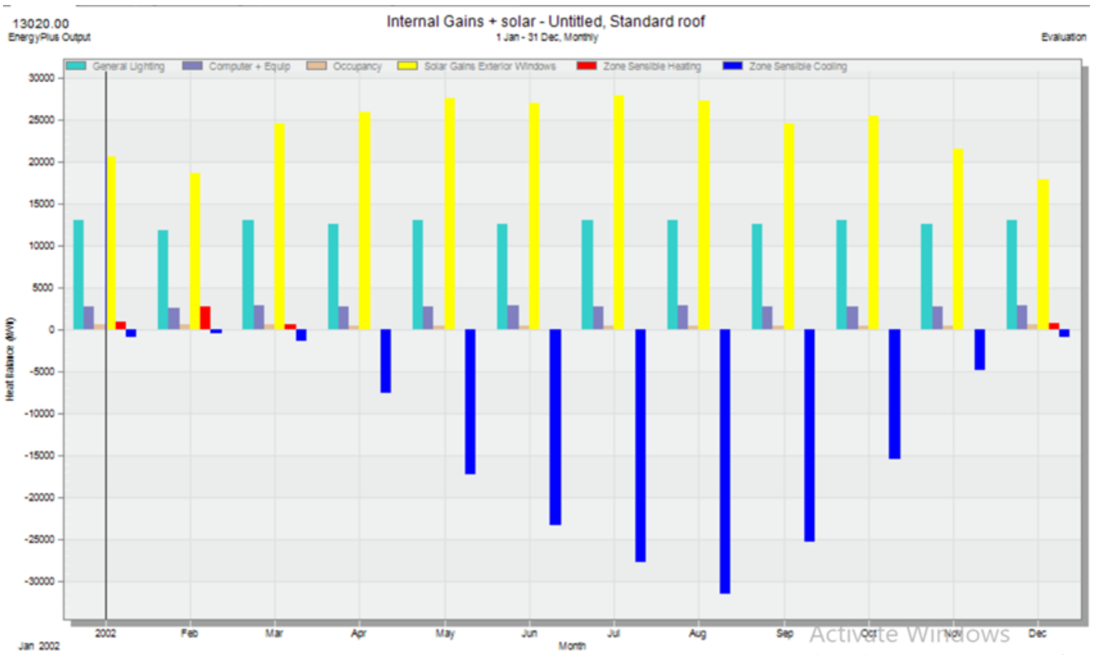


Fig. 12: Monthly results of Building Internal gain for Single Clear glazing (3mm) without shading device. Source: (Design Builder screen shot)

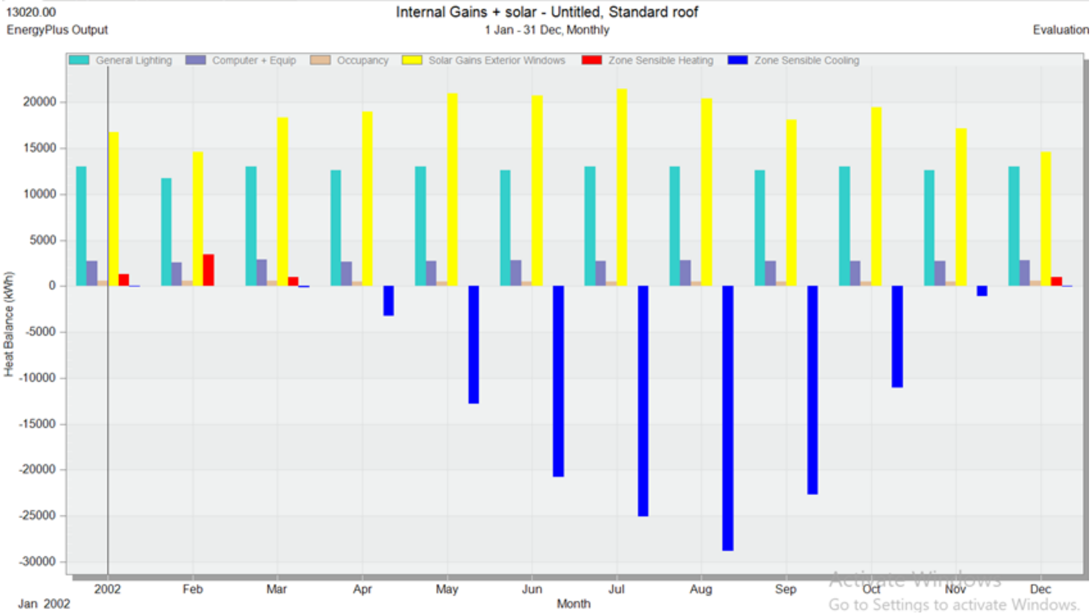


Fig. 13: Monthly results of Building Internal gain for Double Low-E Clear (6mm/13mm) Air with 0.5m projection Louvre. Source: (Design Builder screen shot)

When the Fanger PMV was applied to the Glazing type case study, it was obvious that all fell between -1 and 1 (SET), with the basic case exceeding 4 (SET) with Single Clear glazing (3mm) and no shade device. The findings show that shading has a significant impact on solar gains, cooling load, and the visual environment of occupants. All shading devices contributed to a reduction in total electricity use (fig 13) over the course of a year. From May to September, all shade devices reduce electricity are used at a higher rate than any other months.

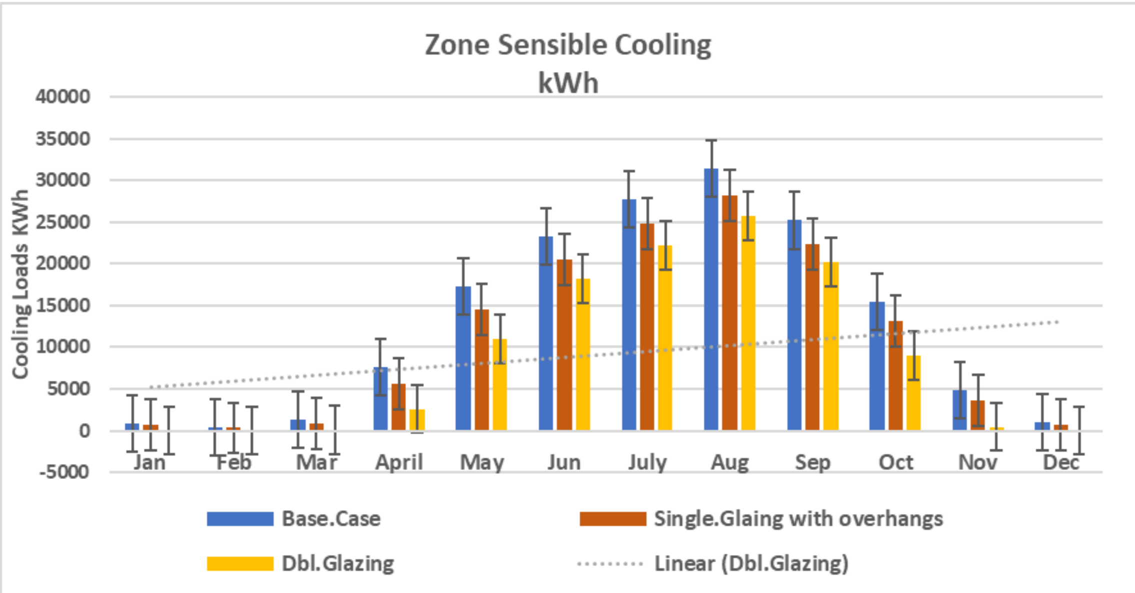


Fig. 14: Monthly results of Zone Sensible Cooling kWh of a residential building with Single Glazing and Double-Glazing system.

The following simulations of Single Skin facade configurations indicate the adverse effect of reducing the thermal transmittance of the glazing (U) on the base case. It was predicted that decreasing the thermal transmittance within a hot arid climate prevented heat loss through the fabric which led to decreasing the cooling loads especially in summer.

From an energy saving perspective, the previous figure.14 indicated the superiority of using the Double Low-E Clear (6mm/13mm) Air with 0.5m projection Louvre of sensible cooling 21000 Kwh than a Single Clear Glazing with 28000 Kwh of sensible cooling in achieving less cooling load demands in July the hottest month in the year.

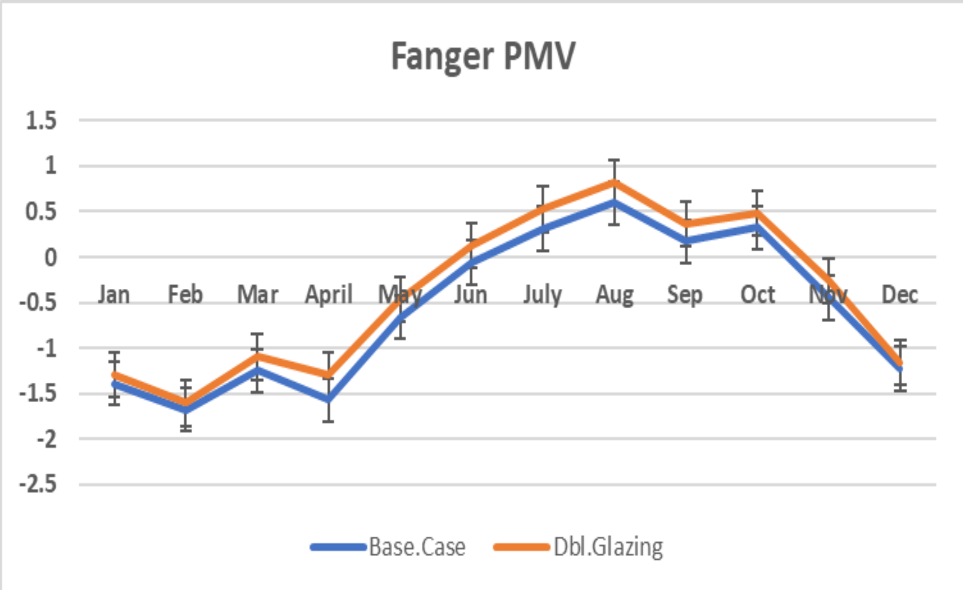


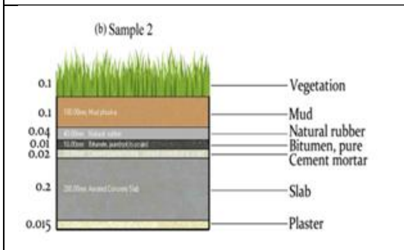
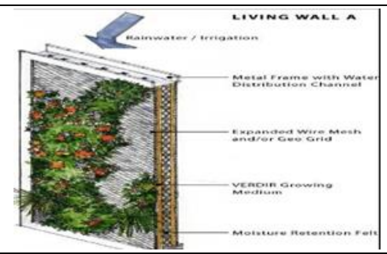
Fig. 15: Monthly results of Fanger PMV for Base case with single glazing and double glazing.

Fig .15 shows that the annual Pierce PMV (SET) values for the base case and retrofitted case with Double Low-E Clear (6mm/13mm) Air with 0.5m projection have the different thermal comfort condition that ranges from -0.5 to +1.2 SET.

10.2. Second Phase: Green Roof and Wall results:

Adapting green technique strategies by considering the outer most surface of the exterior wall as a soil layer of 80 mm, acting as a growing media for the plants.

Table 4: Describes green layer properties for the simulation

<table>
<tr><th>Green Roof</th><th>Green wall</th><th>Base case</th></tr>
<tr><td>
</td><td>
</td><td>
</td></tr>
<tr><td colspan="3">U-Value 1.79 W/m²-K</td></tr>
<tr><td colspan="3">K is Thermal Conductivity in (W/m² -K), SH is Specific Heat in (J/kg-K), D is Density in (kg/m³), LAI is Leaf Area Index, HP is Height of plants in (m) and EI is Emissivity, U-Value in W/ (m² -K)</td></tr>
</table>

Green Roof

By adapting the green roof, we achieve the highest value of thermal comfort range

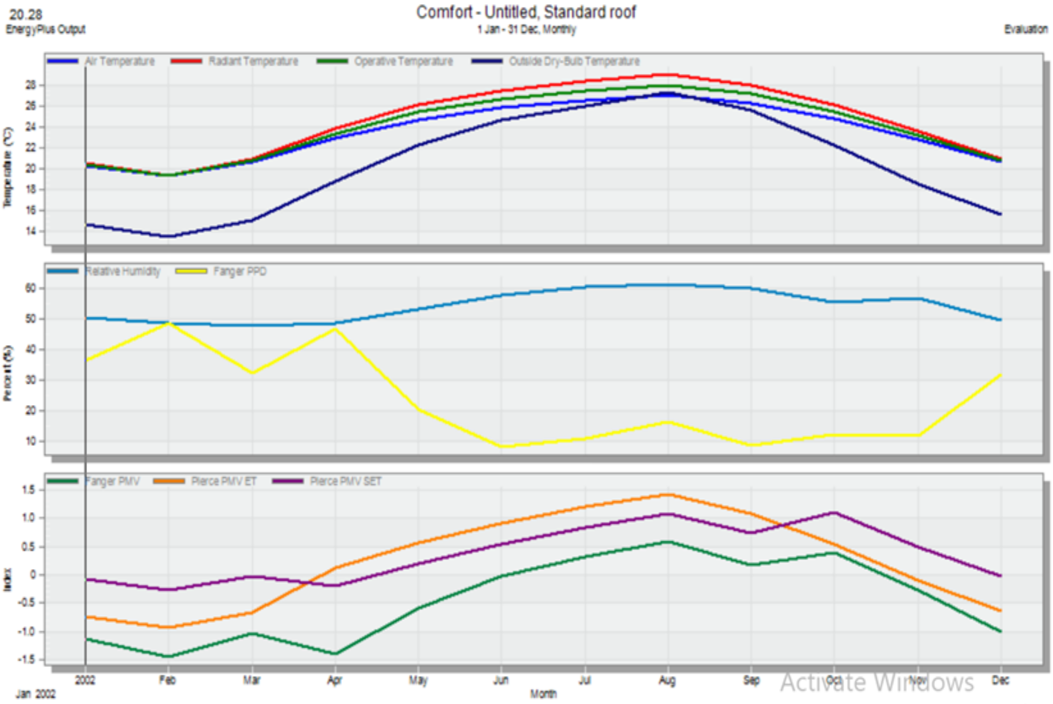


Fig. 16: Monthly results of comfort range for green roof strategy.

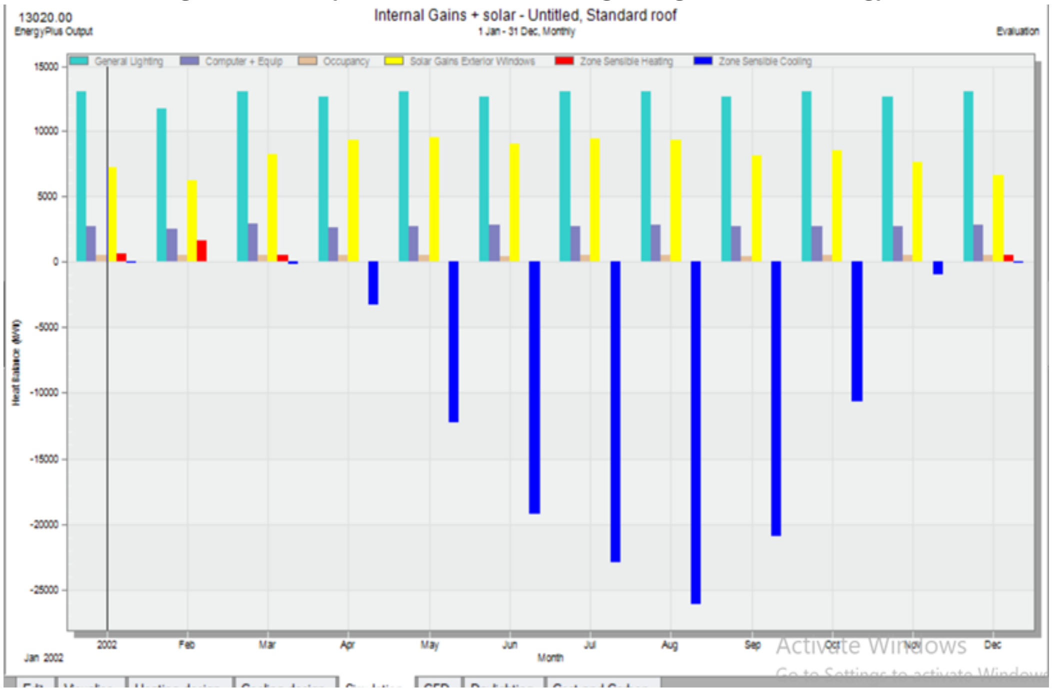


Fig. 17: Monthly results of Internal gain e for green roof

The buildup of carbon dioxide in the atmosphere, which causes global warming and climate change, has long-term consequences. As a result, as shown in figure18, roof greening research is critical for lowering carbon dioxide emissions.

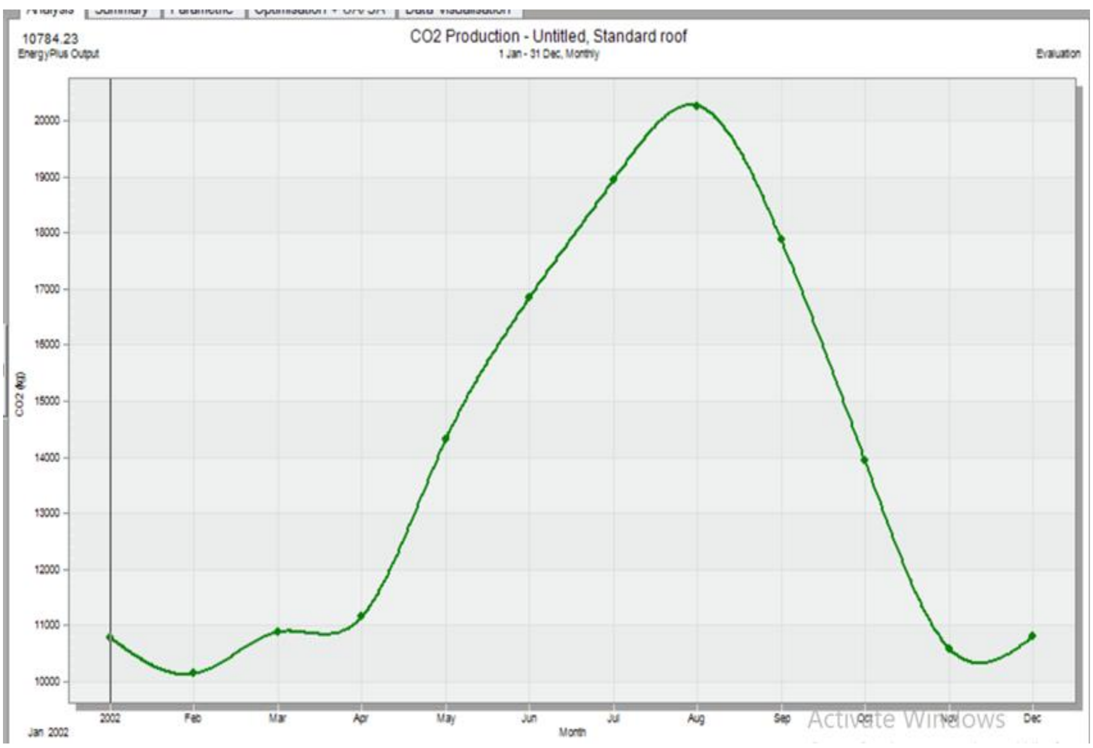


Fig. 18: Monthly Carbon emission (Co_2) reduction benefits of the green roof

Green wall

By adapting the green wall, we achieve the highest value of thermal comfort range.

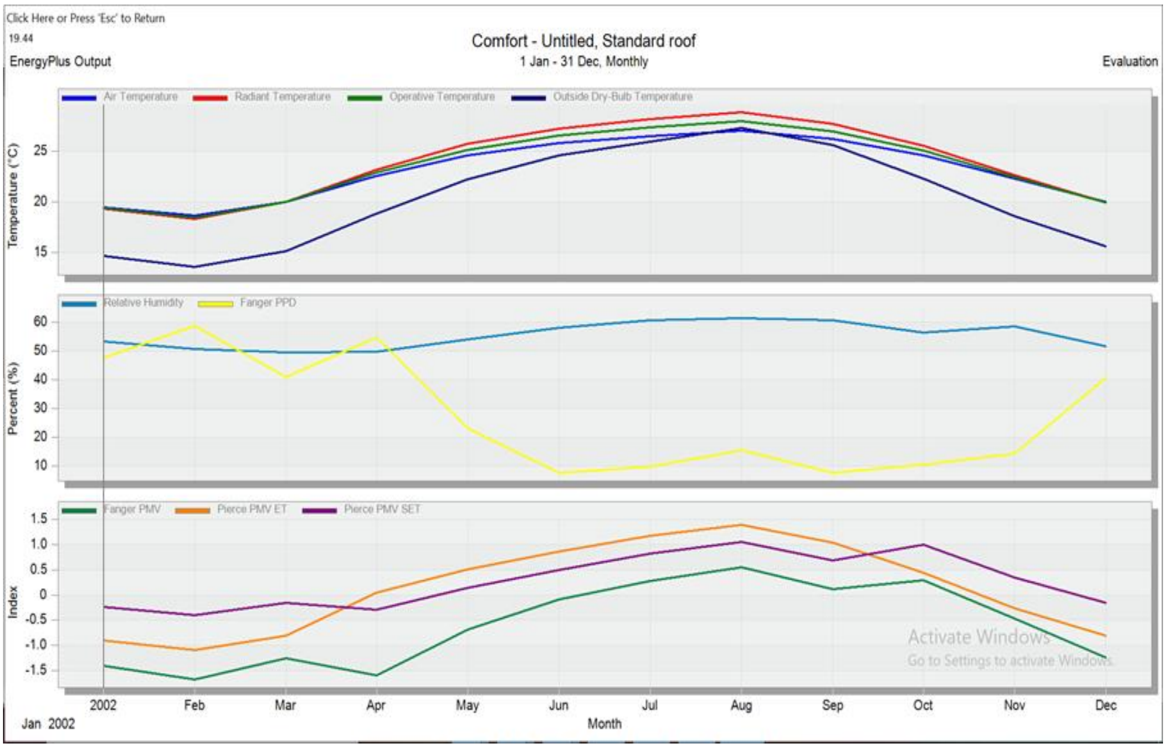


Fig. 19: Monthly results of comfort range for green wall

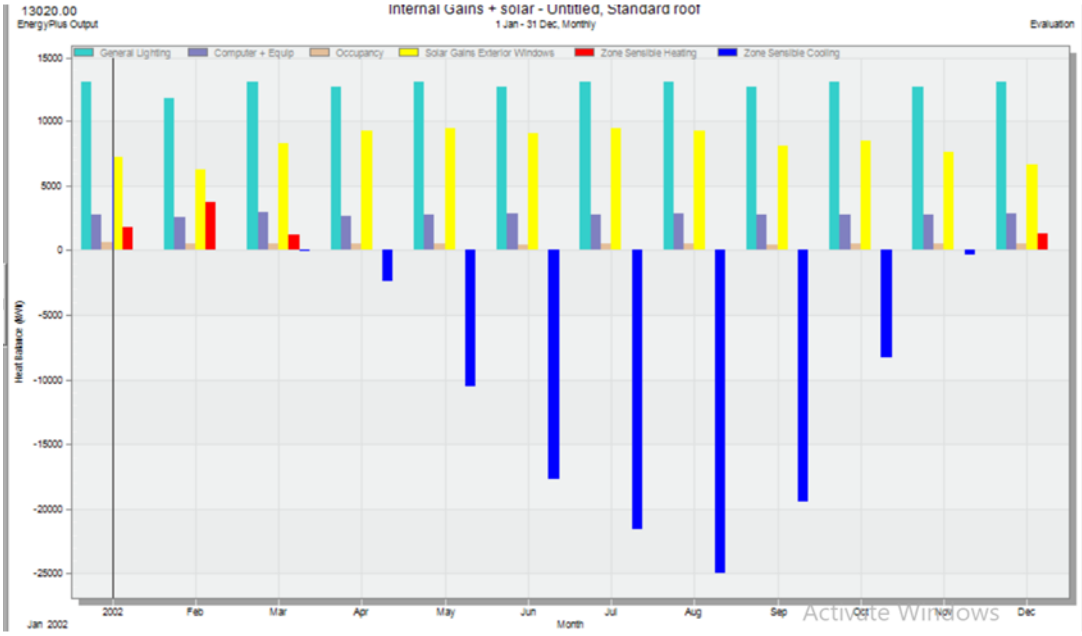


Fig. 20: Monthly results of Building Heat Balance for green wall

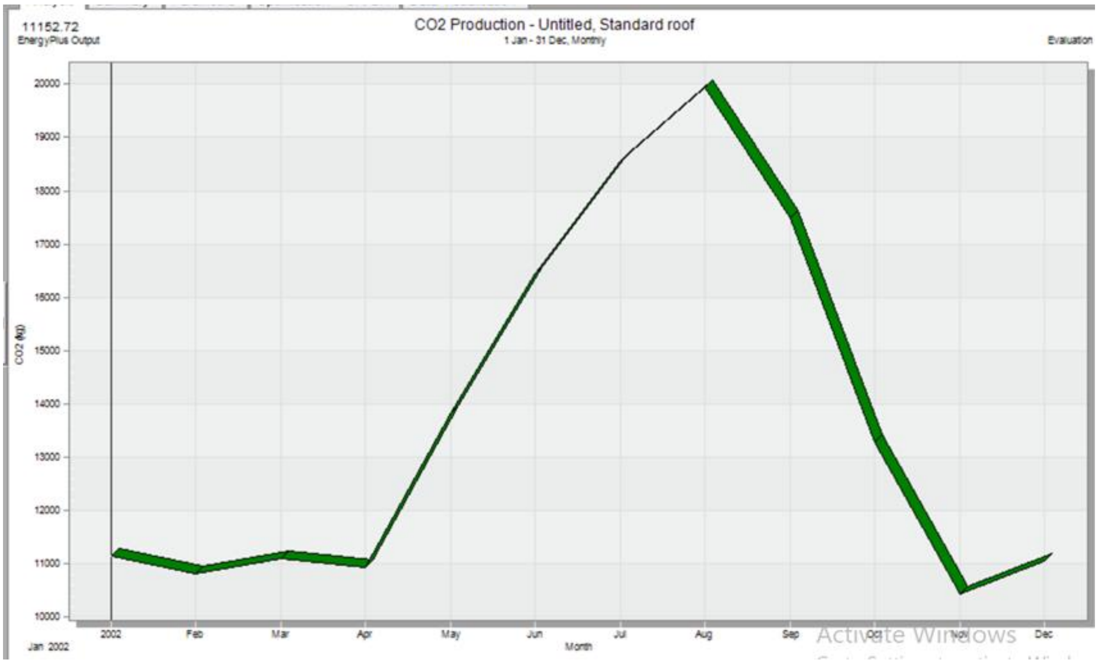


Fig. 21: Monthly Carbon emission (Co2) reduction benefits of the green wall

- Discussion and conclusion

The simulated annual energy consumption results (without vegetation) were compared to the real monthly energy consumption statistics of the investigated buildings table to ensure the veracity of the simulation results. 3. The total energy consumption of the building included all of the structure's power uses (by lighting systems, HVAC system, and appliances). Though the cooling time in the simulation covered June, July, and August, a year-round cooling demand can be justified by the fact that naturally South-facing façades receive the most sun light, which can lead to overheating, especially during the summer. In this simulated architecture, the most significant duty of South-facing façade, which is to use available solar energy to heat a building in the winter, has actually become a disadvantage due to the cooling performance. Vertical and horizontal greenery completely covers the building facades.

The model without any treatment procedures, which is a more prevalent form of contemporary construction style in Alexandria, is used as a reference point in this regard. The following results (percentages) are drawn from a comparison of the base model and several solutions for case studies in various locations.

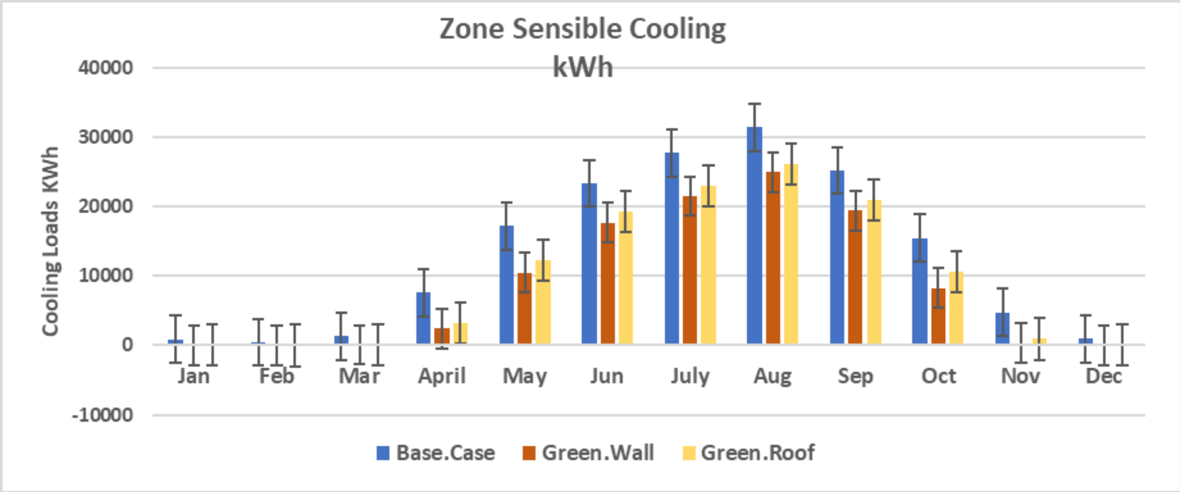


Fig. 22: Monthly results of Zone Sensible Cooling kWh of a residential building with a base case, green wall & green roof.

The graph shows that the zone sensible cooling with the base case without any treatment and with green wall technique oriented to the south façade achieved the best enhancement of sensible cooling of 17000(kWh), while the green roof increased to 18000 (kWh) when compared to the base case model which had the highest value of zone sensible cooling of 29000 (kWh) on July, as shown in Fig.22.

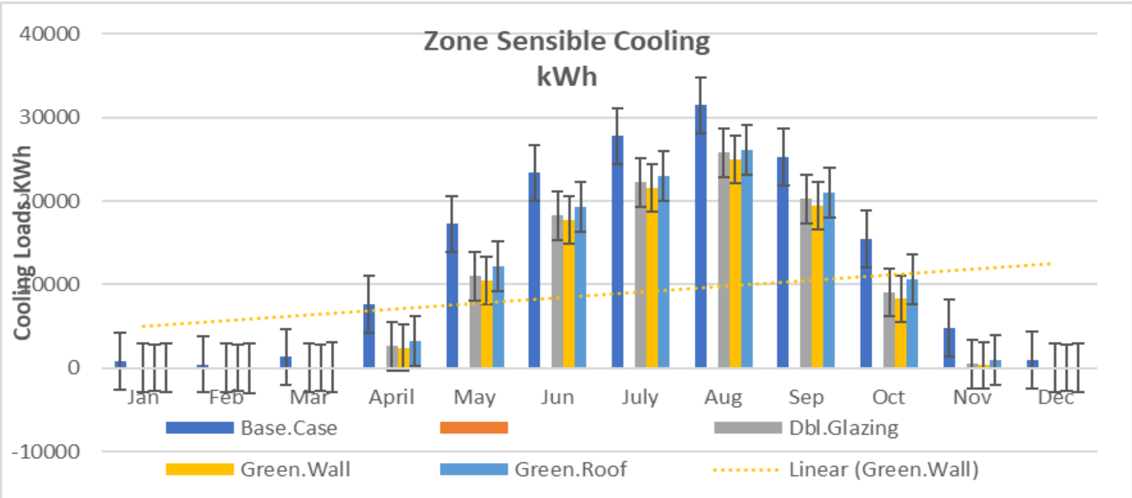


Fig. 23: Monthly results of Zone Sensible Cooling kWh of residential building with all the retrofitted case.

Figures 23 Shows the different adaptation for the strategies of the base case and their relationship with their annual sensible cooling (kWh). Where it was quite clear that the most effective configuration, was the green wall followed by the green roof, finally the double-glazing system.

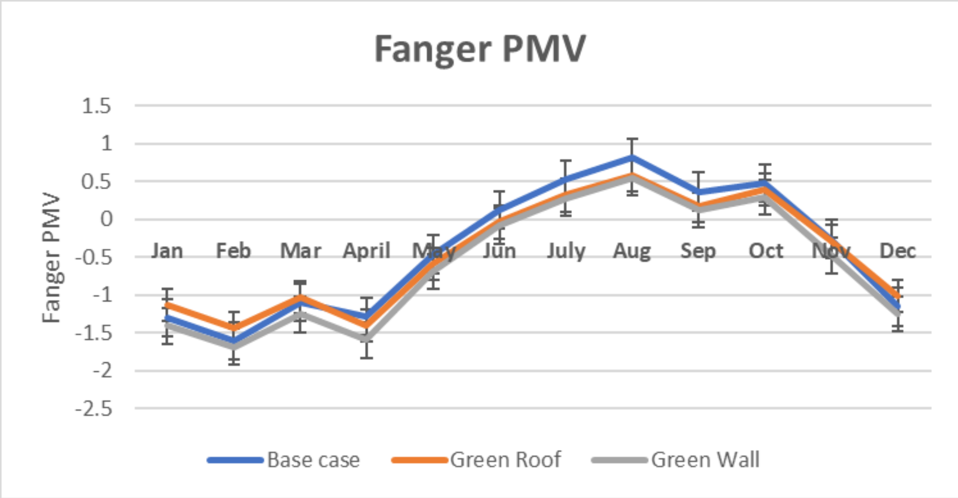


Fig. 24: Monthly results of Fanger PMV for a residential building with a base case. Green wall &Green roof.

Figure 24 illustrates the maximum PMV for green wall, green roof and base case from best to least convenient sustainable design, for cold scales respectively.

11.Discussion and Conclusion:

In order to assure the validity of the simulation outcomes, the simulated annual energy consumption results (without vegetation) were compared with the actual monthly energy consumption data of the studied buildings table.3. Whole building energy consumption included all the electricity uses in the building (by lighting systems, HVAC system, and appliances). Though the cooling period in the simulation included June, July and August, however, a constant cooling requirement throughout the year can be explained by the fact that naturally South-facing façades receive the most sun light which creates a possibility of overheating, particularly in summer months. The most important role of South-facing facades that is to utilize available solar energy to heat up a building in winter had actually become a drawback in case of this simulated building considering the cooling performance, full coverage of building facades by vertical and horizontal vegetation.

In this regard, the model without any treatment strategies, which is a more common type of contemporary construction technique in Alexandria, is considered to be a base point for comparison. Then the following results (percentages) are concluded from the comparison between the base model and different strategies for the case studies in different.

All designers are invited to practice this methodology in order to achieve the best results:

- First: Identify the building and climate zone.
- Second: Indicate the conditions for functioning.
- Third: ASdapt parameters depending on the stage of technology (low or high).
- Fourth: Simulate the interrelated parameters, in the end evaluate the design options and construct a conclusion.

The region is assessed after the development of recommended solutions for the treatment of visual pollution, and the proportion of pollution before and after is compared, as well as the methodology's conclusion, as indicated in table (5).

Table 5: proposed solutions to reduce visual pollution in the study area

Space	Afforestation	Pedestrians & cultivation Square cultivation	Colors of facades Columns of lighting
The current situation	 Lack of trees on the streets	 Lack of vegitation on the square	   Lighting poles and spread of advertisements
Suggested solutions	 Afforestation of streets& pedestrian	 A proposal to beautify the square and to turn it into a social area and a landmark of the city	  A simple fix for stronger and more sustainable cities: Solar streetlights.

Because energy simulations are a common method for improving buildings energy efficiency, having a local digitalized construction and material database reduces the risk of inaccuracies and simplifies the input of constructions into energy simulation programs by selecting the specific material configuration and setting dimensions and orientation.

12.References

[1]. Wang Y, Ni Z, Peng Y, Xia B. Local variation of outdoor thermal comfort in different urban green spaces in Guangzhou, a subtropical city in South China. Urban Forestry & Urban Greening 2018; 32: 99-112.

[2]. Kabisch, Nadja (January 2015). "Ecosystem service implementation and governance challenges in urban green space planning- The case of Berlin, Germany".

[3]. Ryad, Emad, GAZA Islamic university (2014), Open urban spaces development strategies Gaza city as a case study.

[4]. Nasrollahi N, Hatami Z, Taleghani M. Development of outdoor thermal comfort model for tourists in urban historical areas; A case study in Isfahan. Building and Environment 2017; 125: 356-372.

[6]. RahbariManesh, K., Rahmati Zadeh, A. (2012) Analyzing the physical factors in the educational environment in order to enhance the learning process of the children, regional conference of architectural news, Sama faculty in Shooshtar, 2012

[5]. Raven, J., Stone, B., Mills, G., Towers, J., Katzschner, L., Leone, M., Gaborit, P., Georgescu, M., and Hariri, M. (2018). Urban planning and design. In Rosenzweig, C., W. Solecki, P. Romero-Lankao, S. Mehrotra, S. Dhakal, and S. Ali Ibrahim (eds.), Climate Change and Cities: Second Assessment Report of the Urban Climate Change Research Network. Cambridge University Press. New York. 139–172.

[7]. Nolde, E., Vansbotter, B., Rüden, H., König, K.W. (2007). Innovative water concepts. Service water utilization in buildings. Berlin Senate Department for Urban Development. Accessed January 17, 2015: http://www .stadtentwicklung.berlin.de/internationales_eu/stadtplanung/download/betriebswas er_englisch_2007.pdf

[8]. Kevin lynch – "site planning" . Cambridge the M.i.t 1971.p (209)

- Ashihar. Yoshinobu – "exterior design in architecture" – v n. r New York. 1970

[9]. Ong, B. L. (2003). Green plot ratio: An ecological measure for architecture and urban planning. Landscape and Urban Planning 63(4), 197–211.

[10]. Xi T, Wang Q, Qin H, Jin H. Influence of outdoor thermal environment on clothing and activity of tourists and local people in a severely cold climate city. Building and Environment 2020; 173: 106757

[11]. Yin J, Zheng Y, Wu R, Tan J, Ye D, Wang W. An analysis of influential factors on outdoor thermal comfort in summer. Int J Biometeorology 2012; 56: 941-8

[12]. Yoshida A, Hisabayashi T, Kashihara K, Kinoshita S, Hashida S. Evaluation of effect of tree canopy on thermal environment, thermal sensation, and mental state. Urban Climate 2015; 14: 240-250

[13]. Zhao L, Zhou X, Li L, He S, Chen R. Study on outdoor thermal comfort on a campus in a subtropical urban area in summer. Sustainable Cities and Society 2016; 22: 164-170.

[14]. Steffan C., Schmidt M., Köhler M., Hübner I., Reichmann B. (2010). Rain water management concepts, greening buildings, cooling buildings planning, construction, operation and maintenance guidelines. Berlin Senate Department for Urban Development. http://www.stadtentwicklung.berlin.de/bauen/oekologisches_bauen/ download/SenStadt_Regenwasser_engl_bfrei_final.pdf.

[15]. Miller, N., Cavens, D., Condon, P., Kellett, N., and Carbonell, A. (2008). Policy, urban form and tools for measuring and managing greenhouse gas emissions: The North American problem. Climate change and urban design: The third annual congress of the Council for European Urbanism, Oslo.

[16]. Voronych, Y. (2013). Visual pollution of urban space in Lviv, Przestrzeń I Forma.

[17]. street dust heavy metal pollution source apportionment and sustainable management in a typical city- international journal of environmental research and public health 16 (14) :2625 – authors (Kui Kai – Chang li)

[18]. Morozan, Cristian; Enache, Elena; Purice, Suzan. (29 March 2013). "Visual Pollution: A New Axiological Dimension of Marketing?". Brilla, Pite: University of Pite, Faculty of Management-Marketing in Economic Affairs Brilla.

[19]. Wakil, K.; Husnain, M.Q.; Naeem, A.M.; Tahir, A. Regulating outdoor advertisement boards; employing spatial decision support system to control urban visual pollution. In Proceedings of the 8th IGRSM International Conference and Exhibition on Geospatial and Remote Sensing, IOP Conference Proceedings, Kuala Lumpur, Malaysia, 13–14 April 2016.

[20]. Frihy, o. E. (2003). The Nile delta-Alexandria coast: vulnerability to sea-level Rise, consequences and adaptation. Mitigation and adaptation strategies for global change, 8 (2), pp. 115-138

[21]. Tarek M. El-Geziry. General pattern of sea level variation in front of Alexandria (Egypt) and its relationship to the wind pattern- Egyptian journal of aquatic research, 2013

[22]. Researchers, choosing a model from the researchers to test the experiment within the program on it.

[23]. Design Builder. (2016). Design Builder Software (online). Glasgow, Scotland: Design Builder Software Ltd.

[24]. Capeluto, I. G., and C. E. Ochoa. 2014. “Simulation-based Method to Determine Climatic Energy Strategies of an Adaptable Building Retrofit Façade System.” Energy 76: 375–384. doi:10.1016/j.energy.2014.08.028.

[25]. Dessoqy, A.; Atef, Conventional and advanced glazing technologies for enhancing thermal and lighting performance, September 2021/Al-A15.

(26) Sahar Ismael (2018). Social and technological dimensions and their influence on formation of urban spaces in cities (casestudy for urban spaces in government housing)- April 2018- journal of urban research, vol.28-Cairo university.

(27) Shafak Al-Wakeel. Basics and foundations of urban planning- part 1, Cairo, 2006