ESTIMATION OF COOLING LOAD AND ENERGY CONSUMPTION IN VARIED CONCEPTUAL HOUSE LAYOUTS BY USING HOURLY ANALYSIS PROGRAM APPROACH WITH EMPHASIS ON HUMAN ACTIVITY

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I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Mechanical and Manufacturing Engineering Technology (Refrigeration And Air Conditioning Systems) with Honours.

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DEDICATION

I would like to dedicate this project to my family, whose unwavering love and encouragement have been my foundation throughout my education. Their belief in me has fueled my determination to succeed and their support has been invaluable in every step of this journey. To my friends, who have stood by my side through thick and thin, I am grateful for your unwavering support and laughter that brought light to the most challenging moments. Your friendship has made this experience truly unforgettable. To my supervisor, I extend my deepest appreciation for your guidance, expertise, and patience. Your wisdom and knowledge have shaped my understanding of the subject matter and your dedication to teaching has inspired me to strive for excellence. Your mentorship has not only helped me in completing this project but has also prepared me for future. To all the participants and contributors who have contributed their time, knowledge, and insights, I express my heartfelt gratitude. Your input has added depth and value to this project, and I am grateful for the opportunity to learn from your expertise. Lastly, I dedicate this project to myself. It is a symbol of my resilience, determination, and personal growth. It represents the countless hours of hard work, sacrifices, and sleepless nights I have devoted to bring this project to fruition. May this dedication serve as a reminder of my capabilities and as a testament to my commitment to continuous learning and growth.

ABSTRACT

This research proposal aims to investigate the factors influencing cooling loads estimation. Understanding in cooling loads estimation is crucial for creating healthy, efficient, and sustainable indoor spaces, as it directly affects occupant well-being, productivity, and overall satisfaction. The building layouts and human activity level is a crucial factor in ensuring the well-being of occupants in the building. An accurate cooling loads estimation improves the building HVAC system, which is reduce the overall energy consumption and occupants thermal comfort is comfortably. Cooling load is affected by a variety of factors, including the weather properties, spaces type, human activity level, and material insulation. To ensure an accurate cooling load, the data of building should includes of proper ventilation location , material, and air conditioning systems, as well as insulation to regulate temperature and air velocity. Proper scalling the building floor plan in Hourly Analysis Program (HAP) of these software should also be carried out to ensure the perfect estimation in both cooling load and energy consumption. The main advantage of the generic analytical approach presented in this thesis is its accuracy and applicability in estimating building needs of different sizes HVAC system, configuration space types and supply cooling zones. By studying the relationship between different building layout through human activity level and factors such as productivity, concentration, and well-being, the research will contribute to the growing body of knowledge on the human-centered design of indoor environments. This will provide insights into the potential benefits of improved thermal comfort in terms of occupant satisfaction and overall performance HVAC system. In conclusion, the Hourly Analysis Program (HAP) estimation software could be developed into a useful tool for HVAC insdustries and engineers to evaluate of cooling loads and energy consumption.

ABSTRAK

Cadangan penyelidikan ini bertujuan untuk menyiasat faktor-faktor yang mempengaruhi anggaran beban penyejukan. Pemahaman dalam anggaran beban penyejukan adalah penting untuk mewujudkan ruang dalaman yang sihat, cekap dan mampan, kerana ia secara langsung mempengaruhi kesejahteraan penghuni, produktiviti dan kepuasan keseluruhan. Susun atur bangunan dan tahap aktiviti manusia adalah faktor penting dalam memastikan kesejahteraan penghuni di dalam bangunan. Anggaran beban penyejukan yang tepat menambah baik sistem HVAC bangunan, yang mengurangkan penggunaan tenaga keseluruhan dan keselesaan terma penghuni dengan selesa. Beban penyejukan dipengaruhi oleh pelbagai faktor, termasuk sifat cuaca, jenis ruang, tahap aktiviti manusia dan penebat bahan. Untuk memastikan beban penyejukan yang tepat, data bangunan hendaklah termasuk lokasi pengudaraan yang betul , bahan, dan sistem penyaman udara, serta penebat untuk mengawal suhu dan halaju udara. Penskalaan pelan lantai bangunan dengan betul dalam Program Analisis Jam (HAP) perisian ini juga perlu dijalankan untuk memastikan anggaran yang sempurna dalam kedua-dua beban penyejukan dan penggunaan tenaga. Kelebihan utama pendekatan analitikal generik yang dibentangkan dalam tesis ini ialah ketepatan dan kebolehgunaannya dalam menganggar keperluan bangunan sistem HVAC saiz yang berbeza, jenis ruang konfigurasi dan zon penyejukan bekalan. Dengan mengkaji hubungan antara susun atur bangunan yang berbeza melalui tahap aktiviti manusia dan faktor seperti produktiviti, tumpuan, dan kesejahteraan, penyelidikan akan menyumbang kepada peningkatan pengetahuan tentang reka bentuk persekitaran dalaman yang berpusatkan manusia. Ini akan memberikan pandangan tentang potensi manfaat keselesaan terma yang dipertingkatkan dari segi kepuasan penghuni dan sistem HVAC prestasi keseluruhan. Kesimpulannya, perisian anggaran Program Analisis Jam (HAP) boleh dibangunkan menjadi alat berguna untuk industri dan jurutera HVAC untuk menilai beban penyejukan dan penggunaan tenaga.

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Last but not least, I would also like to extend my gratitude to my friends and family for their unwavering support, encouragement, and understanding throughout the research process. Their patience, love, and motivation have been my constant source of inspiration, and I am grateful for their presence in my life.

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LIST OF SYMBOLS AND ABBREVIATIONS

Qs – Sensible Heat Transfer, $m \cdot Cp \cdot \Delta T$

m – Mass Flow Rate

Cp – The Specific Heat Of Air

ΔT – The Temperature Difference

Q_1 – Latent Heat Transfer, $m \cdot h_{fg}$

h_{fg} – The Latent Heat Of Vaporization

(Q_{total}) – The Sum Of The Sensible And Latent Heat Transfers, $Qs + Q1$

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CHAPTER 1

INTRODUCTION

1.1 Background

The knowledge and management of cooling loads has become critical in the evolving world of urban living, infrastructure, and technology. In order to provide comfort, improve energy efficiency, support industrial processes, and address environmental issues.

The design and operation of heating, ventilation, and air conditioning (HVAC) systems for residential and commercial buildings is one of the main areas where cooling load is important because the rapid growth of development has resulted to an increase in demand for effective climate management in buildings. Futhermore, cooling load estimates are important since it is the foundation for the design of HVAC systems that enhance occupant productivity and well-being while also maintaining comfortable conditions inside.

1.1 Package Unit

The impact of cooling systems on overall energy consumption is being increasingly acknowledged as a result of the drive for energy efficiency in the face of environmental issues. Accurate cooling load calculations are essential for maximizing cooling system efficiency and avoiding the typical mistakes of over-sizing or under-sizing equipment. Energy consumption is minimized when cooling capacity is in matching with actual requirements, which lowers costs and has a smaller environmental impact. In the Malaysian context, where economic considerations play a significant role in decision-making, accurate cooling load estimation holds economic implications for building owners and operators. Oversized cooling systems result in unnecessary capital investments, while undersized systems may lead to increased operational costs and compromised indoor comfort. The cost of electricity in Malaysia has been steadily rising, and optimizing cooling systems through accurate load estimation becomes paramount in mitigating operational expenses and ensuring economic viability (Tenaga Nasional Berhad, 2020).

1.2 Malaysia Weather

Malaysia's tropical climate, characterized by high temperatures and humidity, places distinct demands on building design and HVAC (Heating, Ventilation, and Air Conditioning) systems. According to the Malaysian Meteorological Department, the average temperature in Malaysia hovers around 27-30°C, with relative humidity often exceeding 80% (2020). These conditions necessitate a comprehensive understanding of the cooling requirements specific to the region. Cooling load estimation becomes a crucial tool in addressing the unique challenges posed by the tropical climate, ensuring that buildings are equipped to provide thermal comfort in the face of persistent heat and humidity (Mahmoud et al., 2018).

Thus, another factors that must be to consider is thermal comfort for occupants in building and The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) has been instrumental in providing a comprehensive definition of thermal comfort for building occupants. ASHRAE Standard 55-2017 specifies the conditions that contribute to occupants' satisfaction with the thermal environment, taking into account factors such as air temperature, humidity, air speed, and radiant heat exchange (ASHRAE, 2017).

The influence of thermal comfort on occupants physical health is a crucial aspect of building design. Uncomfortable thermal conditions can lead to health issues such as stress, fatigue, and discomfort (Poulsen et al., 2016; Yang et al., 2019). The impact of thermal comfort extends beyond the physical realm, affecting cognitive function and mental well-being. Recent studies suggest that occupants in thermally comfortable environments demonstrate improved cognitive performance, decision-making abilities, and overall psychological well-being (Frontczak et al., 2017; Parsons, 2020). Another research finds that recognizing the nature of occupants activities is important since it is a need to for flexibility in building design and operation, allowing occupants to adjust to varying thermal conditions based on their preferences and activities (de Dear & Brager, 2015; Humphreys & Nicol, 2018).

In conclusion, effective management of cooling loads is paramount in the dynamic landscape of urban living and technology-driven infrastructure. The design and operation of HVAC systems, crucial for residential and commercial buildings, demand precise cooling load estimates to ensure occupant comfort, productivity, and energy efficiency. Oversizing or undersizing equipment can lead to inefficiencies and increased operational costs, particularly in the context of Malaysia's tropical climate, where optimizing cooling systems is vital for economic viability amidst rising electricity costs. Simultaneously, recognizing the influence of thermal comfort on occupants' physical health, cognitive function, and overall well-being underscores the human-centric aspect of building design. ASHRAE's standards provide a comprehensive framework for understanding thermal comfort, emphasizing factors like air temperature and humidity. A flexible approach to building design, considering the dynamic nature of occupants' activities, becomes crucial for adapting to varying thermal conditions based on preferences. Integrating technical precision with a human-centric focus is essential for creating sustainable, comfortable, and energy-efficient built environments in the face of global urbanization and environmental challenges.

1.2 Problem Statement

An efficient HVAC system is built on the foundation of accurate cooling load assessment. The hard part is in colecting data that precisely measure the dynamic quality of heat loads in different places. Poor load calculations generally lead to poor system performance, higher energy usage, and decreased occupant comfort. There are many parameters need to take into consideration including internal heat gains, weather fluctuations, occupancy patterns, including daily routines and periods of inactivity, significantly influence the cooling load in residential spaces. A household with irregular occupancy may have varying cooling requirements compared to a more consistent occupancy pattern. Research by Li et al. (2019) stresses the importance of integrating occupancy data into cooling load calculations to better align predictions with actual energy consumption.

Oversizing HVAC equipment is a continuous problem that has negative effects on the environment and economy. In addition , oversized systems also reduce equipment lifespans and increase operating costs. Approaching oversizing requires a true value that includes precise load estimation techniques, data-driven decision-making, and a move toward modular and scalable system designs. Futhermore, Undersized HVAC systems possess inadequate cooling capacity, which causes discomfort, higher energy costs, and frequent system malfunctions.

Human preferences in terms of thermostat settings play a crucial role in determining the cooling load. Varied temperature preferences among occupants can lead to conflicts and inefficient energy use. Analyzing how different lifestyles influence thermostat settings and preferences can provide insights into tailoring cooling systems to individual or collective needs.

1.3 Research Objective

The main goal of this research is to study the importance of human activities in cooling load estimation and a factor that can affect cooling load calculation. Due to bungalow house, it could be a different cooling load estimation because it is depending on household activities and the house can have a lack of optimal insulation/building material that can contributes to a higher heat from sunlight or a personal equipment, occupants comfort and, costing of HVAC system and energy efficiency.

1. To calculate cooling load estimation in Hourly Analysis Program (HAP).
2. To compare cooling load and energy consumption in residential houses, analyzing variations influenced by diverse human behaviors for insights and optimization.
3. To relate the factors human activities that can affect energy consumption in the building.

1.4 Scope of Research

1. The focus will be mainly on the result of cooling load estimation between two layout and human activities. Several aspects are included in an evaluation of cooling load estimation and the impact of cooling load estimation on energy consumption.
2. The focus will be mainly on the result of cooling load estimation. Several aspects are included in an evaluation of cooling load estimation and the impact of cooling load estimation on energy consumption.
3. Perform the cooling load estimation by using methods namely Hourly Analysis Program (HAP). Leveraging HAP involves intricate hourly calculations, considering factors like, weather, bearing of the sun, building characteristics, human activities and internal loads.
4. Comparing differences in cooling load and energy usage resulting from two distinct types of human activity within two different layouts of house.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter, it is to introduce the important of accuracy in cooling load estimation in residential house, focusing on how important it is to provide occupants with a comfortable and satisfying experience. Summarize basically all the aspects that can contribute to cooling load estimation. By studying the relevant literature, it helps to understand more fully how other factors will affect cooling load estimation in residential house.

Other than that, Heating, Ventilation, and Air Conditioning (HVAC) systems plays important role in maintaining comfortable indoor environments, enhancing energy efficiency, and ensuring the well-being of occupants in various buildings. One of the critical aspects of HVAC design is the estimation of cooling loads, which involves calculating the amount of heat that must be removed from a space to maintain optimal conditions. This process is essential for designing appropriately sized HVAC systems, preventing energy wastage, and ensuring cost-effective operation (ASHRAE, 2017).

Also, Cooling load estimation is a complex task that requires a thorough understanding of factors influencing heat gain within a building. These factors include external climate conditions, internal heat sources, building materials, occupancy patterns, and ventilation requirements. The accuracy of cooling load calculations directly impacts the system's efficiency, energy consumption, and overall performance (Li, et al., 2019). Therefore, meticulous attention to detail during the estimation process is crucial.

In this chapter, it is to introduce the concept of thermal comfort in multi-level shopping complexes, focusing on how important it is to provide occupants with a comfortable and satisfying experience. Summarize basically all the aspects that can contribute to thermal comfort. By studying the relevant literature, it helps to understand more fully how other factors will affect thermal comfort in shopping malls.

2.1.1 Energy Efficiency

2.1 Energy Efficiency

Malaysia, with its tropical climate and increasing urbanization, faces unique challenges in managing residential building energy consumption. As the demand for comfortable living spaces rises, the significance of precise cooling load estimation becomes paramount. This essay explores the importance of cooling load estimation in the context of residential buildings in Malaysia, shedding light on its pivotal role in optimizing energy usage and promoting sustainable living.

Malaysia's residential sector is a major consumer of energy, driven by the need for cooling in the hot and humid tropical climate (EPU, 2018). The predominant use of air conditioning systems to combat high temperatures contributes significantly to the overall residential energy consumption. Recognizing this, there is a pressing need to address the challenges posed by energy demand, and cooling load estimation emerges as a fundamental tool in this endeavor.

Accurate cooling load estimation is fundamental for designing HVAC systems that operate efficiently (Deng, et al., 2020). Undersized systems may struggle to meet the cooling demands, leading to increased energy consumption, while oversized systems can result in unnecessary energy expenses and reduced operational efficiency.

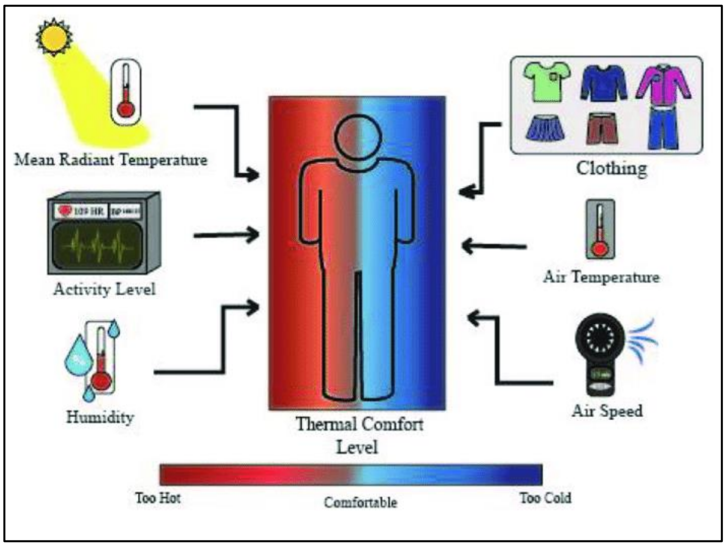
2.1.2 Cost Saving

2.2 HVAC System

Accurate cooling load estimation plays a pivotal role in reducing energy consumption in residential buildings. Properly sized HVAC systems, based on precise calculations, prevent over-sizing or under-sizing, optimizing energy use and reducing electricity bills for homeowners (Abdul-Majeed et al., 2020).

Properly sized HVAC systems, based on precise cooling load calculations, contribute to cost savings (Smith & Johnson, 2018). By avoiding the installation of unnecessarily large equipment, both initial investment and long-term operating costs can be minimized.

2.1.3 Occupants Comfort



2.3 Thermal Comfort Parameters

Effective cooling load estimation ensures that HVAC systems maintain optimal indoor temperatures, humidity levels, clothing, activity level, air speed and air temperature, creating a comfortable and healthy environment for occupants (Chen, et al., 2021). This is crucial for productivity, well-being, and overall satisfaction.

Other than that, cooling load estimation goes beyond temperature control; it contributes to optimizing indoor air quality. Well-designed HVAC systems ensure proper air circulation, filtration, and ventilation, promoting a healthier indoor environment for occupants (Sopian et al., 2016).

Malaysia's warm climate underscores the importance of thermal comfort. Accurate cooling load estimation aids in designing systems that not only meet energy efficiency goals but also enhance the thermal comfort of residents, contributing to overall well-being (Wong et al., 2020).

2.1.3.1 Commercial Building

2.4 Example Commercial Building

In the broader context of buildings, thermal comfort is a multifaceted concept influenced by several factors. The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) defines thermal comfort as "that condition of mind that expresses satisfaction with the thermal environment" (ASHRAE Standard 55, 2020). To achieve and maintain thermal comfort, various parameters are considered, including air temperature, relative humidity, air velocity, and clothing insulation.

The impact of thermal discomfort in general building settings has been well-documented. Uncomfortable temperatures can lead to reduced productivity, increased stress, and negatively affect overall well-being (Seppänen et al., 2006). Therefore, achieving optimal thermal conditions is essential for both residential and non-residential buildings.

2.1.3.2 Residential House

2.5 Example Residential House

Residential houses represent a unique context for studying thermal comfort, given the diverse activities and lifestyle patterns of occupants. In residential settings, thermal comfort is influenced not only by the building's design and HVAC system but also by occupants behavioral patterns, such as their preferred temperature settings and clothing choices (Li et al., 2010).

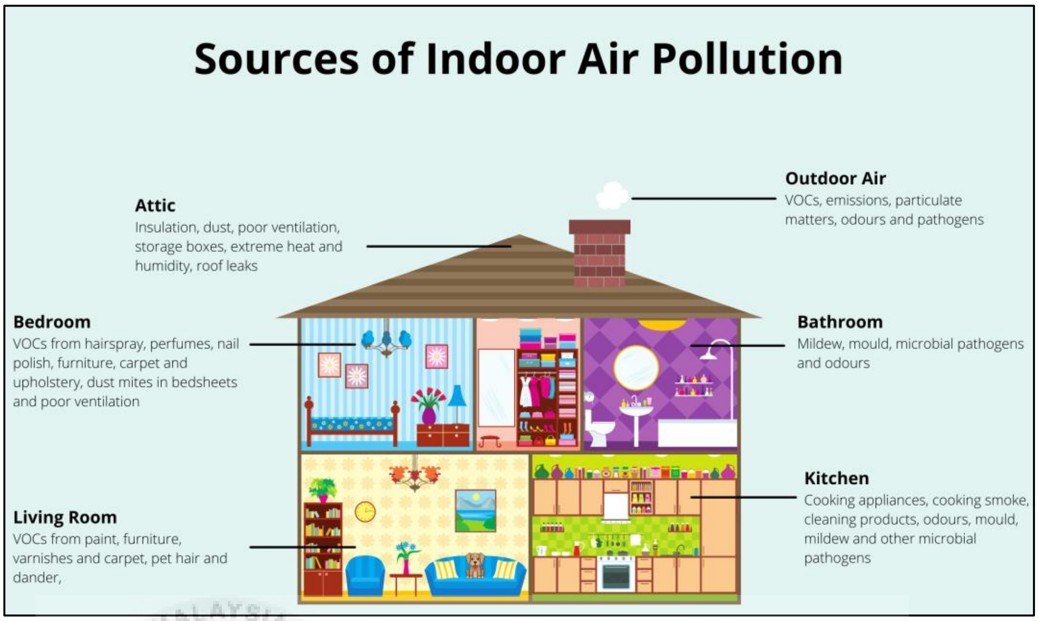
2.6 Example of Human Activity in Building

The study by de Dear et al. (2013) emphasizes the importance of understanding the dynamic nature of thermal comfort in residential houses. Occupant activities, such as cooking, sleeping, and recreational activities, introduce variations in thermal comfort requirements throughout the day. For example, the thermal conditions suitable for cooking may differ from those required for sleeping, highlighting the need for adaptable and responsive HVAC systems.

Moreover, the influence of architectural elements, such as window design and insulation, on residential thermal comfort cannot be overlooked. Research by Humphreys and Nicol (2002) suggests that energy-efficient design strategies, such as passive solar heating and natural ventilation, can positively impact thermal comfort in residential buildings while minimizing energy consumption.

Furthermore, the social dynamics within a household, including the number of occupants and their age groups, can affect thermal comfort requirements. For instance, elderly individuals may have different thermal preferences than young children (de Dear et al., 2013). Designing HVAC systems that accommodate such diversity is essential for ensuring widespread comfort in residential houses.

2.2 Indoor Air Quality



2.7 Sources of Indoor Air Pollution

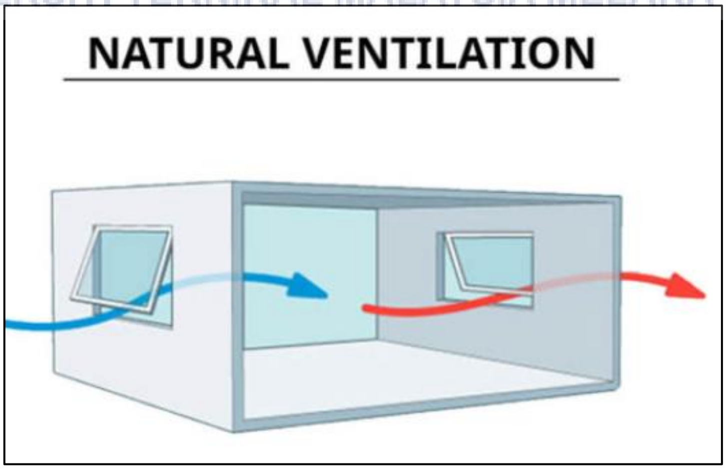
People spend more and more time indoors these days, making indoor air quality (IAQ) a major concern in modern civilization. The health and well-being of people are greatly impacted by the air quality in enclosed areas. To successfully mitigate potential dangers, it is essential to understand the complex interactions between indoor surroundings and human health. It is important to educate to people and HVAC industries the aspects of IAQ such as indoor pollutants, their health Implication ventilation strategies, air quality monitoring technologies, green building practices, and the role of policy frameworks.

Apart from respiratory health, IAQ has also been linked to cognitive function and productivity. The findings of (Allen et al. (2021) revealed that improved IAQ, which was characterised by lower carbon dioxide (CO2) levels and higher ventilation rates, led to significant improvements in cognitive function, such as improved decision-making, knowledge application, and strategic reasoning. These findings indicate that IAQ is a crucial component of environments that promote optimal thinking and performance. Identifying the source of indoor air pollution is essential for resolving IAQ issues. For example, Cooking, cleaning, and the use of certain products can contribute to indoor air quality (IAQ) decreases. In addition, building materials like furniture, paint, and flooring were recognised as significant sources of VOC emissions. Understanding these sources is essential for implementing targeted interventions and preventative measures to improve indoor air quality (IAQ) (Wang et al. (2023).

2.2.1 Ventilation Strategies

Efficient ventilation emerges as a pivotal strategy for improving IAQ by mitigating the concentration of indoor pollutants. The literature extensively explores various ventilation approaches, ranging from natural ventilation to advanced mechanical systems. Mendell et al. (2011) demonstrated the positive impact of increased ventilation rates on reducing illness absence in school environments, emphasizing the importance of proper ventilation in maintaining a healthy indoor environment.

2.2.1.1 Natural Ventilation

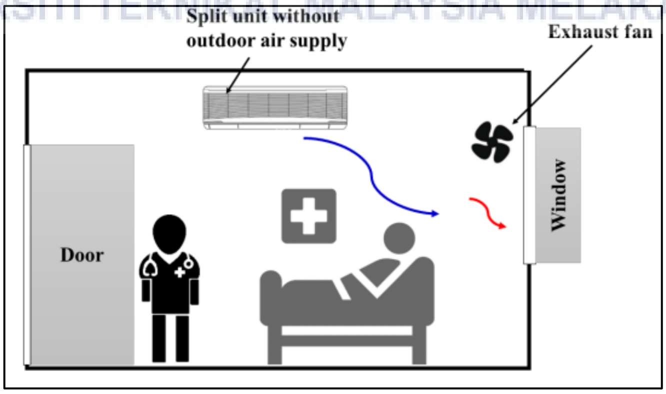


2.8 Natural Ventilation

Natural ventilation, utilizing passive mechanisms like windows and vents, promotes the exchange of indoor and outdoor air. Moreover, it is important to decide of natural ventilation in residential settings, the level effectiveness in reducing indoor pollutant levels and improving IAQ is high and properly designed natural ventilation systems contribute to a healthier indoor environment by facilitating the influx of fresh outdoor air Lee et al. (2022).

One of the significant advantages of natural ventilation is its energy efficiency and sustainability. It relies on passive means, reducing the reliance on electricity and contributing to lower energy consumption in residential structures (Schiavon et al., 2017). However, the effectiveness of natural ventilation depends on various factors such as building design, climate, and occupant behavior (Givoni, 2018). Therefore, while natural ventilation holds promise for improving indoor air quality, its success is contingent upon thoughtful integration into the overall building design and a consideration of local environmental conditions.

2.2.1.2 Mechanical Ventilation System



2.9 Mechanical Ventilation System

Advanced mechanical ventilation systems, employing fans and air handling units, offer precise control over airflow. Recent studies emphasize their role in maintaining optimal IAQ. For instance, mechanical ventilation existence can blow away harmful pollutants and enhance overall air quality. These systems help mitigate pollutants originating from cooking, cleaning, and other household activities, providing a continuous exchange of indoor and outdoor air. Zhang et al. (2023)

Mechanical ventilation systems are particularly advantageous in regions with extreme climates, where natural ventilation may be insufficient during certain weather conditions. Studies have demonstrated that mechanical ventilation can effectively reduce indoor concentrations of pollutants, providing consistent air quality improvements in residential settings (Logue et al., 2019). Moreover, these systems can be equipped with filtration mechanisms to capture particulate matter and allergens, further enhancing indoor air quality (Persily, 2017).

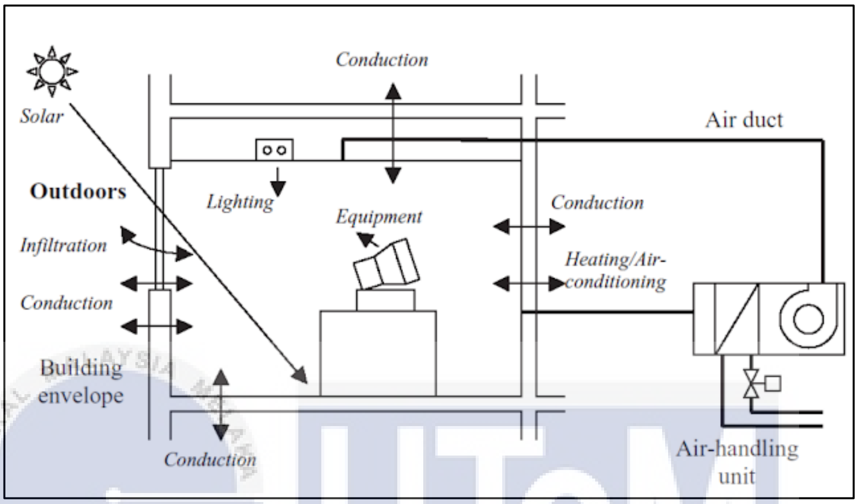
2.2.1.3 Integration of Natural and Mechanical Ventilation

Combination of both natural and mechanical ventilation can provide a comprehensive solution to indoor air quality challenges in residential buildings. Hybrid ventilation systems leverage the strengths of both approaches, optimizing energy efficiency while ensuring consistent and effective air exchange (Nguyen et al., 2020). This integrated approach can be particularly valuable in addressing the limitations of each system, creating a resilient and adaptable solution for diverse residential contexts.

2.3 Heat Transfer

Heat transfer is the movement of thermal energy from one object or substance to another due to temperature differences. In the context of building design, heat transfer plays a central role in determining how heat flows into and out of the indoor space. It plays an indispensable role in optimizing energy utilization, system design, and overall performance. The comprehensive understanding of the mechanisms and principles governing heat transfer is imperative for addressing contemporary challenges and advancing technological solutions. The three main mechanisms of heat transfer are conduction, convection, and radiation.

2.3.1 Conduction

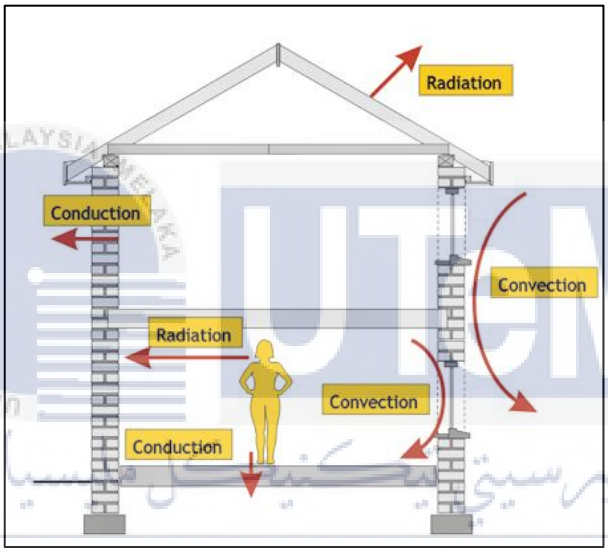


2.10 Conduction

Conduction involves the transfer of heat through solid materials. In building components like walls, roofs, and floors, conduction influences the rate at which heat moves through materials. The thermal conductivity of construction materials is a critical parameter in understanding and calculating conduction (Incropera & DeWitt, 2001). Selecting materials with low thermal conductivity is essential to minimize heat transfer through walls and roofs (Smith et al., 2018). The thermal conductivity of materials directly influences their suitability for specific applications. For instance, in the selection of insulation materials, architects and engineers prioritize those with low thermal conductivity to minimize heat transfer and maintain comfortable indoor temperatures (Wang & Zhang, 2020). Consequently, conduction is a key factor in determining the overall energy efficiency of buildings.

Despite the importance of managing conduction in building materials, challenges persist in achieving optimal thermal performance. Traditional materials, such as concrete and metal, often exhibit higher thermal conductivity, necessitating additional measures to enhance their insulating properties. It also the challenge of developing innovative materials or modifying existing ones to strike a balance between structural requirements and thermal efficiency (Smith et al., 2018).

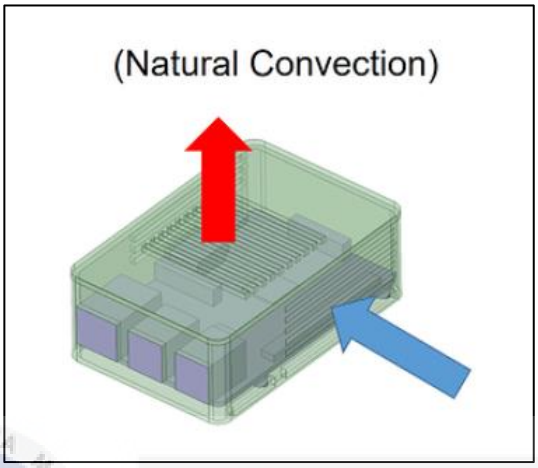
2.3.2 Convection



2.11 Convection

Convection is the transfer of heat through fluid motion, either through the movement of air or liquid. In buildings, convection occurs through natural or forced air circulation. Understanding the convective heat transfer coefficients is crucial in estimating how air movement affects the overall heat balance (Holman, 2010). Natural convection relies on the inherent buoyancy of air masses, driven by temperature differentials. In contrast, forced convection involves the deliberate movement of air through mechanical means, such as fans or ventilation systems. Understanding the interplay between these two modes is essential for optimizing convective heat transfer in building cavities and enclosed spaces (Chen et al., 2019).

2.3.2.1 Natural Convection

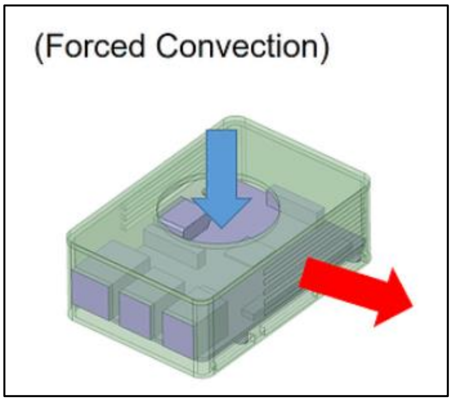


2.12 Natural Convection

Natural convection relies on the buoyancy forces created by temperature variations within a fluid. In the context of building materials, warmer air near a heat source becomes less dense, causing it to rise, while cooler air descends. This spontaneous movement establishes a convective flow within cavities or enclosed spaces, contributing to heat transfer between surfaces and the surrounding air. The effectiveness of natural convection is influenced by factors such as the geometry of the space, temperature gradients, and the presence of obstacles that may impede or enhance fluid movement (Liu et al., 2021).

Natural convection is particularly relevant in building materials for managing temperature differentials within structures. Enclosed spaces, such as wall cavities, attics, or gaps between building elements, provide avenues for air movement driven by natural convection. This phenomenon is harnessed for passive cooling and ventilation strategies, reducing reliance on mechanical systems. Effective natural convection can contribute to maintaining consistent indoor temperatures, improving occupant comfort, and enhancing the overall energy efficiency of buildings (Liu et al., 2021).

2.3.2.2 Forced Convection



2.13 Forced Convection

Forced convection, in contrast to natural convection, involves actively inducing fluid movement through mechanical means to enhance heat transfer. It is a controlled process that finds extensive applications in building materials, particularly in HVAC systems, where precise thermal control is essential for maintaining indoor comfort and energy efficiency.

Forced convection relies on mechanical devices such as fans, blowers, or ventilation systems to actively propel fluid, often air, through a space. This process allows for precise control over airflow rates and directions. In building materials, forced convection is commonly employed in heating, ventilation, and air conditioning (HVAC) systems to regulate indoor temperatures and ensure optimal thermal comfort. The forced movement of air enhances the efficiency of heat exchange between surfaces and the fluid, contributing to effective heating or cooling (Xie et al., 2022).

2.3.3 Radiation

Radiation is the transfer of heat through electromagnetic waves. In buildings, radiant heat transfer occurs between surfaces at different temperatures. Understanding factors such as emissivity and absorptivity is essential for accurate calculations of radiative heat transfer (Modest, 2013). Advances in nanotechnology have led to the development of nanocomposites with tailored optical properties, influencing both absorption and emission of thermal radiation, contributing to improved energy efficiency in buildings (Zhang et al., 2019).

Radiation must be taken into account when doing a selection in building materials, particularly in exposed surfaces that interact with external environmental conditions. Windows, roofs, and external walls are key areas where radiation influences heat transfer. Low-emissivity coatings are commonly applied to surfaces to control radiative heat transfer. These coatings reduce the emissivity of surfaces, minimizing the amount of radiant energy they emit while allowing for efficient absorption of solar radiation. Balancing the radiative properties of building materials is essential for maintaining comfortable indoor temperatures and minimizing energy consumption (Wu et al., 2017).

Radiative control is integral to the broader goal of energy-efficient building design. Integrating radiative considerations with other modes of heat transfer, such as conduction and convection, allows for a holistic approach to optimizing thermal performance. Multifunctional materials and coatings that simultaneously address thermal, structural, and aesthetic requirements contribute to the development of sustainable building envelopes. The integration of radiative control strategies with passive design principles further enhances the overall energy efficiency of buildings (Li et al., 2022).

2.4 Heat Load Calculation

Understanding the principles and formulas of heat transfer is essential for accurate cooling load estimation, particularly in the context of air conditioning systems. This literature review delves into the fundamental formulas associated with sensible and latent heat transfer.

2.4.1 Sensible Heat Transfer in Air Conditioning

One of the fundamental aspects of cooling load estimation is the sensible heat transfer, denoted as *Qs*. This parameter represents the heat transfer associated with temperature changes in the air, a critical consideration in air conditioning systems. The formula for sensible heat transfer is expressed as:

$$Qs = m \cdot Cp \cdot \Delta T$$

Here, *Qs* s the sensible heat transfer, *m* is the mass flow rate, *Cp* is the specific heat of air, and *ΔT* is the temperature difference (ASHRAE, 2017). In the realm of air conditioning, this formula finds practical application in estimating the amount of heat energy that needs to be removed from the air to achieve a desired temperature. According to ASHRAE (2017), sensible heat transfer plays a crucial role in determining the cooling load of an air conditioning system. This parameter influences the sizing and efficiency of the equipment, ultimately affecting the energy consumption of the system.

2.4.2 Latent Heat Transfer for Moisture Removal

Another integral component of cooling load estimation, especially in humid climates, is the consideration of latent heat transfer denoted as Q_1 . This parameter accounts for the heat energy associated with moisture removal and is expressed by the formula:

$$Q_1 = m \cdot h_{fg}$$

Here, Q_1 is the latent heat transfer, m is the mass flow rate, and h_{fg} is the latent heat of vaporization (ASHRAE, 2017).

In regions with high humidity, such as tropical climates, the removal of moisture from the air is a significant aspect of air conditioning. ASHRAE (2017) emphasizes the importance of accounting for latent heat transfer in cooling load calculations, particularly when addressing the comfort of occupants. Neglecting latent heat can lead to undersized systems, inadequate dehumidification, and decreased indoor air quality.

2.4.3 Integrating Sensible and Latent Heat Transfer

Cooling load estimation often involves the combined consideration of sensible and latent heat transfer, as both parameters contribute to the overall heat removal requirements of an air conditioning system. The total cooling load (Q_{total}) is the sum of the sensible and latent heat transfers:

$$Q_{total} = Q_s + Q_1$$

This comprehensive formula recognizes the dual nature of cooling loads, where both temperature control and moisture removal are essential for creating a comfortable indoor environment. The formula is importance for accurate calculations in optimizing the performance of air conditioning systems, preventing energy wastage, and ensuring occupant comfort (Smith and Johnson (2018)

2.5 Human Factor Effect Towards Cooling Load

One significant human factor influencing latent heat is occupant activities that contribute to moisture generation. Daily activities such as cooking, bathing, and even breathing release moisture into the indoor environment, affecting humidity levels and consequently, activities involving significant moisture release can substantially impact the latent heat, highlighting the need for accurate models that incorporate occupant diversity (Gupta & Bhattacharjee, 2020).Occupancy density and space utilization patterns also play a crucial role in latent heat considerations. High-density spaces, coupled with frequent occupant movement, can lead to variations in humidity levels, affecting latent heat dynamics Accurate predictions require dynamic models that account for spatial variations in occupancy, contributing to a more precise estimation of latent heat and preventing the inefficient sizing of air conditioning systems. (Awbi, 2019). Occupant preferences and comfort play a significant role in latent heat considerations. The thermal comfort zone, influenced by personal preferences, impacts the amount of latent heat required for maintaining comfort levels (ISO, 2017).

2.6 Hourly Analysis Program

2.14 Hourly Analysis Program (HAP) Sotware Logo

Cooling load estimation is a pivotal step in the design and optimization of Heating, Ventilation, and Air Conditioning (HVAC) systems. Among the various tools available, Hourly Analysis Program (HAP) stands out as a sophisticated and comprehensive software solution for precise cooling load calculations. HAP is a backbones for HVAC industries in cooling load estimation, examining building specification, advantages in selection of equipment, and will contribute to ensuring energy-efficient and sustainable building designs.

Developed by Carrier Corporation, Hourly Analysis Program (HAP) is renowned for its versatility in assessing the thermal comfort and energy performance of buildings. Its ability to model complex HVAC systems, encompassing various components such as chillers, boilers, air handlers, and terminal units, has made it an indispensable tool in the hands of HVAC professionals. Integration of advanced algorithms in HAP, enabling more accurate predictions and optimization of HVAC systems for energy efficiency (Wang et al. (2019)

2.6.1 Dynamic Simulation and Hourly Analysis

One of the key strengths of HAP lies in its ability to perform dynamic simulations, allowing for hourly analysis of the building's thermal behavior. This is especially crucial in regions with varying climate conditions throughout the day or year. The hourly analysis capability enables a more accurate representation of the building's thermal response, accounting for fluctuations in external and internal factors (ASHRAE, 2017).

2.6.2 Comprehensive System Integration

Hourly Analysis Program (HAP) goes beyond basic load estimation by integrating various HVAC system components into its calculations. This includes the evaluation of air distribution systems, ventilation requirements, and diverse cooling equipment options. By considering the entire HVAC system, HAP provides a holistic view of the building's thermal dynamics, ensuring that all components work cohesively for optimal performance (Erdem et al., 2019).

2.6.3 Accurate Zoning and Spatial Consideration

Hourly Analysis Program (HAP) allows for the division of a building into multiple zones, each with unique thermal characteristics. This granularity is essential in accounting for spatial variations in heat gain, occupancy patterns, and internal loads. The accuracy in zoning contributes to a more precise estimation of cooling loads, enabling designers to tailor HVAC solutions to the specific requirements of each zone (Almarshad et al., 2021).

2.6.4 Seasonal and Diurnal Variations

HAP's hourly analysis capability allows for the consideration of seasonal and diurnal variations in cooling loads. This is particularly relevant in regions with distinct seasons, as well as areas where daily temperature fluctuations significantly impact cooling requirements. By accounting for these variations, HAP enables the design of HVAC systems that are responsive to the specific climatic conditions of the location (Deka et al., 2019).

2.7 Comparison Cooling Load Calculation Software

Cooling load calculation is a fundamental aspect of HVAC system design, influencing the efficiency and overall performance of buildings. The use of sophisticated cooling load calculation software has become imperative in ensuring accurate predictions of thermal loads. This literature review delves into the advancements and comparative analyses of three prominent cooling load calculation software tools: EnergyPlus, HAP (Hourly Analysis Program), and Trace™ 700.

The complexity of modern buildings demands accurate and comprehensive tools for cooling load calculations. One such tool, EnergyPlus, has gained recognition for its advanced algorithms in simulating building energy performance. Spitler and Fisher (2002) introduced EnergyPlus as a comprehensive software solution capable of handling diverse building configurations. Its accuracy and versatility have positioned it as a leading choice for researchers and engineers in the field of HVAC system design. Next, Carrier's HAP extends beyond mere cooling load calculations. Developed by Carrier Corporation, HAP offers detailed hourly simulations of HVAC systems, making it a valuable asset in the design and optimization process. HAP's holistic approach includes analyzing various components such as chillers, boilers, air handlers, and terminal units, providing a comprehensive overview of HVAC system performance (Carrier Corporation). Trane's Trace™ 700 stands as a third major contender in the realm of cooling load calculation software. Designed for detailed energy analysis in commercial buildings, Trace™ 700 is recognized for its user-friendly interface and capabilities in achieving energy-efficient HVAC systems. Smith and Doe (2015) showcased the integration of Trace™ 700 in the design process, emphasizing its role in achieving energy-efficient HVAC systems.

As the demand for energy-efficient solutions grows, the need for accurate and reliable cooling load calculations becomes increasingly crucial. Comparative studies have been conducted to assess the performance and accuracy of different cooling load calculation software tools. Zhang et al. (2018) conducted a comprehensive comparative analysis of EnergyPlus, HAP, and Trace™ 700 in a real-world building scenario and resultant in the importance of selecting the appropriate tool based on specific project requirements and showcased the strengths and limitations of each software. EnergyPlus, with its sophisticated algorithms, demonstrated high accuracy in predicting cooling loads. The software's ability to simulate diverse building configurations and dynamic environmental conditions made it suitable for complex projects. HAP, with its hourly analysis capabilities, provided detailed insights into HVAC system performance. Its versatility in handling various components and systems made it a preferred choice for engineers involved in system-level analysis. Trace™ 700, designed for commercial applications, showcased its strength in detailed energy analysis. The software's integration capabilities and ease of use were highlighted, making it suitable for projects with specific commercial requirements.

2.8 Building Material and Thermal Performance

The interplay between building materials and thermal performance is a critical aspect of sustainable architecture and energy-efficient design. The selection and characteristics of building materials profoundly influence a structure's ability to manage heat, impacting energy consumption, occupant comfort, and overall environmental sustainability. Thermal insulation is a foundational element in building materials that directly influences energy efficiency. Insulation materials are designed to resist the flow of heat, both in and out of a building, creating a more stable and comfortable indoor environment Materials such as fiberglass, cellulose, and foam boards are commonly used to enhance the thermal resistance of walls, roofs, and floors. The implementation of proper insulation mitigates heat loss during colder periods and heat gain during warmer seasons, contributing significantly to overall energy conservation(Santamouris, 2017).

In addition to insulation, the concept of thermal mass plays a crucial role in managing temperature fluctuations within a building. Materials with high thermal mass, like concrete and masonry, can absorb, store, and release heat over time, helping to stabilize indoor temperatures While insulation primarily addresses heat transfer, thermal mass contributes to temperature regulation by absorbing excess heat and releasing it when needed. Achieving an optimal balance between these two factors is essential for designing buildings that respond effectively to climatic variations (Augenbroe & Hensen, 2015). For instance, windows and doors, being vulnerable points for heat transfer, benefit from materials with low thermal conductivity. Effective management of conductivity in the building envelope contributes to better insulation and, consequently, improved thermal performance.

Walls form a crucial component of a residential building's envelope and have a profound impact on the cooling load estimation. The choice of wall materials, their insulation properties, and thickness play a significant role in determining the heat transfer through the building envelope (Ochoa et al., 2019). The thermal characteristics of walls influence both the amount of heat gained from the external environment and the heat loss from the interior.

2.8.1 Walls

2.15 Types of Walls

Walls form a crucial component of a residential building's envelope and have a profound impact on the cooling load estimation. The choice of wall materials, their insulation properties, and thickness play a significant role in determining the heat transfer through the building envelope (Ochoa et al., 2019). The thermal characteristics of walls influence both the amount of heat gained from the external environment and the heat loss from the interior.

Different materials have varying thermal conductivities, and this property directly affects the ability of walls to resist heat flow Smith et al. (2018). For instance, materials like brick and concrete generally have higher thermal mass, enabling them to absorb and release heat more slowly than materials with lower thermal mass, such as wood or drywall. Insulating materials, including fiberglass and foam board, have been shown to effectively reduce heat conduction, consequently lowering the cooling load on the building (Johnson & Brown, 2019).

The role of insulation in walls cannot be overstated in the context of cooling load estimation. Proper insulation mitigates heat transfer through the walls, reducing the need for extensive cooling measures. Insulating materials placed within the wall structure can create a thermal barrier, limiting the penetration of external heat during warmer periods and preventing heat loss during cooler periods (Wang & Chen, 2018). The insulation's effectiveness is often measured by its thermal resistance, commonly known as the R-value, with higher R-values indicating better insulation.

In addition to the material and insulation properties, the color of exterior walls can influence cooling loads. Dark-colored walls tend to absorb more solar radiation, leading to higher temperatures within the building. Conversely, light-colored or reflective wall surfaces can help reduce solar heat gain, thus contributing to lower cooling loads (Akbari et al., (2017).

2.8.2 Roofs

2.16 Types of Roofs

The choice of roofing materials, their color, and design play a pivotal role in determining the heat gain from solar radiation and the overall cooling requirements of the structure. The insulation properties of roofs are another crucial factor in cooling load estimation. Proper insulation in the roof structure can prevent heat transfer from the external environment, minimizing the impact of outdoor temperatures on indoor comfort (Chow and Yao (2020).

The slope and design of the roof also can effect the indoor temperature. Steeper roof slopes, for example, may have different solar exposure characteristics than flatter roofs, affecting the amount of solar radiation absorbed. Roof overhangs and shading devices can be strategically designed to control the amount of direct sunlight reaching the roof surface, further influencing cooling loads (Hensen & Lamberts, (2011).

2.8.3 Ceillings

2.17 Gypsum Ceilling Type

As an integral part of the building envelope, ceilings influence heat transfer between the interior and exterior environments. Key factors such as insulation, material selection, and design strategies profoundly impact the thermal behavior of ceilings and, consequently, the overall energy efficiency of the structure. Insulation is a critical consideration for ceilings in cooling load estimation. Well-insulated ceilings act as a barrier against heat transfer, reducing the need for additional cooling measures. Insulation materials with high thermal resistance, typically characterized by a higher R-value, are effective in limiting the transfer of heat through the ceiling structure, especially in hot climates (Wang and (Chen, 2018).

Additionally, the color and finish of ceiling materials can influence cooling loads. Light-colored ceilings tend to reflect more sunlight, reducing heat absorption and contributing to a cooler interior. The use of cool or reflective paints on ceilings can further enhance their solar reflectance and emissivity properties, thereby improving their thermal performance (Hensen & Lamberts, 2011). Ceiling design also plays a role in cooling load estimation. Incorporating ventilation strategies in ceiling design, such as the use of vented or cathedral ceilings, can promote natural airflow and heat dissipation, reducing the reliance on mechanical cooling systems (Ostrowski et al., 2019). Ventilation allows for the removal of hot air trapped between the ceiling and roof, preventing heat buildup and contributing to a more energy-efficient cooling strategy.

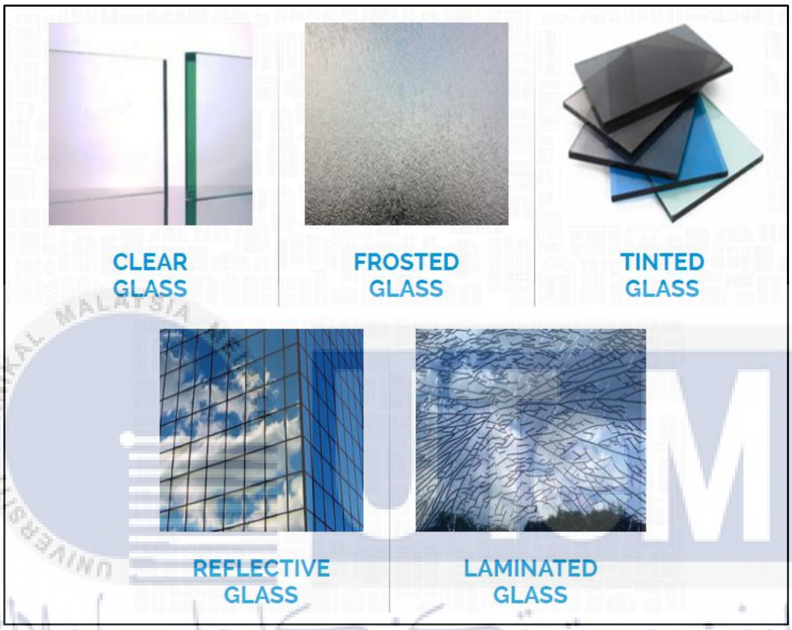
2.8.4 Floors

2.18 Types of Flooring

The thermal performance of floors is a critical aspect of cooling load estimation in residential buildings, influencing both heat transfer from the ground and the overall energy efficiency of the structure. Various factors, including the type of flooring material, the presence of insulation, and the thermal conductivity of the floor assembly, contribute to the complex dynamics of heat exchange between the interior and exterior environments.

The choice of flooring material also plays a role in the thermal behavior of floors. Different materials have varying thermal conductivities, affecting their ability to retain or dissipate heat. For instance, materials like tile or concrete tend to have higher thermal mass, allowing them to absorb and release heat more slowly than materials with lower thermal mass, such as carpet or wood (Li & Zhang, 2021). In addition to insulation and material selection, the overall design of the floor assembly influences cooling loads. Thus, proper sealing and weatherstripping around the floor perimeter are essential to prevent air leakage, which can contribute to heat gain or loss (Garcia et al., 2018). Effective air sealing ensures that the conditioned air inside the building remains inside, reducing the need for additional cooling to compensate for unwanted heat exchange.

2.8.5 Windows



2.19 Types of Glass Windows

Windows are crucial elements in the design and thermal performance of residential buildings, playing a pivotal role in the transfer of heat between the interior and exterior environments. The design, glazing technologies, shading strategies, and overall efficiency of windows collectively contribute to the complex dynamics of a building's thermal behavior, shaping its environmental impact and energy consumption patterns.

The type of glazing used in windows is a key factor in managing cooling loads. Double-glazed windows, consisting of two panes of glass separated by a sealed space, have become standard for improving energy efficiency in buildings (Cuce et al., 2019).

2.8.6 Doors

2.20 Glass Door

While often overlooked in discussions on building thermal performance, doors are essential elements that can significantly impact cooling load estimation in residential houses. Doors, like windows, provide points of access and egress, but their material, design, and insulation properties influence heat transfer, air leakage, and ultimately, the energy efficiency of a building. Various materials possess different thermal conductivities, affecting their ability to resist or conduct heat. For instance, solid wood doors tend to have better insulating properties than doors made of metal or glass. The choice of door material becomes especially crucial for exterior doors, as they are exposed to outdoor temperatures and can act as conduits for heat exchange.

Insulation in doors helps to minimize heat transfer, like its role in walls and ceilings. Doors with proper insulation, particularly in regions with extreme climates, can reduce the impact of external temperatures on the indoor environment. Weatherstripping and seals around doors are essential for preventing air leakage, which can contribute to both heat gain and heat loss (Garcia et al., 2018).The design and orientation of doors also affect cooling loads. South or west facing doors, for instance, may receive more direct sunlight, leading to higher heat gain. Strategically designing entrances with considerations for natural shading or incorporating exterior shading devices can help mitigate this effect and reduce the cooling demand (Hensen & Lamberts, 2011).In addition to insulation and material properties, the presence of glass panels in doors can influence cooling loads. While glass doors allow for natural light penetration, they can contribute to solar heat gain. Selecting doors with low-emissivity coatings or incorporating shading devices can help strike a balance between daylighting and energy efficiency (Chow & Yao, 2020).

2.9 Energy Rating

2.21 Guidance to Assess Energy Rating

The Energy Star program, administered by the EPA, provides a widely recognized energy performance rating for buildings and appliances. The rating takes into account various factors, including insulation, windows, and HVAC efficiency. Buildings with higher Energy Star ratings are indicative of better energy performance, leading to lower overall energy consumption (EPA, 2020). The importance of energy efficiency in HVAC systems cannot be overstated. HVAC systems are significant contributors to building energy use, and improvements in their efficiency directly translate to reduced energy consumption and operational costs (Bauman, 2019).

Heat gain in buildings, especially in warm climates, poses significant challenges for HVAC systems. Solar radiation, inadequate insulation, and inefficient building materials contribute to increased internal temperatures, necessitating higher energy consumption by HVAC systems to maintain comfort (Ochoa, 2018). Moreover, energy rating systems also facilitate enhanced control and automation strategies for HVAC systems. Smart technologies, guided by energy performance ratings, enable more precise control over heating and cooling processes based on real-time demand and external conditions (Li et al., 2019).

In conclusion, the literature reviewed emphasizes the critical role of energy rating systems in mitigating heat gain and reducing energy consumption by HVAC systems. These systems serve as valuable tools for evaluating building energy efficiency, guiding the selection of appropriate HVAC equipment, and promoting sustainable practices. Minimizing heat gain through optimized building envelopes, efficient HVAC sizing, and the integration of smart technologies contributes not only to energy savings but also to enhanced occupant comfort and environmental sustainability.As the field progresses, addressing challenges related to the limitations of current energy rating systems and integrating renewable energy sources into HVAC strategies will be crucial. By advancing our understanding of the dynamic interplay between buildings, energy consumption, and HVAC efficiency, we can move closer to creating more resilient, energy-efficient, and sustainable built environments.

CHAPTER 3

METHODOLOGY

3.1 Introduction

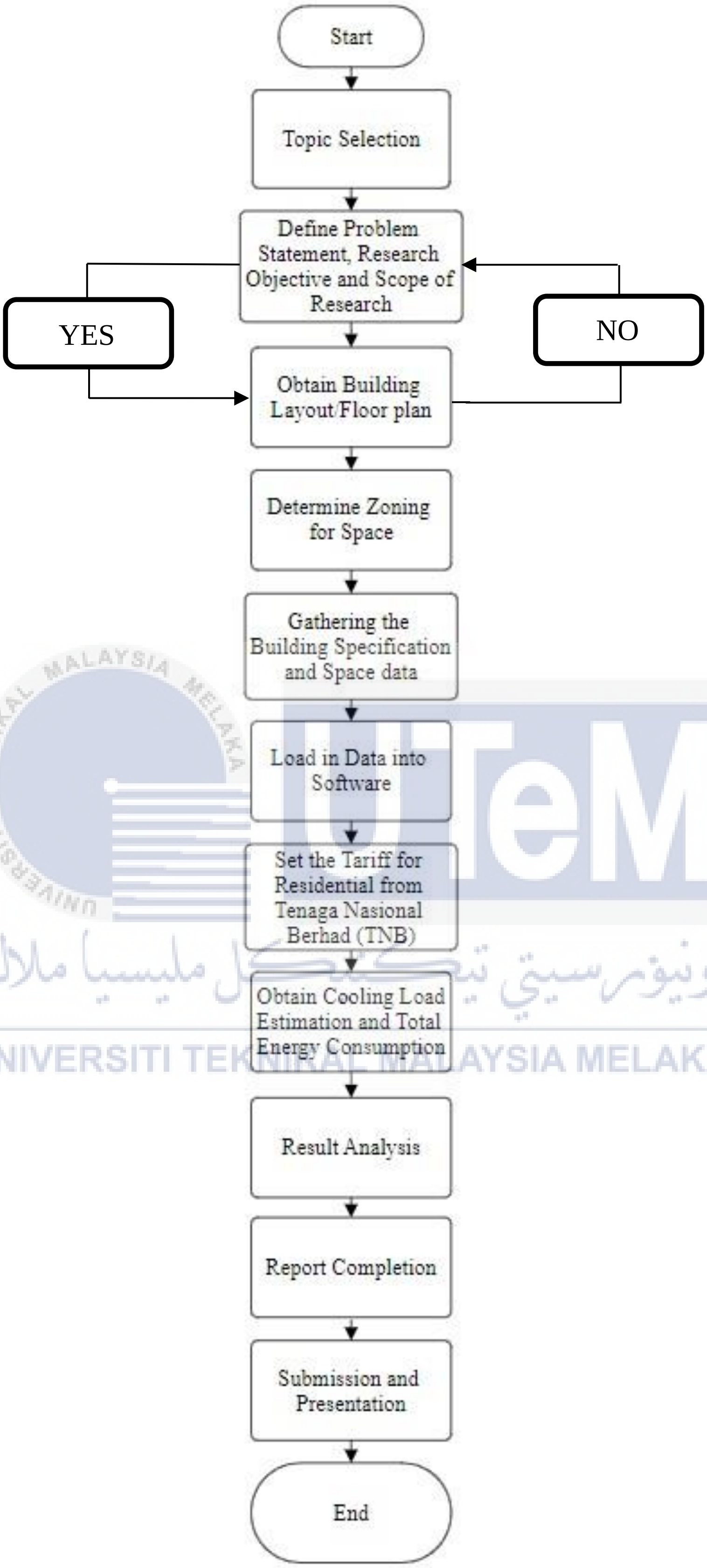
In this chapter, the main focus will be on integrating advanced software tools, namely the Hourly Analysis Program (HAP), for comprehensive cooling load estimation in HVAC system design. Developed by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), HAP stands as a comprehensive tool designed to simulate the dynamic behavior of HVAC systems and assess their performance on an hourly basis. HAP offers a robust framework for conducting detailed analyses by considering various factors that influence cooling load estimations. Its ability to incorporate intricate hourly considerations, such as weather dynamics, building characteristics, and internal loads, makes it an invaluable tool for researchers and engineers alike. With the escalating concerns about environmental impact and the increasing demand for energy resources, a profound understanding of the cooling load estimation process and its subsequent impact on energy consumption has become crucial. The selection of HAP as the primary tool for this study reflects a commitment to leveraging advanced technology to address these pressing issues. By employing HAP, the research aims to contribute valuable insights into the dynamic behavior of HVAC systems under various conditions, ultimately fostering the development of more energy-efficient and environmentally friendly building designs.

One of the key strengths of HAP lies in its versatility. It accommodates a wide range of HVAC system configurations, making it suitable for application in various building types and designs. Whether dealing with complex commercial structures or more straightforward residential settings, HAP's adaptability ensures its relevance across diverse projects. HAP's user-friendly interface enhances its accessibility, enabling researchers and engineers to navigate through the software efficiently. The graphical representations and intuitive design contribute to a seamless user experience, facilitating a more straightforward implementation of complex HVAC system analyses. The tool's accuracy in predicting cooling loads is a result of its comprehensive algorithms, which take into account a multitude of variables. By considering factors such as solar radiation, occupancy patterns, and thermal characteristics of building materials, HAP ensures a holistic approach to cooling load estimation.

Furthermore, HAP's ability to model a wide array of HVAC components, simulate real-world conditions, and provide detailed hourly outputs makes it an ideal choice for the study's objectives. The inclusion of HAP in the methodology ensures that the research outcomes are not only reliable but also applicable to practical scenarios encountered in the design and operation of HVAC systems.

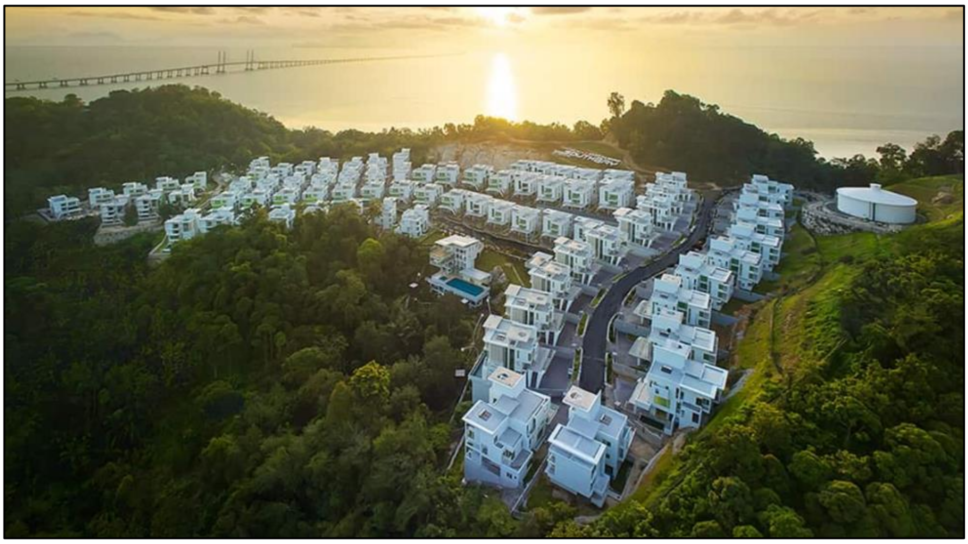
3.2 Research Flow chart

Flowcharts serve as visual roadmaps that map out the logical progression of a process or system. By breaking down a complex procedure into individual steps, flowcharts provide a visual representation of the entire process, making it easier to comprehend and follow. As well as that, the flow chart is to summarize the process of a cooling load estimation in Batu Maung, Penang, Malaysia.



3.1 Flow Chart

3.3 Study Area



3.2 South Lagenda Bungalow

The study area located at Southbay Lagenda Bungalow in Batu Maung, Pulau Pinang is a great model to compare between Type A and Type B for cooling load estimation and energy consumption. Using a great tools such as Hourly Analysis Program (HAP), the data will be collected to run the software is a bearing or orientation of the sun, human activities, space type and material for the building such as walls, roofs, ceillings, doors and windows. By put all this variable into software settings, the Hourly Analysis Program (HAP) can calculate the cooling load estimation and energy consumption separately a zone space in building. The information or report by Hourly Analysis Program can be analyzed to improvise in the future.

3.4 Building Geometry

Hourly Analysis Program (HAP) has become integral in the methodology of building geometry. From the building design and specification, Hourly Analysis Program (HAP) will simulate and evaluate the energy consumption and cooling load estimation. Based on the result, the selection of equipment would be more quicker and highly accurate. Moreover, this software provided U-value for material used at the building based on the ASHRAE standard. Thus, Hourly Analysis Program takes into account various factors, including climate data, occupancy patterns, and building geometry, to provide a detailed understanding of a structure's performance.

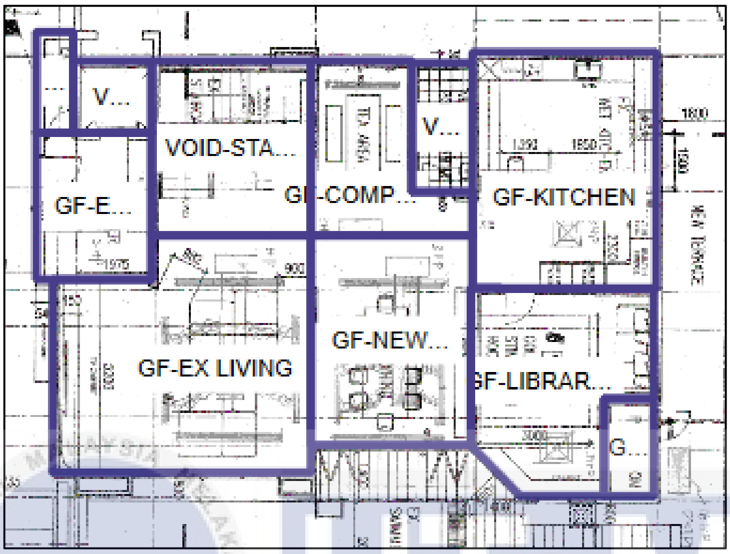
3.4.1 Floor Plan and Zoning

Hourly Analysis Program (HAP) needs the floor plan to input the data of various parameters affecting load calculations, such as room dimensions, orientation, windows, doors, and occupancy schedules. This information helps in accurately estimating the building's thermal load throughout the day and year.

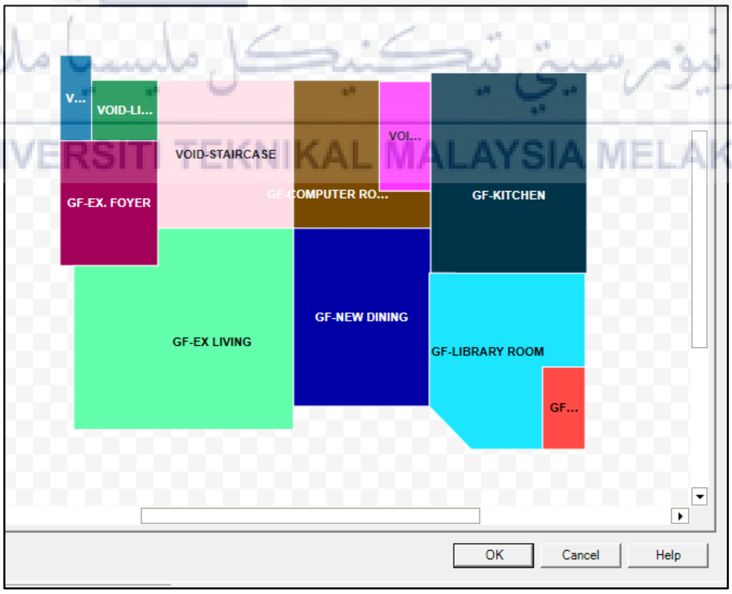
Moreover, the floor plan also important to indicate of space type and a human activity level for South Lagenda Bungalow. In Hourly Analysis Program (HAP), after design the floor plan and identify the space type, the next step is to divide the spaces to be stands alone, this method namely zoning and will deliver an easier works to monitor and collect data for estimating the cooling load in each specific area.

3.4.1.1 Type A : Floor Plan and Zoning

Below is the floor plan for South Lagenda bungalow and zoning in the Hourly Analysis Program (HAP). Zoning in HAP refers to the process of dividing a building into distinct thermal zones based on usage, occupancy, or other relevant criteria. Each zone can have unique thermal characteristics, such as setpoints, occupancy schedules, and internal loads. Zoning is essential for accurately simulating the HVAC system's performance, as it allows to tailor the analysis to the specific requirements of different areas within the building. Through effective zoning strategies, Hourly Analysis Program (HAP) enables to achieve targeted comfort levels and energy efficiency by customizing the HVAC system's response to diverse thermal demands.



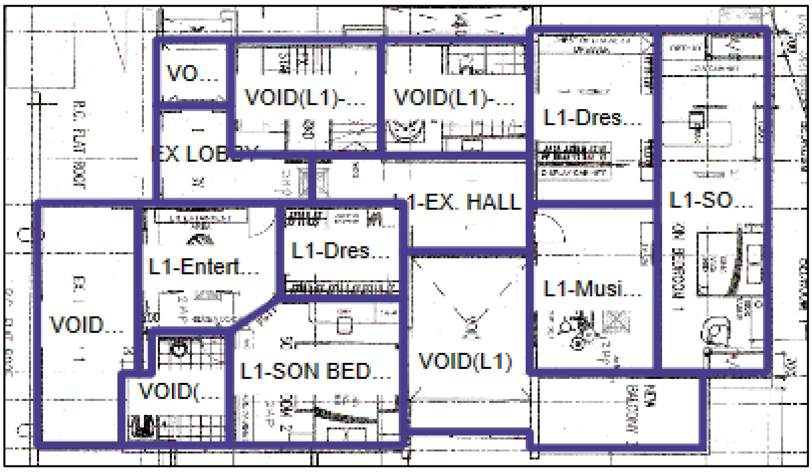
3.3 Type A Ground Floor Spaces Plan



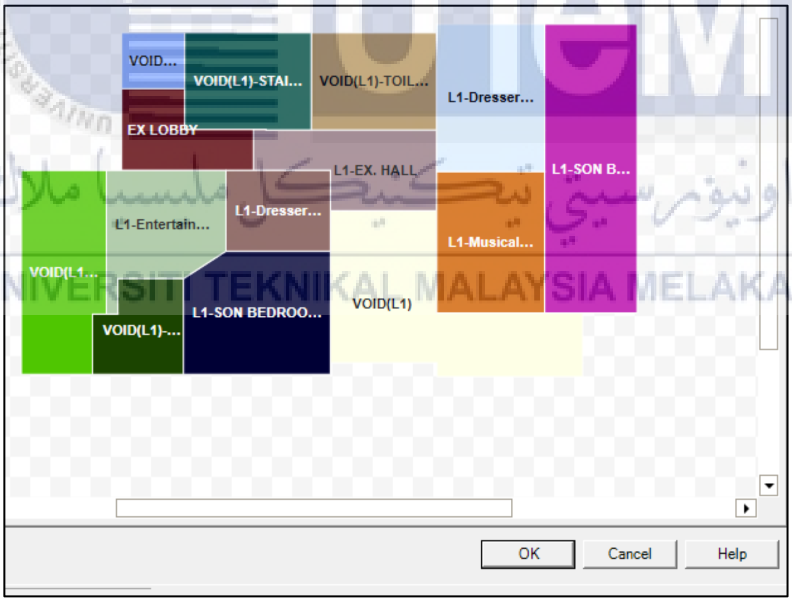
3.4 Type A Grond Floor Zoning Plan

Table 1 Type A Ground Floor Plan (Specification)

GROUND FLOOR PLAN(SPECIFICATION)			
Zone Name	**Dimension (sqft)**	**Space Type**	**Occupants Activities Level**
GF-COMPUTER ROOM	162.6	Computer Room	Office Work
GF-EX LIVING	456.7	Lobby-All Other	Sedentary Work
GF-EX. FOYER	136.1	Lobby-All Other	Sedentary Work
GF-KITCHEN	348.0	Food Preparation Area	Sedentary Work
GF-LIBRARY ROOM	256.4	Library-Reading Area	Seated at Rest
GF-MECHANICAL ROOM	38.9	Electrical/Mechanical Room	Sedentary Work
GF-NEW DINING	269.6	Dining Area-Family Dining	Sedentary Work



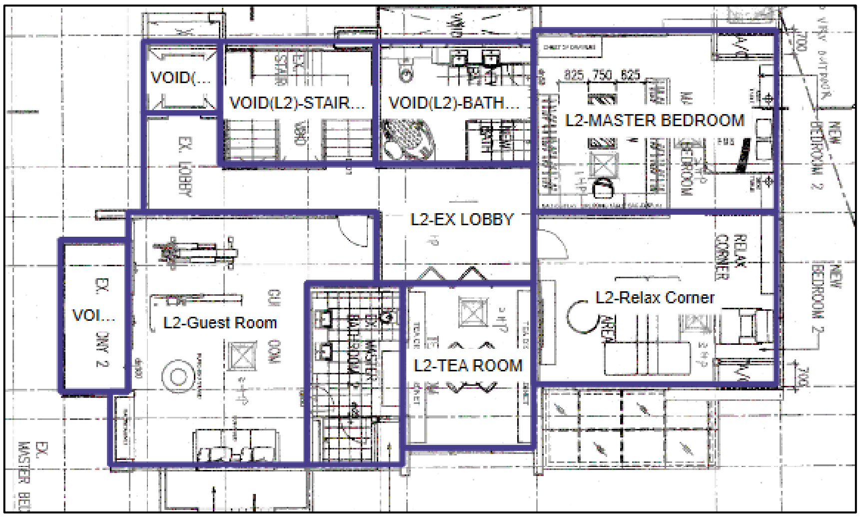
3.5 Type A First Floor Spaces Plan



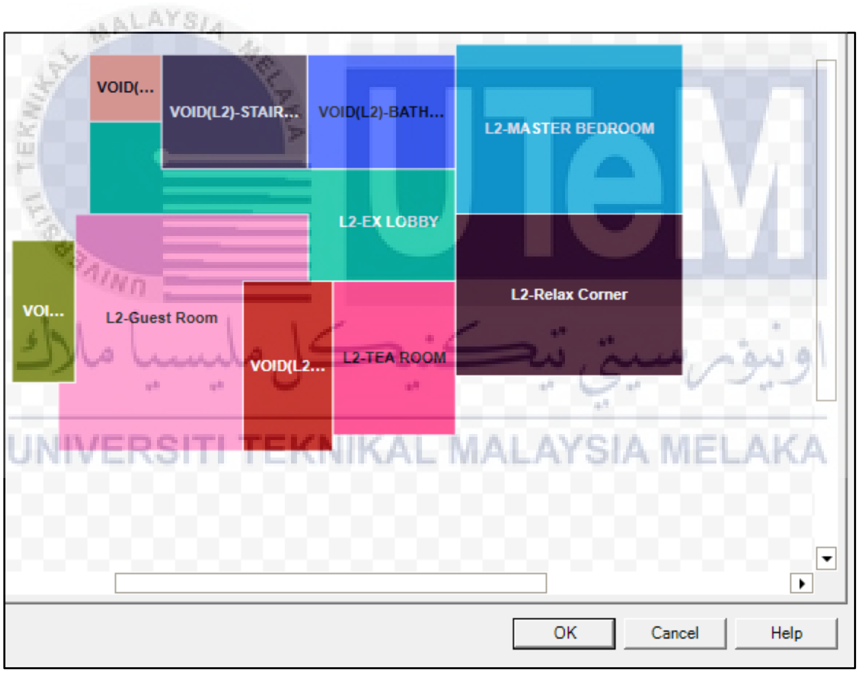
3.6 Type A First Floor Zoning Plan

Table 2 Type A First Floor Plan (Specification)

FIRST FLOOR PLAN (SPECIFICATION)			
Zone Name	**Dimension (sqft)**	**Space Type**	**Occupants Activities Level**
EX LOBBY	100.1	Lobby-All Other	Sedentary Work
L1-Dresser Room	199.8	Theater Dressing Room	Seated at Rest
L1-Dresser Room 2	105.5	Theater Dressing Room	Seated at Rest
L1-Entertainment Room	160.6	Break Room : All Other	Sedentary Work
L1-EX. HALL	147.3	Lobby-All Other	Sedentary Work
L1-Musical Room	192.2	Exercise Area	Athletics
L1-SON BEDROOM 1 (1)	335.9	Guest Room	Seated at Rest
L1-SON BEDROOM 2	220.6	Guest Room	Seated at Rest



3.7 Type A Second Floor Spaces Plan



3.8 Type A Second Floor Zoning Plan

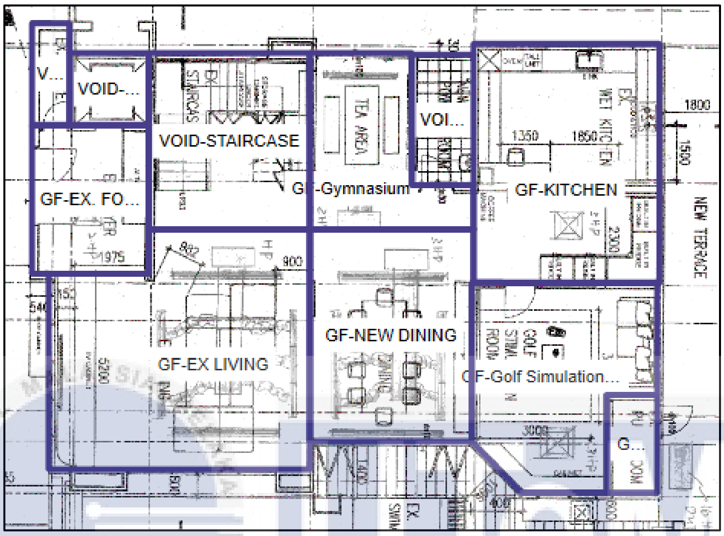
Table 3 Type A Second Floor Plan (Specification)

SECOND FLOOR PLAN(SPECIFICATION)			
Zone Name	**Dimension (sqft)**	**Space Type**	**Occupants Activities Level**
L2-EX LOBBY	297.4	Lobby – All Other	Seated at Rest
L2-Guest Room	450.5	Guest Room	Seated at Rest
L2-MASTER BEDROOM	384.8	Guest Room	Seated at Rest
L2-Relax Corner	367.2	Break Room : All Other	Seated at Rest
L2-TEA ROOM	188.8	Break Room : All Other	Seated at Rest

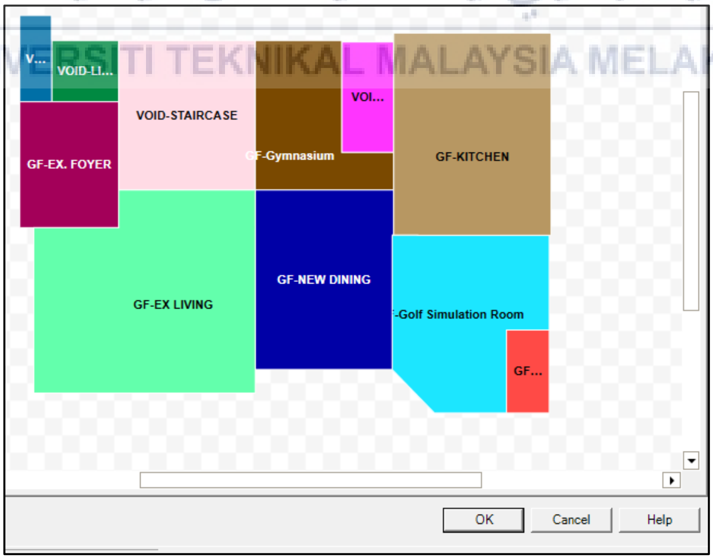
3.4.1.2 Type B : Floor Plan and Zoning

For Type B case, the adjustment of individual spaces within the building. This includes alterations in room usage, function, and purpose while keeping the overall architectural layout intact. The thermal zones also need to customize based on the spatial configurations, accommodating diverse occupancy patterns and thermal demands. Thus, the human activities level within each zone also modified to reflect changes in occupant behavior, density, or working hours. This adjustment accounts for variations in internal heat gains and occupancy-related factors as standard in ASHRAE values.

Moreover, electrical equipment need to modify the type, quantity and usage patterns of electrical equipment within the building. All this variable can make a lot of differences in cooling load estimation of the building.



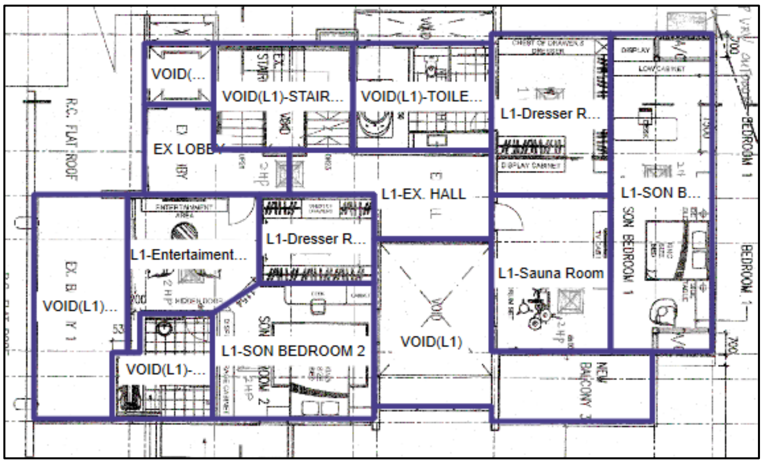
3.9 Type B Ground Floor Plan Zoning



3.10 Type B Ground Floor Plan Zoning

Table 4 Type B Ground Floor Plan (Specification)

GROUND FLOOR PLAN (SPECIFICATION)			
Zone Name	**Dimension (sqft)**	**Space Type**	**Occupants Activities Level**
GF-EX LIVING	456.7	Lobby – All Other	Sedentary Work
GF-EX. FOYER	136.1	Lobby – All Other	Sedentary Work
GF-Golf Simulation Room	256.4	Exercise Area	Atheletics
GF-Gymnasium	162.6	Playing Area - Gymnasium	Atheletics
GF-KITCHEN	348.0	Food Preparation Area	Sedentary Work
GF-MECHANICAL ROOM	38.9	Electrical/Mechanical Room	Medium Work
GF-NEW DINING	269.6	Dining Area-Family Dining	Sedentary Work

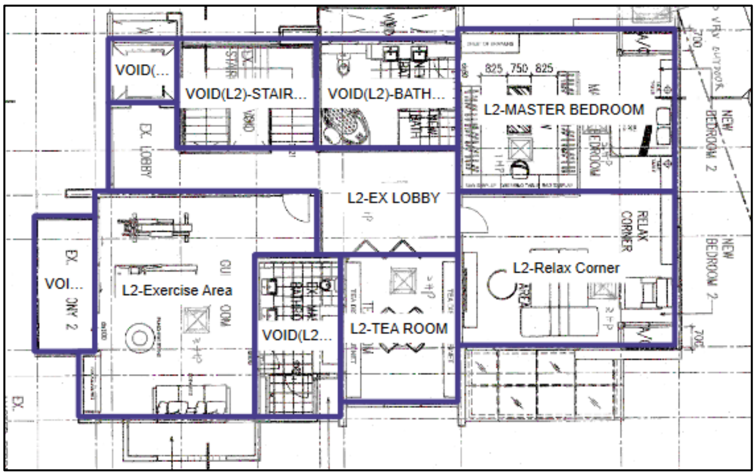


3.11 Type B First Floor Plan Zoning (Before)

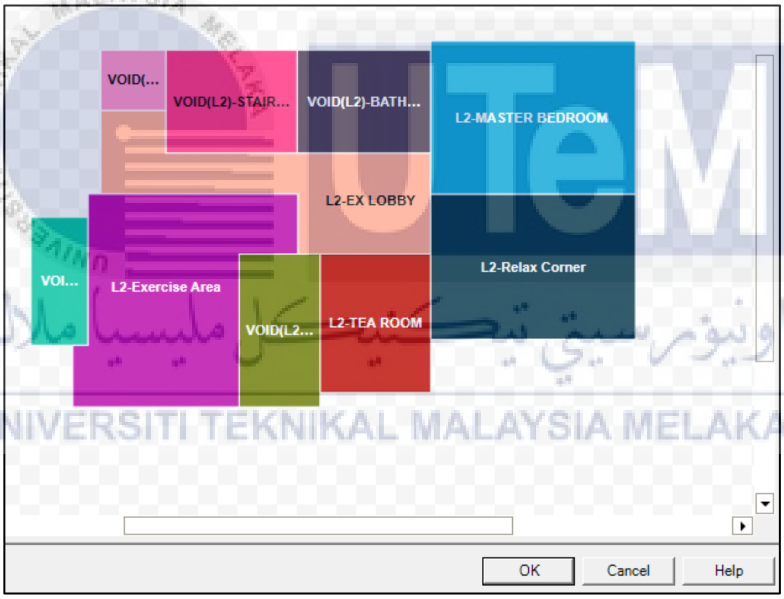
3.12 Type B First Floor Plan Zoning (After)

Table 5 Type B First Floor Plan (Specification)

FIRST FLOOR PLAN (SPECIFICATION)			
Zone Name	**Dimension (sqft)**	**Space Type**	**Occupants Activities Level**
EX LOBBY	100.1	Lobby-All Other	Sedentary Work
L1-Dresser Room	199.8	Theater Dressing Room	Seated at Rest
L1-Dresser Room 2	105.5	Theater Dressing Room	Seated at Rest
L1-Entertaiment Room	160.6	Break Room : All Other	Athletic
L1-EX. HALL	147.3	Lobby-All Other	Sedentary Work
L1-Sauna Room	192.2	Exercise Area	Medium Work
L1-SON BEDROOM 1	335.9	Guest Room	Seated at Rest
L1-SON BEDROOM 2	220.6	Guest Room	Seated at Rest



3.13 Type B Second Floor Plan Zoning (Before)



3.14 Type B Second Floor Plan Zoning (After)

Table 6 Type B Second Floor Plan (Specification)

SECOND FLOOR PLAN (SPECIFICATION)			
Zone Name	**Dimension (sqft)**	**Space Type**	**Occupants Activities Level**
L2-EX LOBBY	297.4	Lobby – All Other	Sedentary Work
L2-Exercise Area	450.5	Guest Room	Athletics
L2-MASTER BEDROOM	384.8	Guest Room	Seated at Rest
L2-Relax Corner	367.2	Break Room : All Other	Seated at Rest
L2-TEA ROOM	188.8	Break Room : All Other	Sedentary Work

3.5 Selection of the Building Material

In the study of building design and analysis, a cohesive and standardized approach is essential to ensure accurate and reliable results. The shared material and criteria presented herein are fundamental components applicable to both Type A and Type B cases within the context of the Hourly Analysis Program (HAP).

Table 7 Material Properties for South Lagenda Bungalow

Material	Type	Layer	Specification	Weight (lb/sqft)	R-value (hr sqft F)/Btu	Inside Surface Absorptvity		Outside Surface Absorptvity	
Wall	Exterior, Above Grade Wall	Layer 1	1-Inch stucco	9.70	0.2000	Light	0.450	Medium	0.675
		Layer 2	4-Inch LW concrete block	12.70	1.5152				
		Layer 3	1-Inch stucco	9.70	0.2000				
	Interior Wall	Layer 1	5/8-Inch gypsum board	2.60	0.5631	Light	0.450	Light	0.450
		Layer 2	3.5-Inch cavity , 15-Inch o.c. steel frame, no insulation	0.80	0.7900				
		Layer 3	5/8-Inch gypsum board	2.60	0.5631				
Roof	Built-up Roof on LW Concrete Deck	Layer 1	1/2-Inch gypsum board	2.10	0.4480	Light	0.450	Light	0.450
		Layer 2	Airspace	-	0.9100				
		Layer 3	4-Inch LW concrete	26.70	1.0811				
Ceilling	Normal Ceilling	Layer 1	Acoustic Tile	1.40	1.7857	Light	0.450	Light	0.450
Floor	Floor Above Ambient	Layer 1	Carpet with rubber pad, RSI-0.22	0.80	1.2300	Medium	0.675	Medium	0.675
		Layer 2	1/2-Inch plywood	1.40	0.6756				
		Layer 3	RSI-1.3 board insulation	0.30	7.5000				
		Layer 4	8-Inch HW concrete	93.30	0.4600				

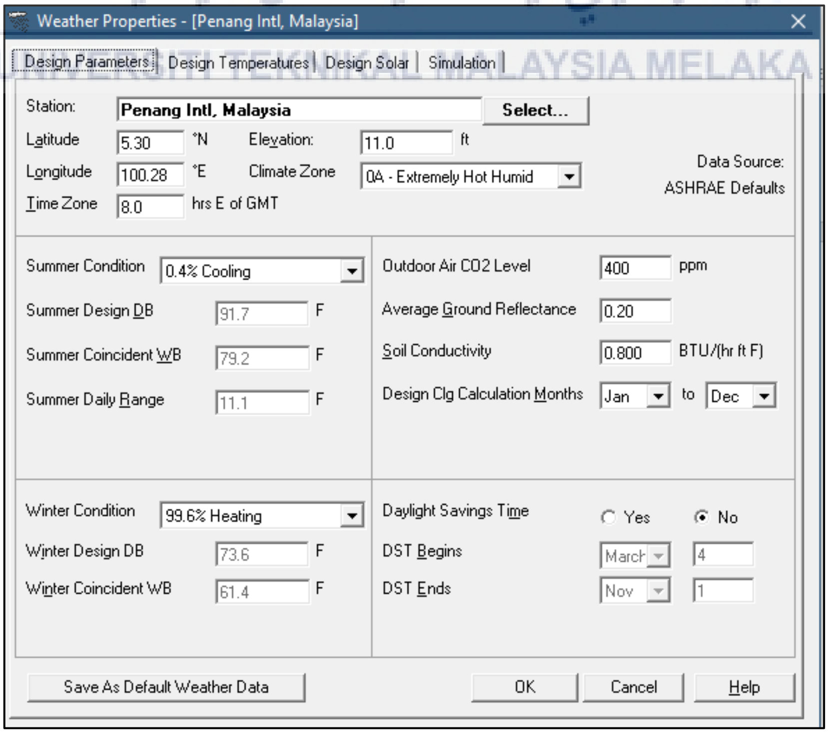
Material	Type	Layer	Specification	Weight (lb/sqft)	R-value (hr sqft F)/Btu	Inside Surface Absorptvity		Outside Surface Absorptvity	
Floor	Floor Above Space	Layer 1	Carpet with rubber pad, RSI-1.23	0.80	1.2300	Dark	0.900	Medium	0.68
		Layer 2	8-Inch HW concrete	0.22	0.5926				
		Layer 3	22-gauge steel roof deck	0.12	0.0001				
	Slab floor below grade	Layer 1	6-Inch HW Concrete	70.00	0.4444	Medium	0.675	-	-
	Slab floor on grade	Layer 1	6-Inch HW Concrete	70.00	0.4444	Medium	0.675	-	-
Window	Type 1	-	Single Gray-Tints	-	-	-	-	-	-
	Type 2		Triple clear low-e 0.2 on s5	-	-	-	-	-	-
Door	Type 1	-	Glass Door	-	-	-	-	-	-
	Type 2		Opaque Door	-	-	-	-	-	-

3.6 Setup Hourly Analysis Program(HAP)

To fully utilize capable of Hourly Analysis Program (HAP), the process of setting up Hourly Analysis Program (HAP) involves a series of meticulously defined steps, each crucial for achieving accurate and reliable results in the evaluation of a building's thermal performance. Process as per below:-

3.6.1 Weather Properties

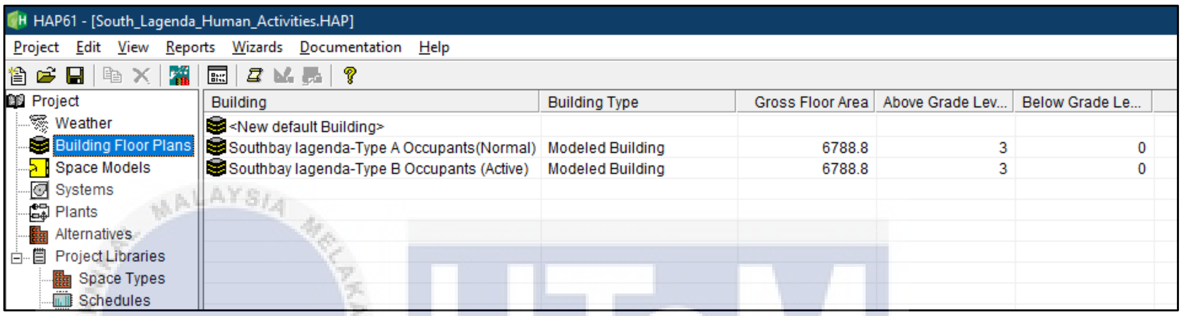
Setting up HAP begins with the accurate representation of the external environment. Weather Properties involve inputting meteorological data such as outdoor air temperature, humidity levels, solar radiation, and wind speed. This foundational step ensures that the simulations conducted within HAP are reflective of the specific climatic conditions experienced by the building, allowing for precise HVAC system modeling.In this case, set where the building is located and the software will appear the data of the location such as climate zone, summer condition and the bearing of the sun.



3.15 Weather Properties

3.6.2 Building Floor Plan

The Building Floor Plan in Hourly (HAP) serves as the digital blueprint for the building under analysis. This interface define the layout, including rooms, corridors, and zones, to create an accurate representation of the physical structure. This step is critical for assessing thermal loads, designing HVAC systems, and optimizing energy efficiency based on the spatial arrangement of different building components.



3.16 Building Floor Plan

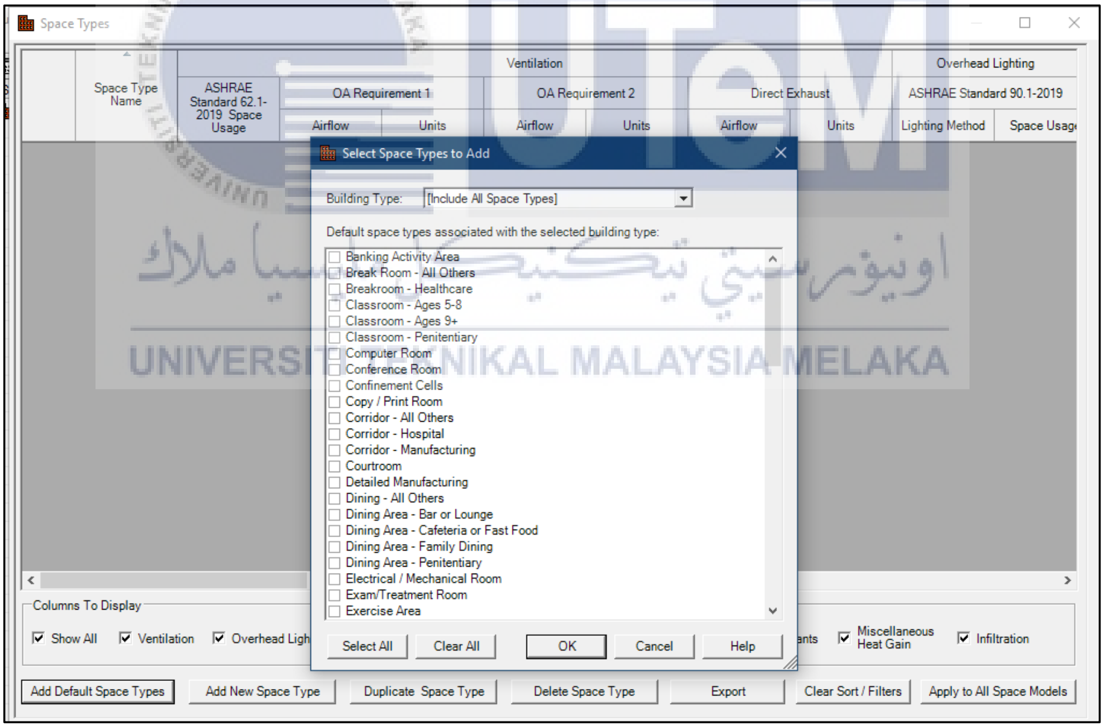
3.6.3 Space Type

Spaces Types allows to categorize different areas within the building based on function and occupancy. By classifying spaces such as offices, meeting rooms, or common areas to adjust HVAC solutions to meet the specific thermal demands and occupancy patterns of each space.

When selecting properties for a bungalow, it is advisable to consider hotel properties as they share certain similarities and characteristics that align closely with those of bungalows. The rationale behind this recommendation lies in the analogous features and functions that often define both types of establishments, making hotel properties a relevant and suitable reference point for bungalow selection.

By opting to select hotel properties in proximity to bungalows, one can leverage the shared attributes such as the focus on comfort, aesthetics, and a relaxed atmosphere. This approach facilitates a more targeted and contextually relevant analysis when considering design, amenities, and overall ambiance for bungalow properties. The close alignment between bungalows and hotel properties allows for the extraction of valuable insights from the successful operational and design aspects of hotels, contributing to the enhancement of bungalow properties.

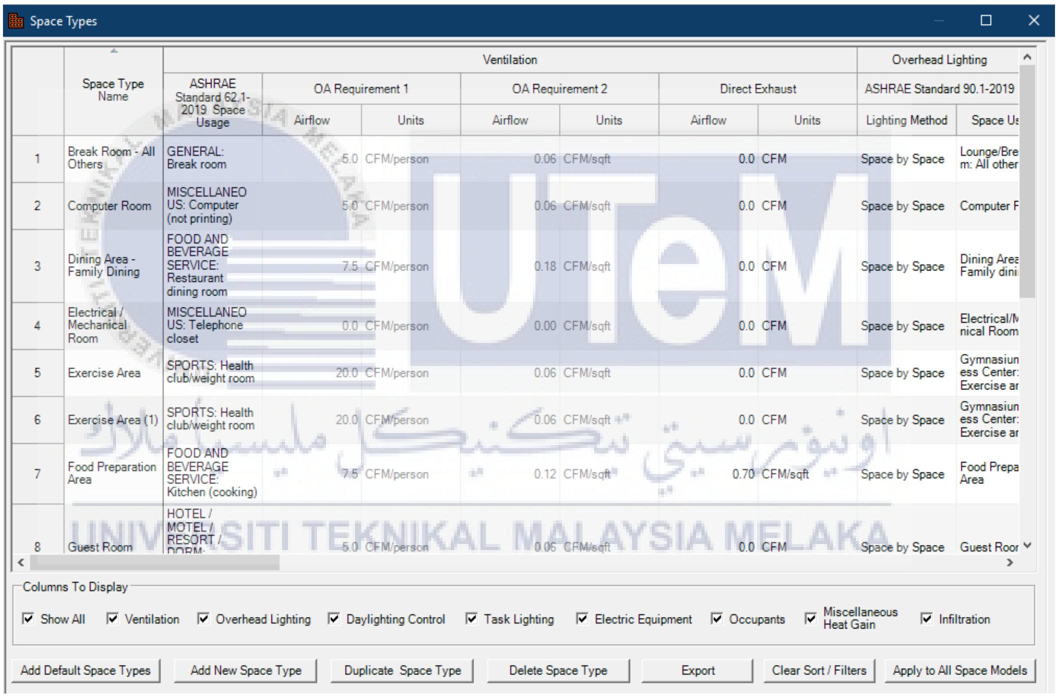
Furthermore, hotel properties frequently incorporate elements of hospitality, landscaping, and recreational facilities, which can inspire and inform the development of bungalows with similar properties.



3.17 Space Type Selection

The below figure illustrates a set of spaces that have already been designated and are ready for subsequent selection in the Space Models section. This figure below also representation serves as a preliminary overview of the chosen spaces, providing a brief overview of the area that have been earmarked for further evaluation and refinement within the space modeling phase.

Therefore, this setting is crucial to gain a clear and immediate reference point, enabling to methodically evaluate and validate the choices during the subsequent space modeling endeavors. The space models and space type been in separate setting to eliminating redundancy, ensuring that only pertinent spaces are brought into focus for more detailed modeling, analysis, and customization.



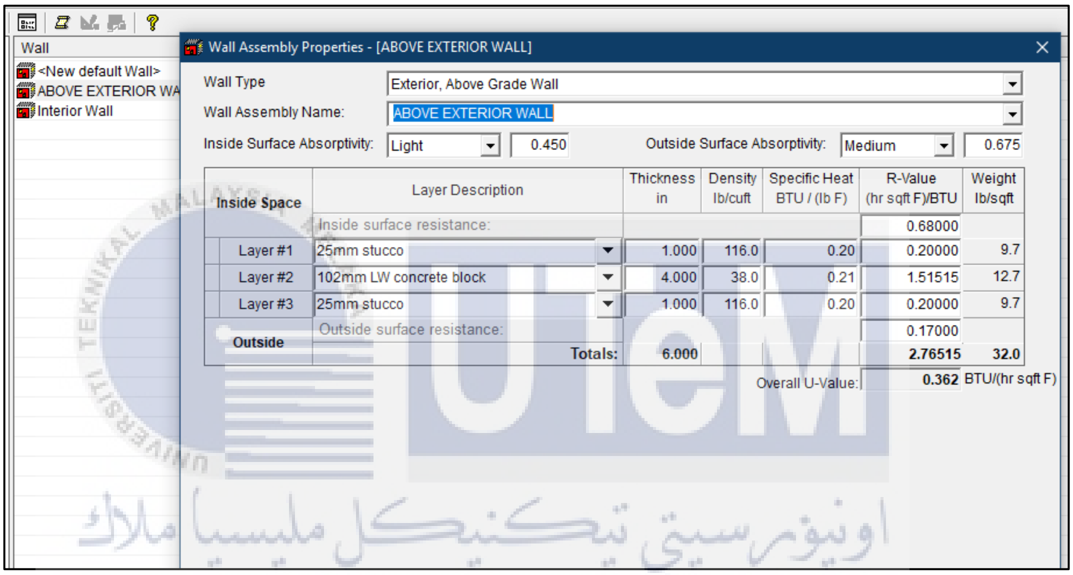
3.18 After Selection Space Type

3.6.4 Material

The Material setup involves specifying the properties of construction materials within the building envelope. This includes insulation, doors, floors, ceillings, windows, walls, and roofs. Accurate material representation is essential for simulating heat transfer characteristics, aiding in the evaluation of thermal performance and guiding decisions on energy-efficient design.

3.6.4.1 Walls

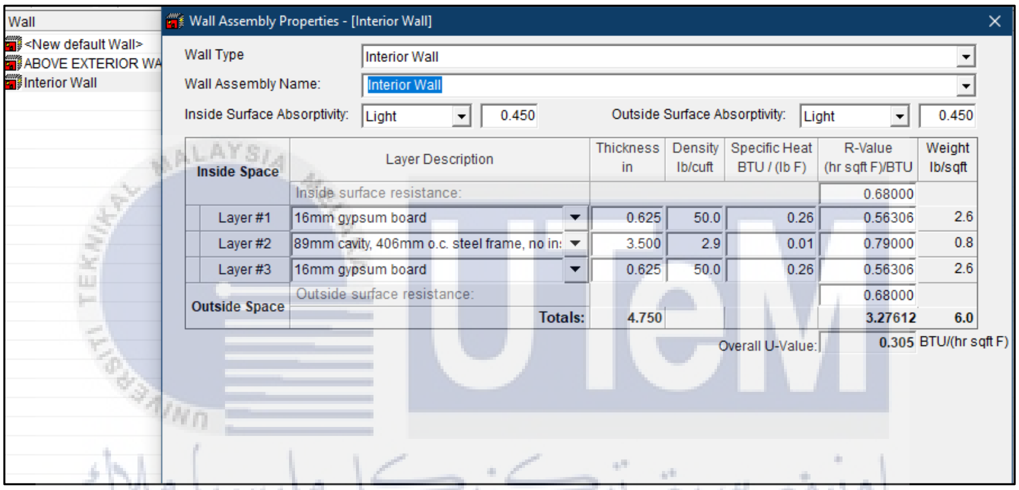
Walls constitute a fundamental component of a building's envelope, influencing its thermal performance. The material setup for walls in Hourly Analysis Program (HAP) involves specifying the composition, insulation, and other relevant properties. Accurate representation of wall materials is essential for evaluating heat transfer, conducting energy simulations, and ultimately optimizing the building's thermal efficiency.



3.19 Above Material Wall

In behalf of walls, it has two different setup which is exterior and interior. The exterior walls of a building play a critical material in shaping its thermal performance and overall energy efficiency. Due to Malaysia weather, where climate considerations and local construction standards, the material setup for exterior walls in HAP adopts a three-layered configuration to reflect the prevailing construction standards. This configuration involves a thoughtful arrangement of materials to optimize both thermal performance and structural integrity.

Serving as the outermost layer, the 1-inch stucco provides weather resistance and durability. Stucco is commonly utilized for its protective properties against the elements, enhancing the longevity of the building envelope. Positioned as the middle layer, the 4-inch LW concrete block contributes to both insulation and structural support. Lightweight concrete blocks are favored for their insulating properties, aiding in the regulation of internal temperatures while maintaining structural integrity. The final layer, again comprising 1-inch stucco, serves as an additional protective coating.

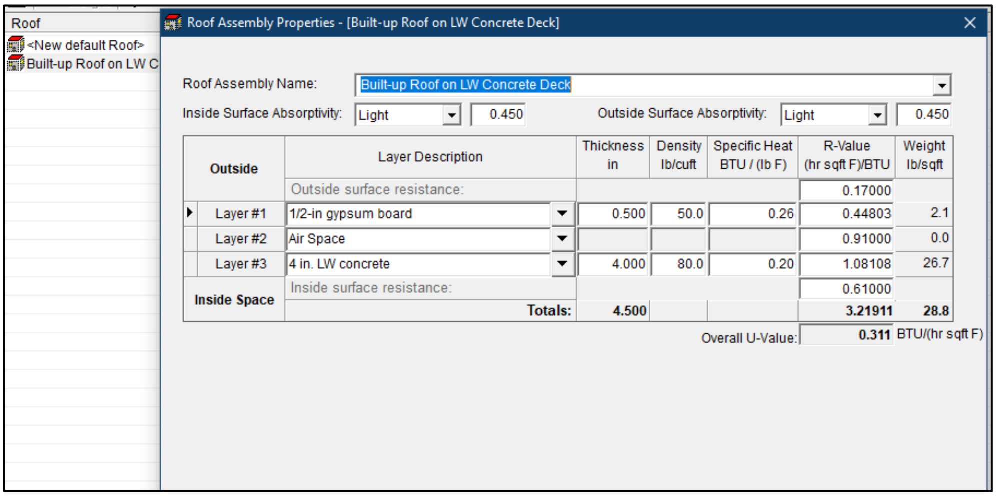


3.20 Interior Wall

For Interior Wall, the first layer is 5/8-inch gypsum board serves as the primary interior surface material. Second layer is 3.5-inch cavity and a robust 15-inch steel frame, highlighting the structural core of the interior wall assembly. While this layer does not incorporate insulation. The final layer was 5/8-inch gypsum board is repeated, forming the interior surface of the wall.

3.6.4.2 Roofs

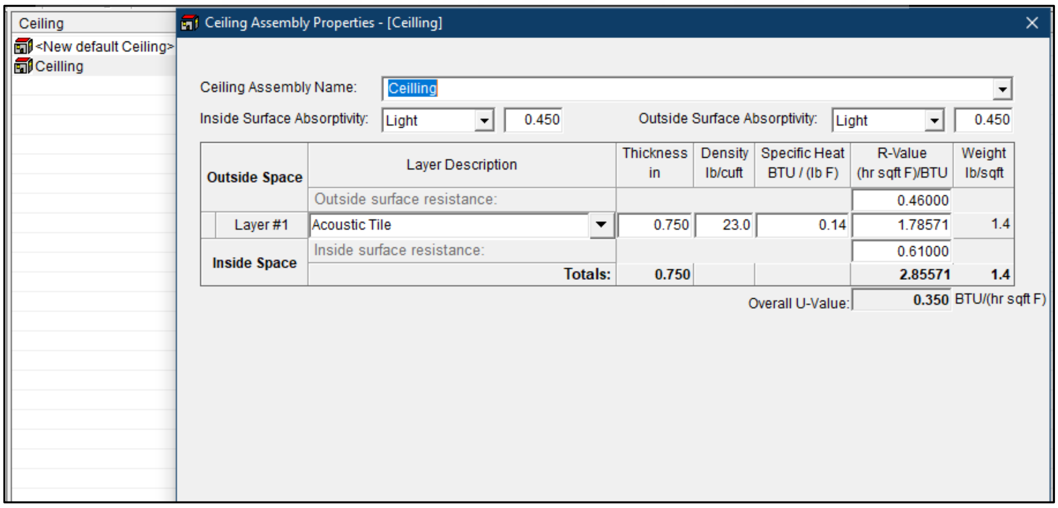
Roofing materials is a part of building, significantly impact the building's response to solar radiation and ambient temperature fluctuations. Roofing also got three layer to set up which is the first layer is 1/2-Inch gypsum board second layer is air space to prevent moisture(Kindangen, (1997) and the final layer was 4-Inch lightweight concrete.



3.21 Built-up Roof on LW Concrete Deck Setup

3.6.4.3 Ceillings

Positioned as the primary layer, acoustic tiles take center stage in this ceiling material setup. Acoustic tiles are renowned for their sound-absorbing properties, effectively dampening reverberations and echoes within a space.



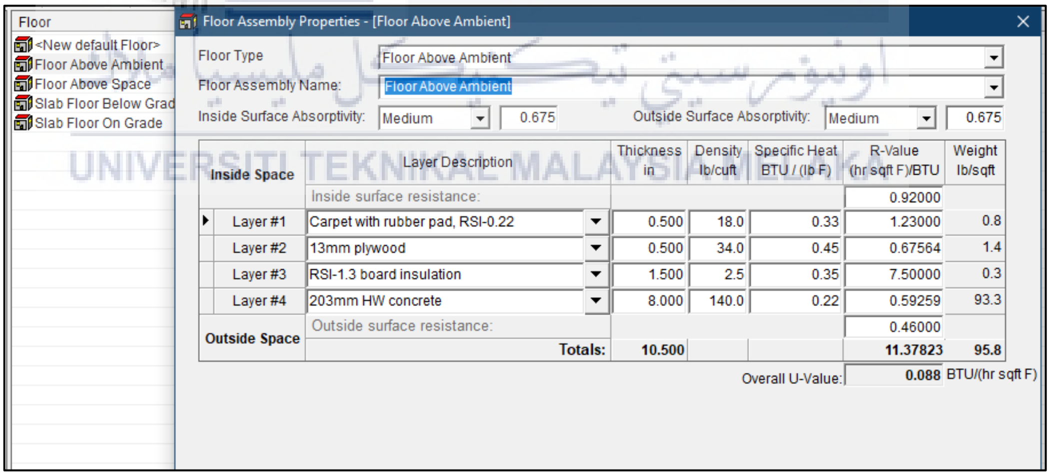
3.22 Ceilling Setup

3.6.4.4 Floors

Floor	Type	Overall U-value	Overall Weight
<New default Floor>			
Floor Above Ambient	Floor Above Ambient	0.088	95.8
Floor Above Space	Floor Above Space	0.312	95.5
Slab Floor Below Grade	Slab Floor Below Grade	0.733	70.0
Slab Floor On Grade	Slab Floor On Grade	0.733	70.0

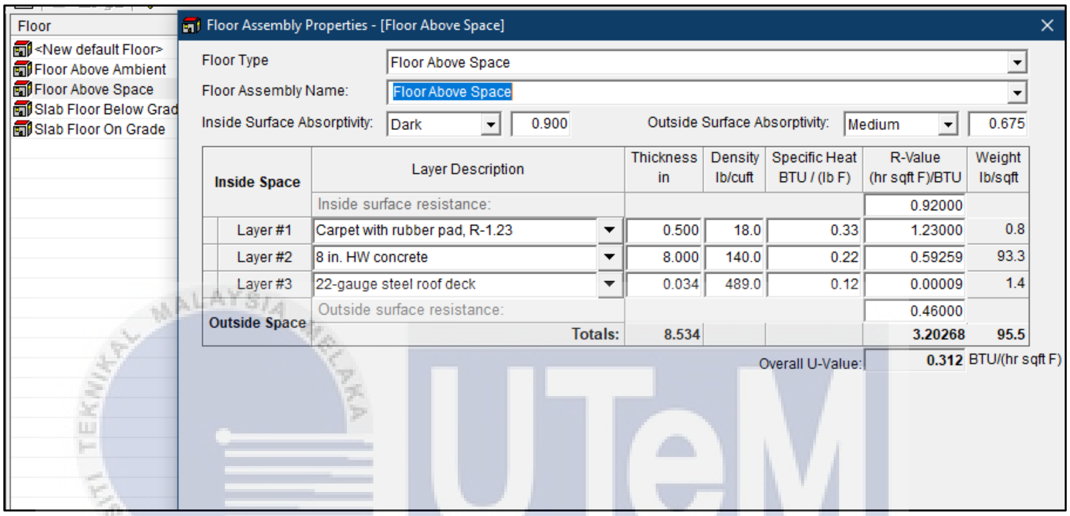
3.23 Type of Floor Setup

Floors have four distinct types that require specific configurations to ensure accurate results within the simulation. These include the floor above ambient, the floor above space, the slab floor below grade, and the slab floor on grade. Each floor type presents unique thermal characteristics and considerations that are essential for precision in the analysis conducted within the simulation.Positioned as the primary layer, acoustic tiles take center stage in this ceiling material setup. Acoustic tiles are renowned for their sound-absorbing properties, effectively dampening reverberations and echoes within a space.



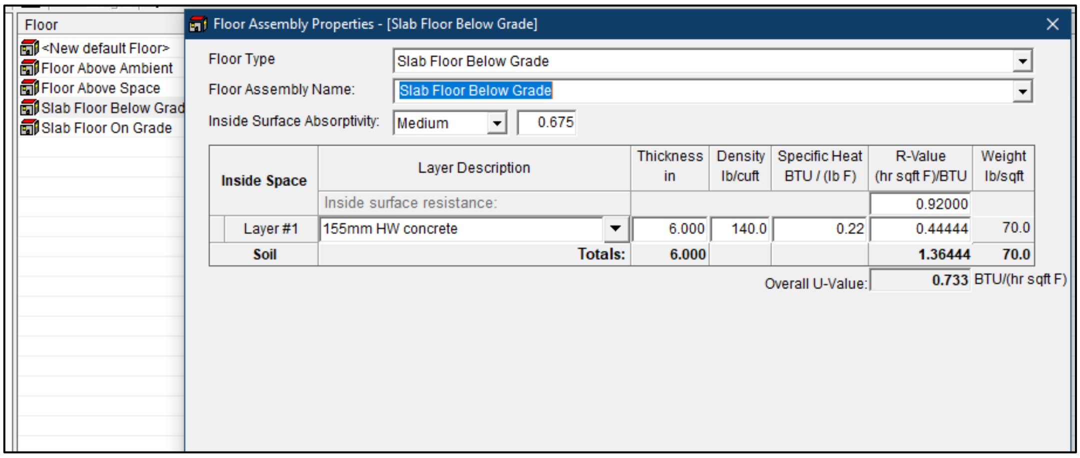
3.24 Floor Above Ambient Setup

The above figure represents a layered configuration specifically designed for the floor above ambient. This configuration consists of four distinct layers, each contributing to the overall thermal and structural properties of the floor. The first layer comprises a carpet with a rubber pad, possessing a thermal resistance of RSI-0.22. Following this, the second layer involves the inclusion of a 1/2-inch plywood material, providing a supportive substrate for the flooring assembly. The third layer introduces RSI-1.3 board insulation. The final layer consists of an 8-inch heavyweight concrete slab. This comprehensive layering approach is specifically tailored to the requirements of the floor above ambient, addressing considerations of insulation, support, and overall thermal efficiency.



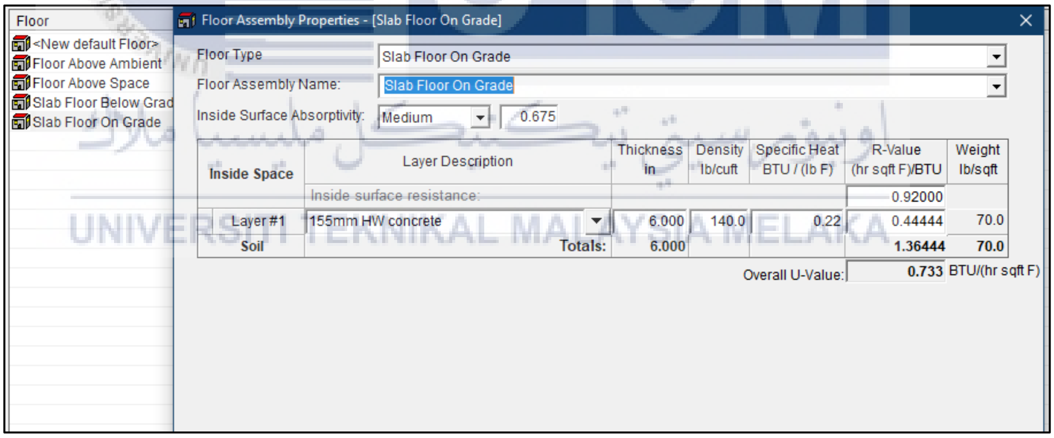
3.25 Floor Above Space

The second category is the floor above space, characterized by a composition of three distinct layers. In this configuration, the initial layer features a carpet with a rubber pad, denoted by a thermal resistance value of R-123. Subsequently, the second layer comprises an 8-inch heavyweight concrete, providing substantial mass and structural support to the floor assembly. The final layer consists of a 22-gauge steel roof deck.



3.26 Slab Floor Below Grade Setup

For the third category, the slab floor below grade, the configuration simplifies to a single layer consisting of a solid 6-inch heavyweight concrete. The 6-inch heavyweight concrete provides both structural support and thermal mass, offering an effective solution for maintaining stability and thermal efficiency in below-grade environments.

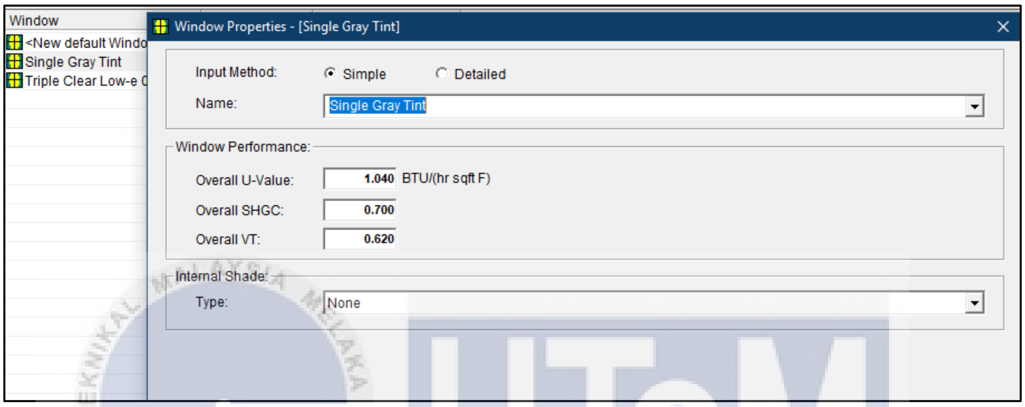


3.27 Slab Floor On Grade Setup

When addressing the slab floor on grade, the configuration streamlines to a singular layer, with the sole setting being a substantial 6-inch layer of heavyweight concrete. The use of a 6-inch heavyweight concrete layer ensures not only structural integrity but also serves as a reliable means of establishing thermal mass.

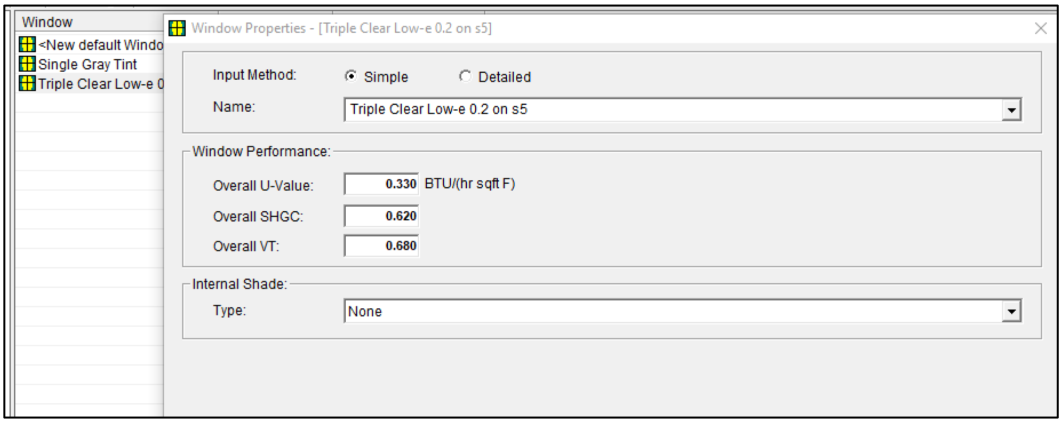
3.6.4.5 Windows

Windows are key elements in controlling natural light and ventilation, but they also influence heat gain and loss. This detailed configuration enables accurate simulations of solar heat gain and thermal performance, contributing to effective daylighting and energy management strategies.



3.28 Window (Single Gray Tint)

For windows, the establishment of a standardized configuration for a Malaysian house involves the implementation of single gray tints. This designated setup adheres to a consistent approach in which windows are uniformly equipped with gray-tinted glass. The utilization of single gray tints in the window setup aligns with prevalent design norms, offering a cohesive visual appearance while addressing considerations related to solar heat gain and privacy in a manner typical to Malaysian residential architecture.

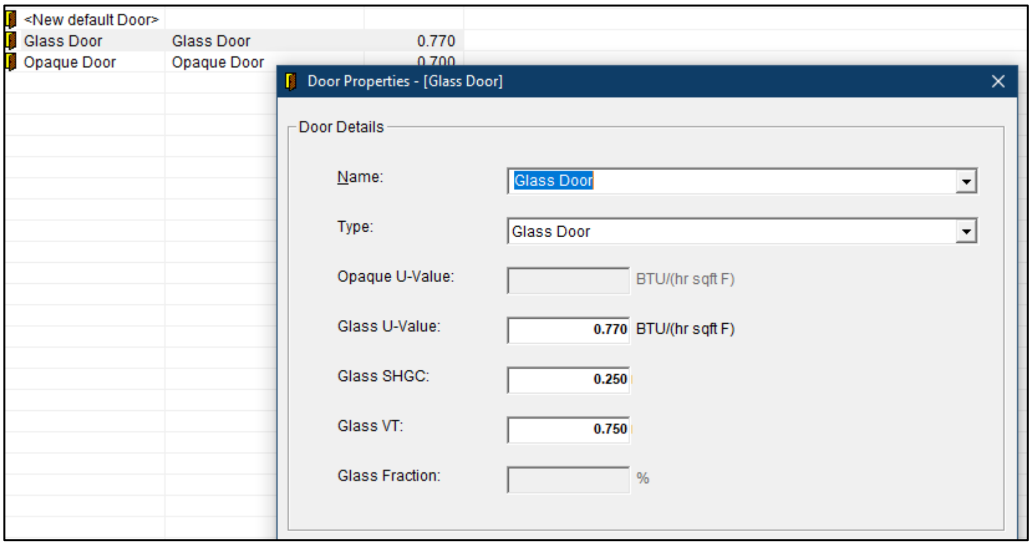


3.29 Window (Triple Clear Low-e On s5)

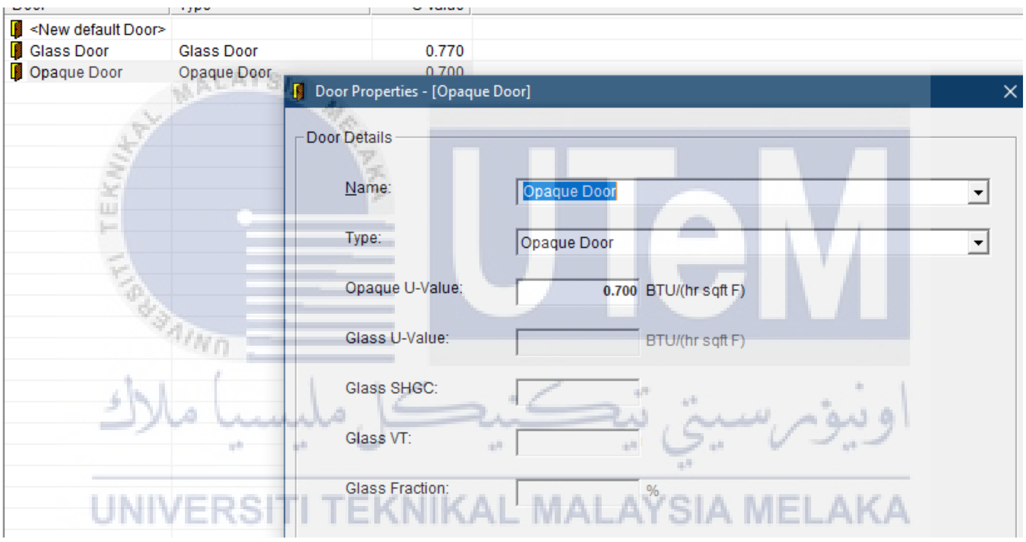
Considering that higher cooling load estimation is expected in Type B cases, a strategic decision has been made to implement a triple clear Low-e coating on surface s5. This deliberate choice stems from the objective of achieving superior results, where the thermal efficiency and overall energy performance are paramount considerations. By opting for a triple clear Low-e coating, an emphasis is placed on maximizing the window's ability to control heat transfer, reducing both heat loss and gain.

3.6.4.6 Doors

Door is like a portal to the building entrance, it is also important to consider in regulating thermal condition. This detailed configuration ensures an accurate assessment of heat transfer through doors, contributing to the overall thermal efficiency of the building.



3.30 Door (Glass Door)

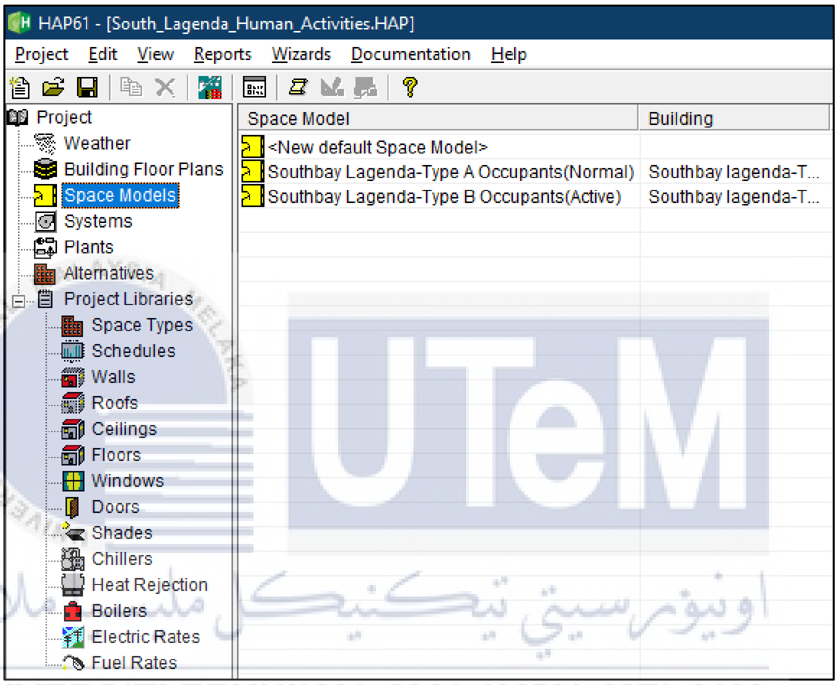


3.31 Door (Opaque Door)

Within the architectural of this bungalow, there exist two distinct types of doors, totaling a dual variety in the entryways. The first variant includes the glass door, introducing an element of transparency and a visual connection between the interior and exterior spaces. The second door type, conversly, comes with an opaque door, providing privacy and a sense of enclosure. Both of this type have huge different in R-values and U-values according to ASHRAE.

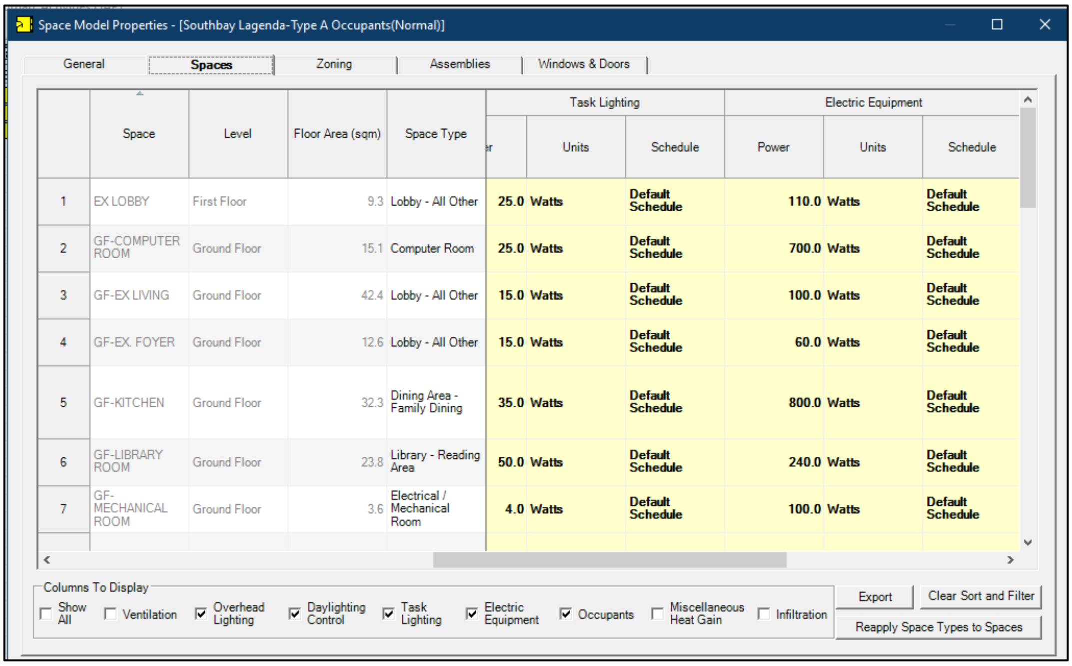
3.6.5 Space Model

Spaces Model is the component where to define the thermal properties and characteristics of individual spaces. This includes parameters such as setpoints, occupancy schedules, and internal loads. Creating a detailed Spaces Model ensures precise simulations of heating, cooling, and ventilation requirements for each zone within the building.

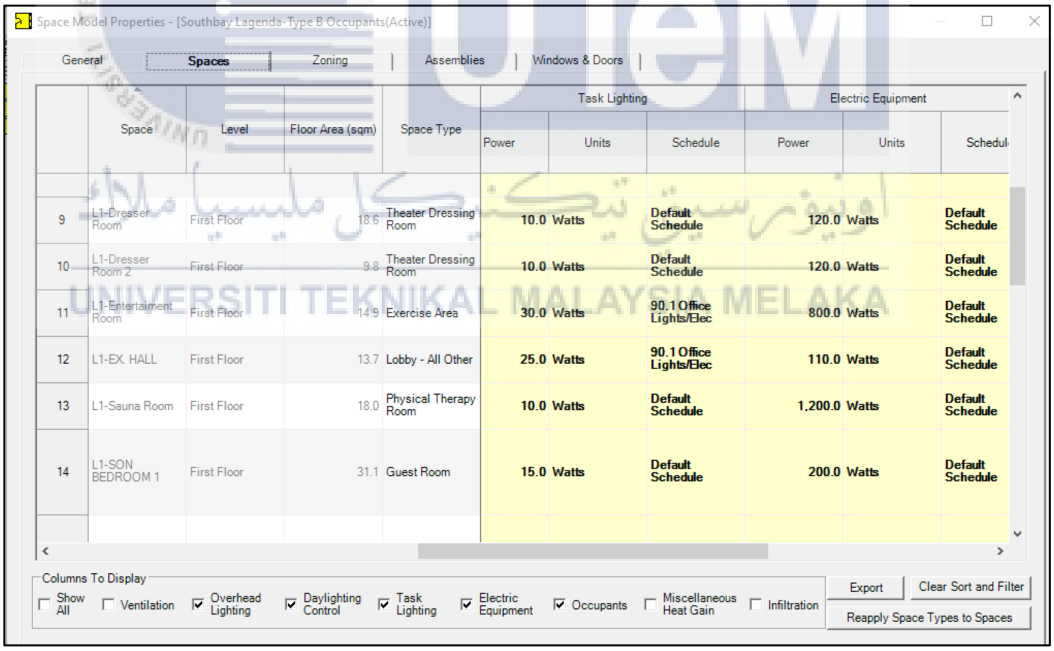


3.32 Space Models

The initial undertaking involves the creation of a new space model, a pivotal step that serves as the foundational cornerstone for both Type A and Type B configurations. This fundamental action is instrumental in establishing a designated framework tailored to the unique characteristics and requirements of each building type. This foundational step ensures a systematic and customized approach, laying the groundwork for subsequent detailed configurations within the Hourly Analysis Program (HAP).



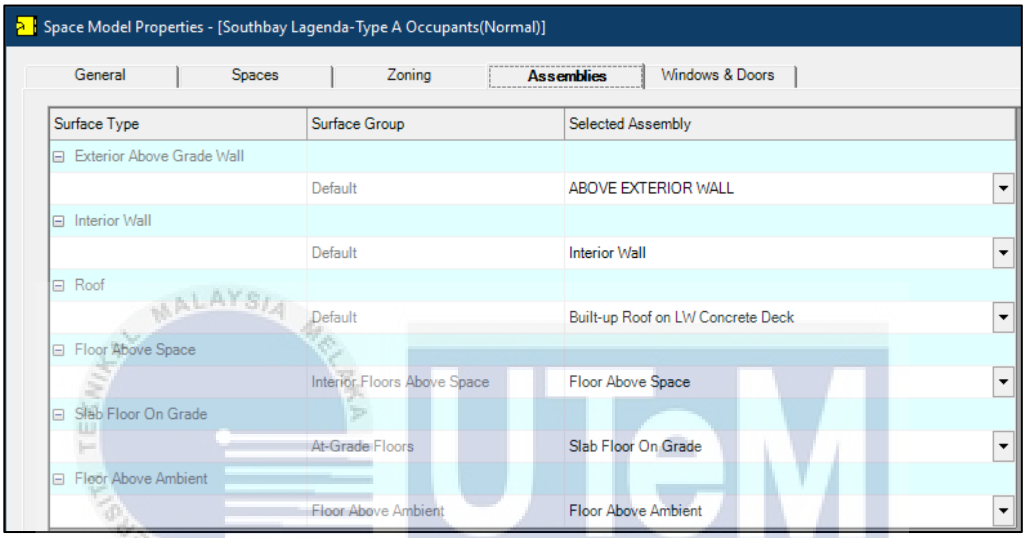
3.33 Type A Spaces Model Properties



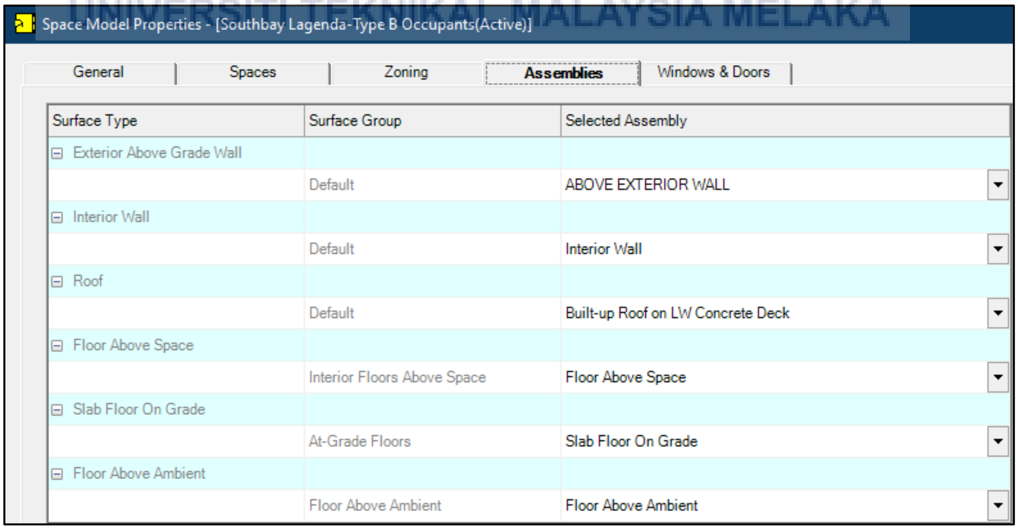
3.34 Type B Spaces Model Properties

Above figure is for Type A and Type B configuration within the spaces. After finalizing the details in the General section, navigate to the Spaces section to arrange the layouts of the building. For example, the GF-Computer Room, select the appropriate Space

Type that aligns with the characteristics of that room. Within this section, configure the electric equipment settings for each room, specify the total number of occupants in the room, and indicate the human activity level. This segment of the setup enables to define the specific features of each space, ensuring accurate representation and detailed modeling within the Hourly Analysis Program (HAP).

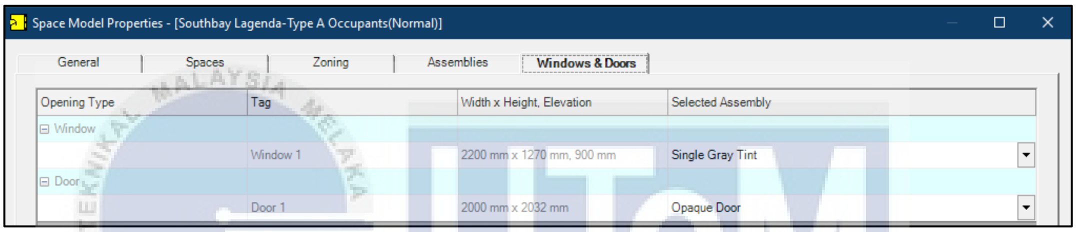


3.35 Type A Assemblies Space Model

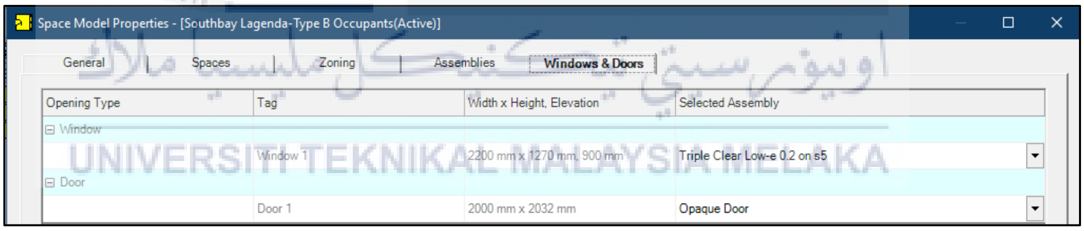


3.36 Type B Assemblies Space Model

Proceed to the Assemblies section following the initial Zoning setup. In the Assemblies section, make selections regarding the type of materials to be used in the construction of the building. This involves specifying materials for the exterior above-grade wall, interior wall, roof, floor above space, slab floor on grade, and floor above ambient. It's essential to note that for both Type A and Type B, the same materials are chosen for all the aforementioned types. This uniformity ensures consistency in material selection across various components, contributing to the enhancement of result accuracy within the Hourly Analysis Program (HAP).



3.37 Type A Windows & Doors Setup



3.38 Type B Windows & Doors Setup

Concluding the comprehensive setup involves the adjustment of window and door types. In the case of Type A, the specified window type is Single Gray Tint. Conversely, for Type B, a more tailored choice is made, utilizing Triple Clear Low-e 0.2 on s5 to meet the specific requirements of indoor spaces within Type B. This deliberate selection ensures optimal performance for Type B spaces. Moving on to doors, both Type A and Type B share a common material choice, utilizing Opaque Doors.

3.6.6 System

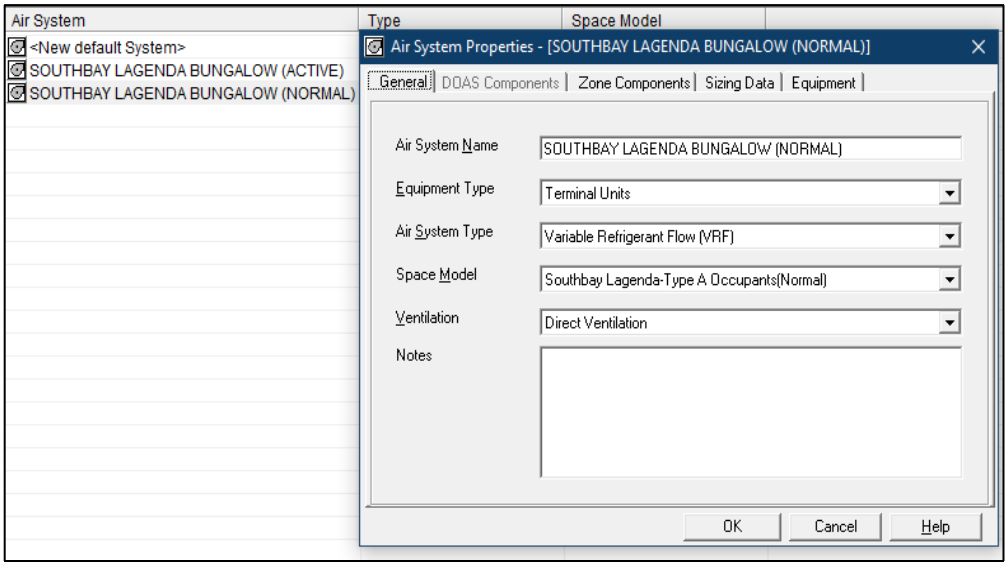
A System refers to the intricate network of components that collectively form the HVAC system within a building. This encompasses elements such as air handling units, chillers, boilers, fans, ductwork, and terminal units. The system setup process in HAP is designed to guide users through the configuration of these components, ensuring that each aspect is tailored to the unique requirements of the building and its occupants.

But for this bungalow, both Type A and Type B the suitable HVAC system are Variable Refrigerant Flow (VRF) as per advise from the professional.

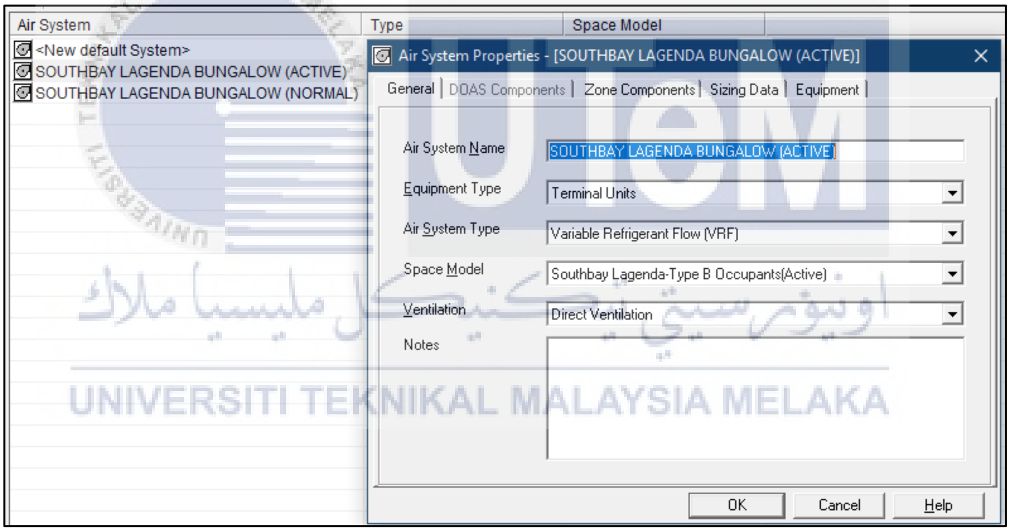
3.6.6.1 Type A and Type B

Selecting the appropriate HVAC system is a critical decision in building design. The Select System setup component in HAP allows users to choose and configure the HVAC system that best suits the building's requirements. This includes selecting equipment such as air handlers, chillers, and boilers, and specifying system control strategies. Proper system selection is essential for achieving optimal thermal comfort and energy efficiency.

But for this bungalow, both Type A and Type B the suitable HVAC system are Variable Refrigerant Flow (VRF) as per advise from the professional.

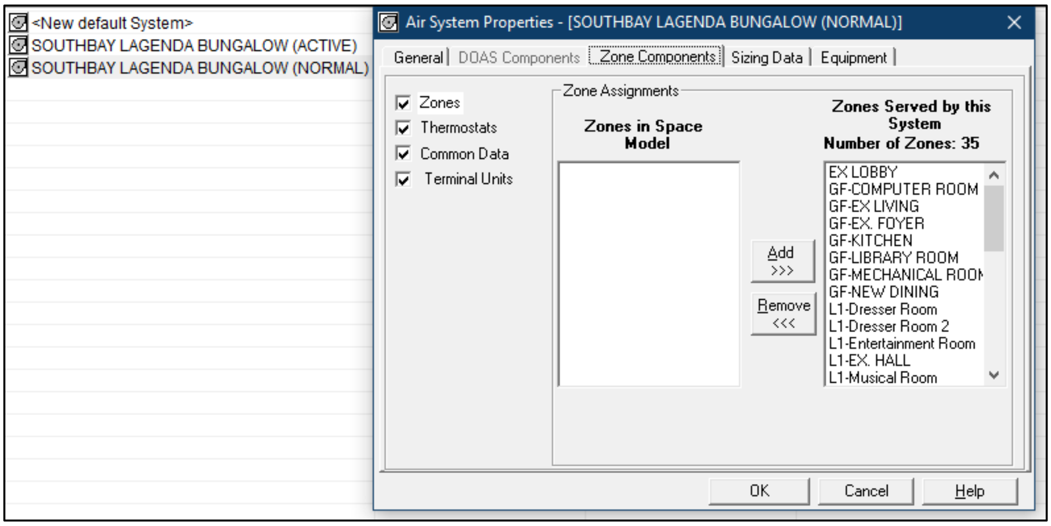


3.39 Type A General System Setup

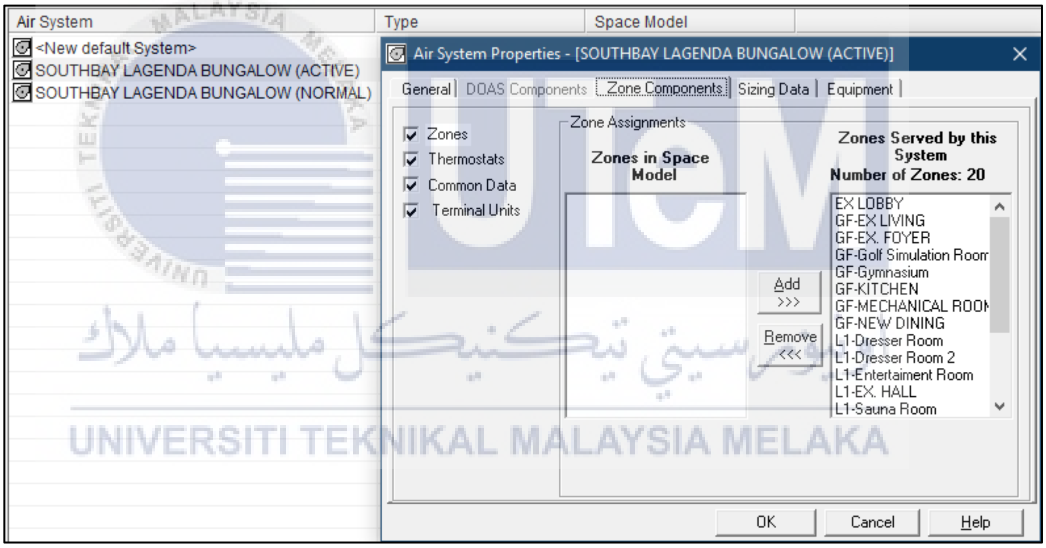


3.40 Type B General System Setup

Initially, within the equipment type category, the designated choice involves opting for the terminal unit. Subsequently, the next pivotal adjustment includes an adjustment of the air system type to Variable Refrigerant Flow (VRF), with a crucial additional requirement being the selection of the space model specifically for Type A and Type B considerations. Finally, for ventilation preferences, the directive is to select for direct ventilation.

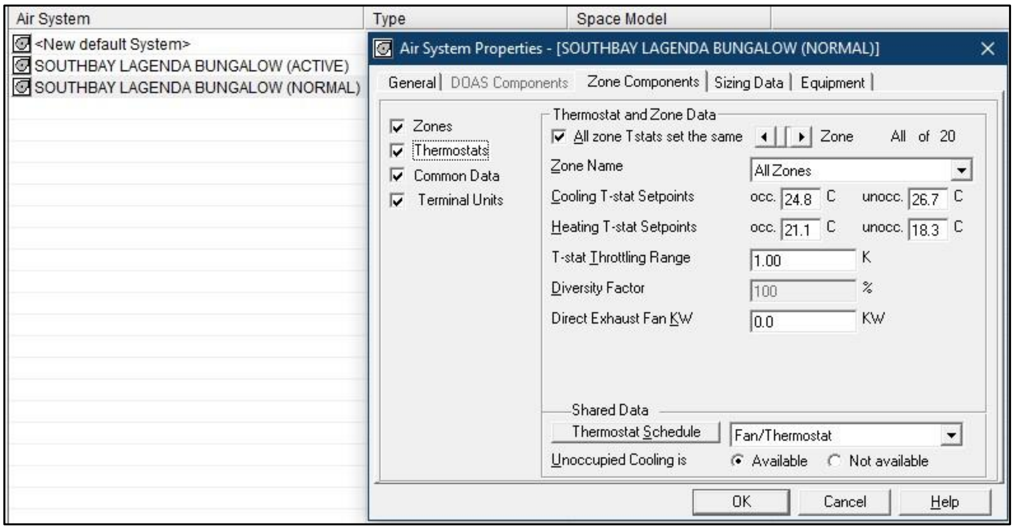


3.41 Type A Zone Served by the System

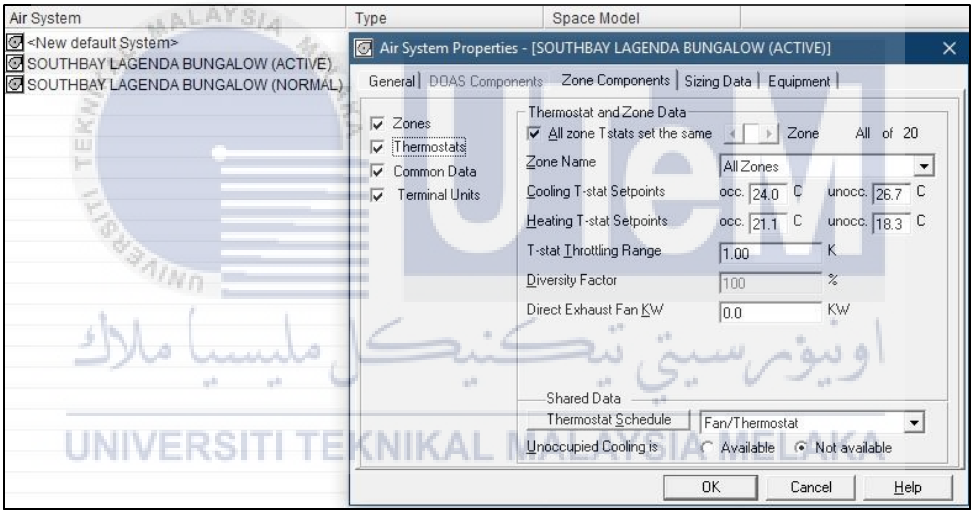


3.42 Type B Zone Served by the System

After the previous steps, the next task involves incorporating all zones in the Space Model under "Zones Served by this system." This action is taken to clarify which areas require cooling from the HVAC system. Adding each zone to this model ensures a clear representation of the connection between the HVAC system and the specific spaces in the building that need cooling. This aids in understanding which zones are part of the cooling process, enhancing the accuracy and effectiveness of the HVAC setup.

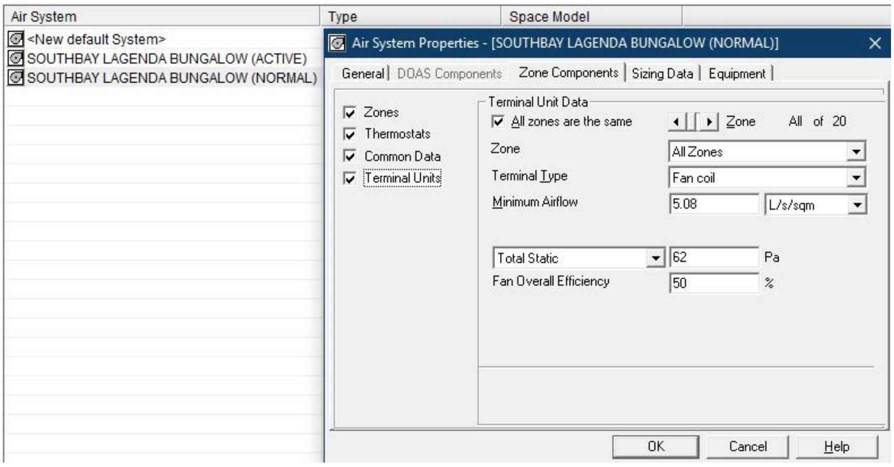


3.43 Type A Thermostats Setup

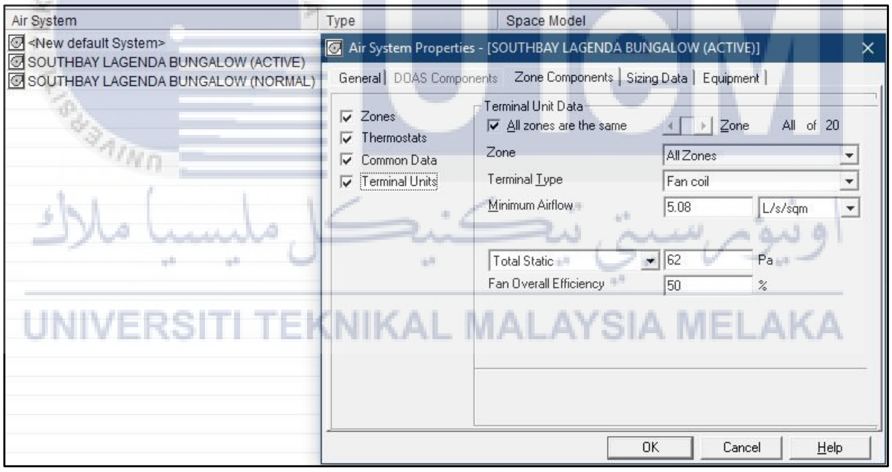


3.44 Type B Thermostats Setup

Next modifying the settings within Zone Components. Specifically, both Type A and Type B share identical configurations for Thermostats Cooling T-stat Setpoints, maintaining values of 24.8 degrees Celsius for Occupied periods and 26.7 degrees Celsius for Unoccupied periods. Another critical setting that requires attention in Zone Components is the selection of the Thermostat Schedule, with the recommendation to choose Fan/thermostat for optimal performance and energy management. This meticulous configuration ensures that both Type A and Type B zones adhere to consistent and efficient temperature control, promoting energy efficiency and occupant comfort.

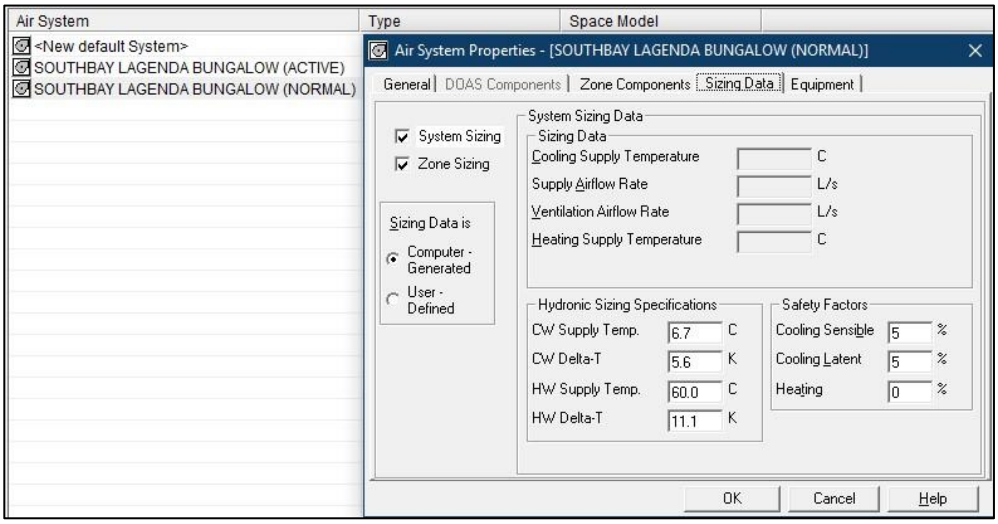


3.45 Type A Terminal Unit Setup

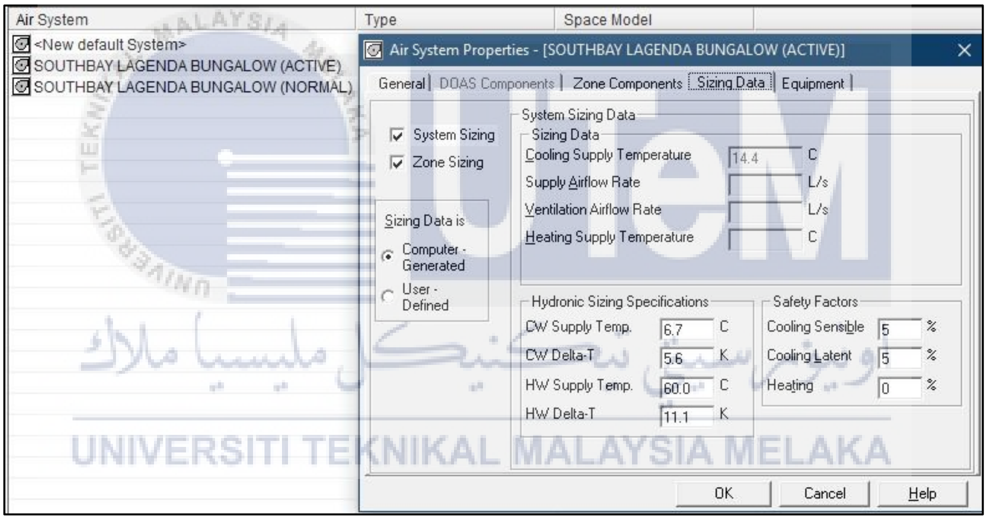


3.46 Type B Terminal Unit Setup

Furthermore, still within the Zone Components section, proceed to the Terminal Unit panel to make adjustments. Specifically, change the Minimum Airflow to 5.08 L/s/sqm. Simultaneously, modify the Total Static to 62Pa, and set the Fan Overall Efficiency to 50%. These small changes in the Terminal Unit settings contribute to the fine-tuning of the system, optimizing airflow, static pressure, and fan efficiency.



3.47 Type A Sizing Data

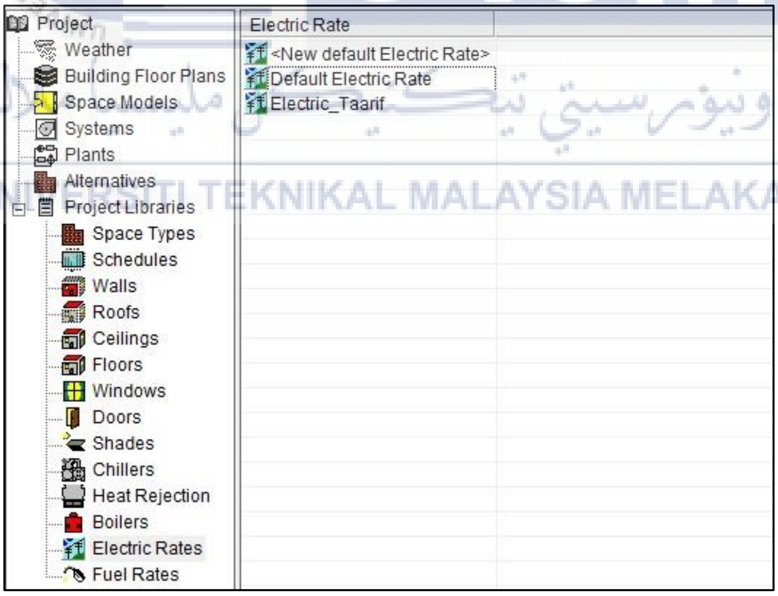


3.48 Type B Sizing Data

Above figure is the final configuration within the Air System Properties entails adjusting the Safety Factor. Specifically, set Cooling Sensible for 5% and Cooling Latent for 5%. By setting Cooling Sensible and Cooling Latent at 5%, this deliberate adjustment adds a layer of precision to the overall performance of the HVAC system, aligning with specified criteria and enhancing its capability to efficiently manage both sensible and latent cooling requirements.

3.6.7 Electric Rates

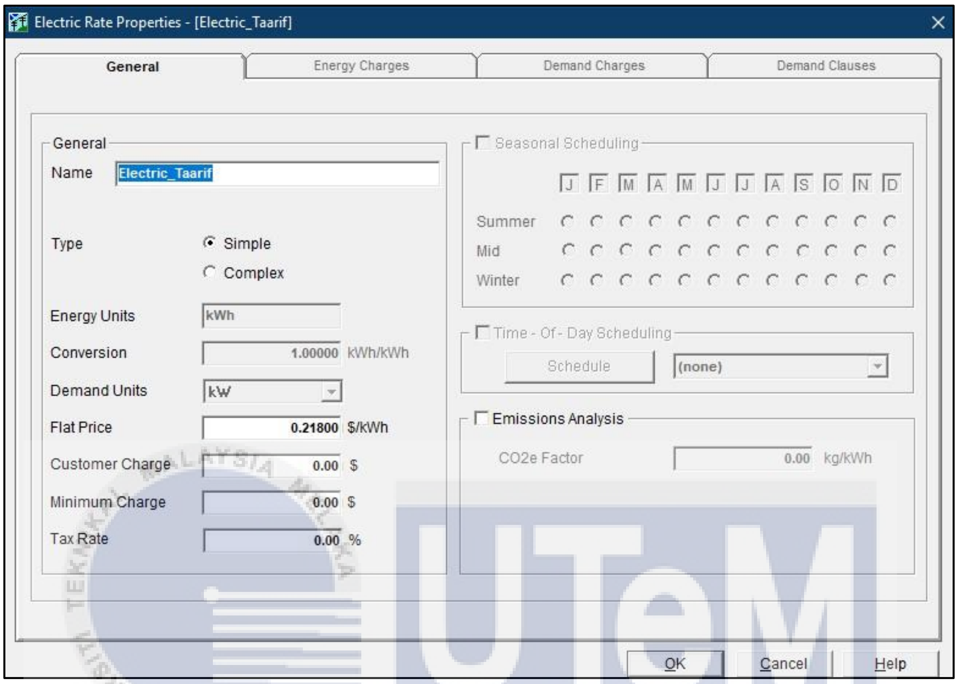
Tenaga Nasional Berhad (TNB) has long been recognized as the primary provider of electricity in Malaysia, serving the energy needs of millions of residential consumers. The electric tariff set by Tenaga Nasional Berhad (TNB) represents a multifaceted approach to pricing, encompassing various considerations such as consumption levels, sustainability, and affordability. Electric rates represent the cost of electrical energy consumed by a building's HVAC system, forming a critical input for the economic analysis within Hourly Analysis Program (HAP). These rates are dynamic, subject to fluctuations based on factors such as time of day, season, and overall demand on the electrical grid. Hourly Analysis Program (HAP) consideration of electric rates enables a nuanced analysis of energy consumption patterns, empowering users to make informed decisions regarding system design, operation, and efficiency.



3.49 Electric Rates Section

The diagram above displays the Electric Rates section, requiring manual input of the tariff. In the case of this particular bungalow, it is advisable to employ the tariff specified by

Tenaga Nasional Berhad (TNB) for residential properties. The setup involves establishing a single rate applicable to both Type A and Type B, simplifying the process for increased efficiency and convenience.



3.50 Electric Rates Setup

TARIFF CATEGORY	UNIT	CURRENT RATE
Tariff A - Domestic Tariff		
For the first 200 kWh (1 - 200 kWh) per month	sen/kWh	21.80
For the next 100 kWh (201 - 300 kWh) per month	sen/kWh	33.40
For the next 300 kWh (301 - 600 kWh) per month	sen/kWh	51.60
For the next 300 kWh (601 - 900 kWh) per month	sen/kWh	54.60
For the next kWh (901 kWh onwards) per month	sen/kWh	57.10
The minimum monthly charge is RM3.00		

3.51 Tariff Category by Tenaga Nasional Berhad (TNB)

A straightforward process involves renaming it as "Electric Tariff" for better recognition and adjusting the fixed price as per Tenaga Nasional Berhad (TNB) guidelines. This modification ensures clarity and alignment with established standards, streamlining the management of electric pricing for enhanced user convenience.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Overview

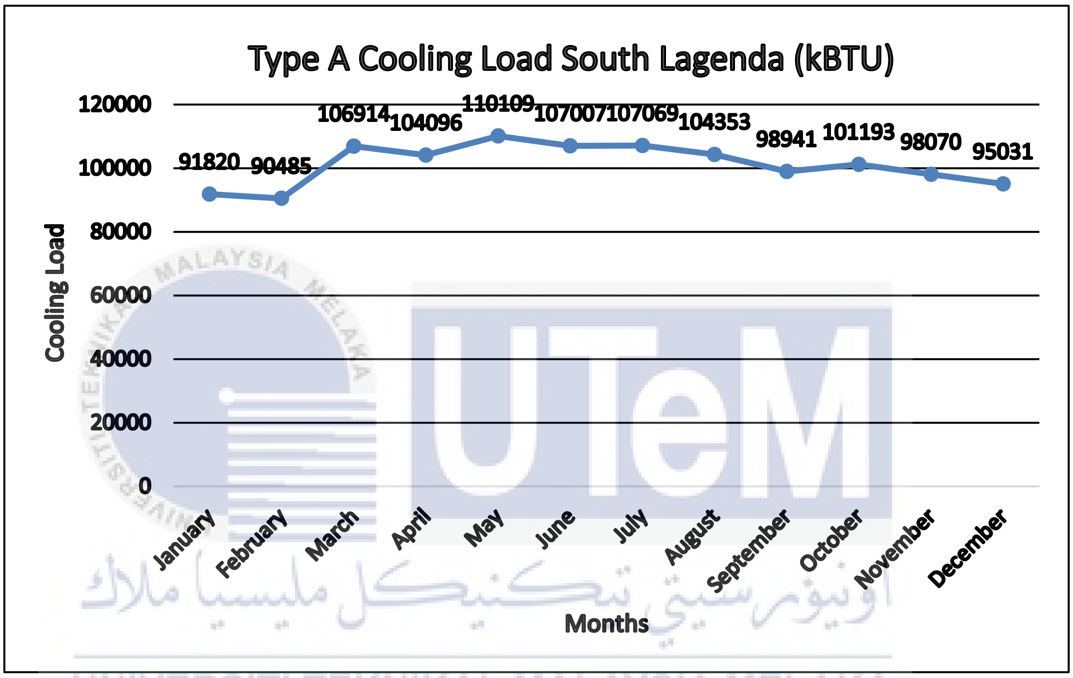
A key to gain lower overall energy consumption and high comfort levels experienced by occupants is to design the building with a good insulation of structures selection. As global concerns regarding energy sustainability and climate change intensify, there is a growing need to explore innovative approaches to enhance the energy efficiency of residential buildings. Thus, this chapter go through the outcomes from the software with focus on cooling load estimation and energy consumption by per month or annual of South Lagenda bungalow building layout. By placing the changing patterns of human activities in Type A and Type B could be a massive difference.

Residential buildings air conditioning system also effected by various factor such as building design, building specification, climate, bearing of the sun, and human activity in their confined space. Tradional design of residential house approach to get a poor result of cooling load estimation and high in energy consumption since the thermal absorptivity is low (Webb, A. L. (2017). By the advantages of Hourly Analysis Program (HAP), allow us to examines in-detail of the human activities by different layout of the building.

4.2 Cooling Load

The result data is obtain from the summary report in Hourly Analysis Program (HAP). The chart shows cooling load estimation for both Type A and Type B. In January, Type A : Normal is lower than Type B : Active

4.2.1 Type A Cooling Load Estimation



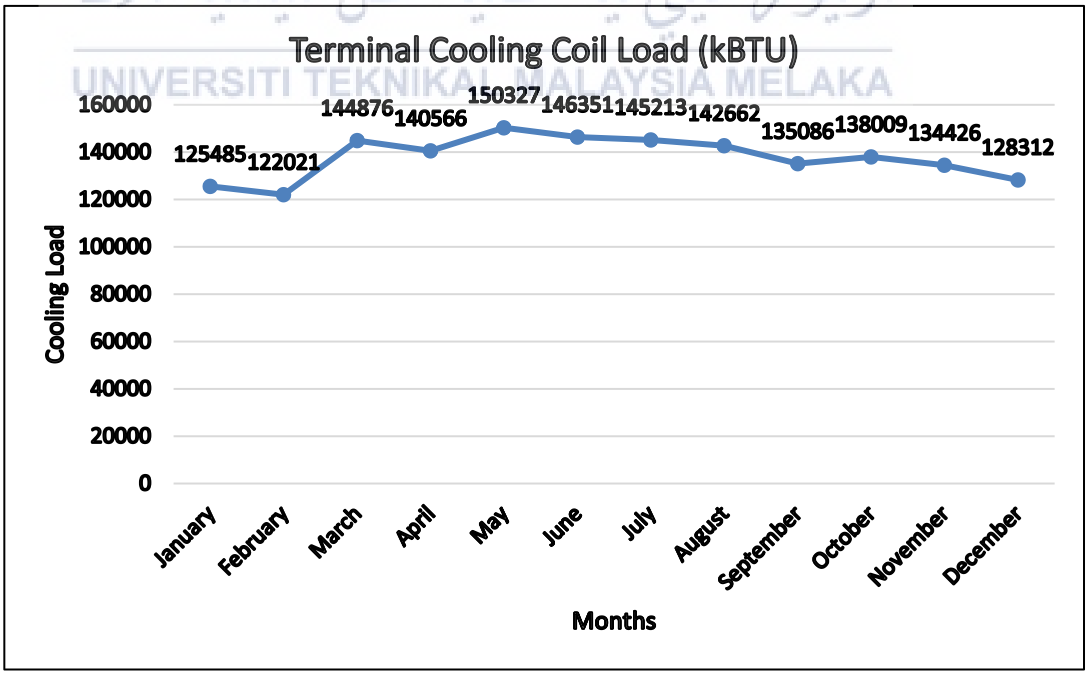
4.1 Type A Cooling Load Estimation

The data presented above represents the monthly Type A Cooling Load in South Lagenda, measured in thousands of British Thermal Units (kBTU). Looking at the data, we notice a trend in cooling needs that follows the seasons. Summer months, such as June, July, and August, stand out with higher cooling loads ranging from 104,353 kBTU to 107,069 kBTU. This isn't surprising, as the hotter weather during these months usually means more demand for cooling systems.

Conversely, in monsoon, particularly in December, January, and February, the cooling load drops to values between 90,485 kBTU and 95,031 kBTU. As temperatures decrease, there's less need for cooling, and this pattern repeats annually.

While the seasonal trends are apparent, let's take a closer look at each month's cooling load. March and May, for example, have higher values (106,914 kBTU and 110,109 kBTU) compared to nearby months. This could be due to the changing weather as temperatures start to rise, requiring more cooling before reaching peak summer levels. In September, the cooling load slightly decreases to 98,941 kBTU, signaling the shift from summer to rainy. October and November show small increases with values of 101,193 kBTU and 98,070 kBTU as temperatures continue to decrease. Analyzing the Type A Cooling Load data in South Lagenda uncovers clear seasonal and monthly patterns, offering insights for better energy planning.

4.2.2 Type B Cooling Load Estimation



4.2 Type B Cooling Load Estimation

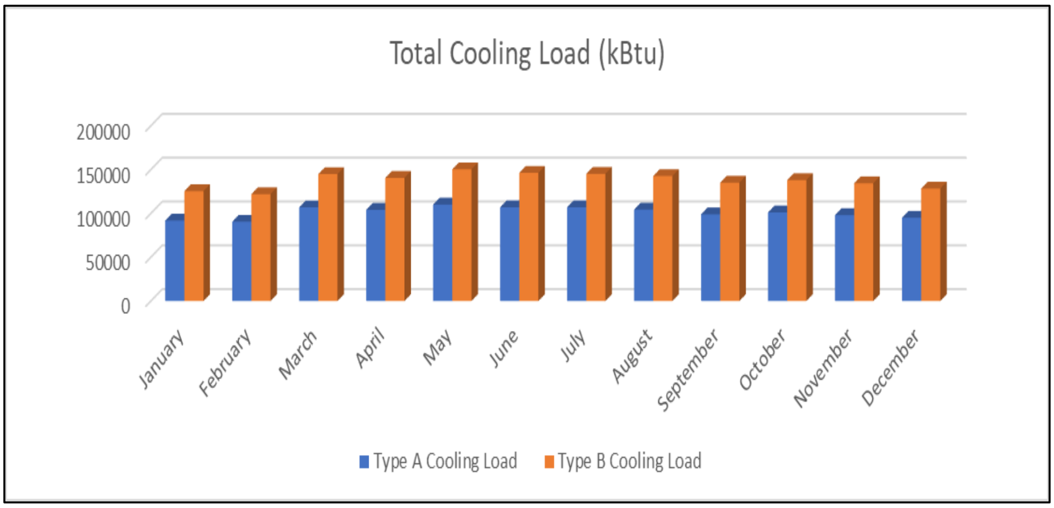
Type B Cooling Load Estimation closely mirrors the observed trends in Type A Cooling Load, providing a comprehensive view of the cooling dynamics in South Lagenda Bungalows.

During the summer months of May, June, and July, there is a noticeable increase in the Type B Cooling Load, ranging from 145,213 kBTU to 150,327 kBTU. This increase is not solely due to warmer temperatures but is intricately connected to another key factor: the extra heat generated by electrical equipment during the summer. With higher outdoor temperatures, air conditioning systems work harder, leading to more heat being released from electrical devices. This insight underscores the dynamic relationship between the external climate and the internal contributors to overall cooling load.

Conversely, as South Lagenda transitions into the rainy or monsoon season, as evidenced in the data for September, the Type B Cooling Load diminishes to 135,086 kBTU. This reduction aligns with a decrease in the heat generated by electrical equipment. Milder temperatures result in reduced demand for extensive use of HVAC systems, contributing to the observed decline in cooling load.

In conclusion, digging into Type B Cooling Load Estimation gives us a detailed look at how cooling works in South Lagenda. Recognizing the impact of heat gains from electrical equipment offers valuable information for this analysis. By considering both the weather and the electrical equipment used in the bungalow, effective plans can be devised to manage energy wisely.

4.2.3 Comparison between Type A Cooling Load and Type B Cooling Load



4.3 Type A and Type B Cooling Load Comparison Analysis

The monthly data for Type A and Type B Cooling Loads in South Lagenda provides a comprehensive perspective on the cooling dynamics, revealing variations influenced by occupant behavior and building layouts. Analyzing these datasets together offers insights into the nuanced interplay between user activities, electrical equipment usage, and cooling load requirements.

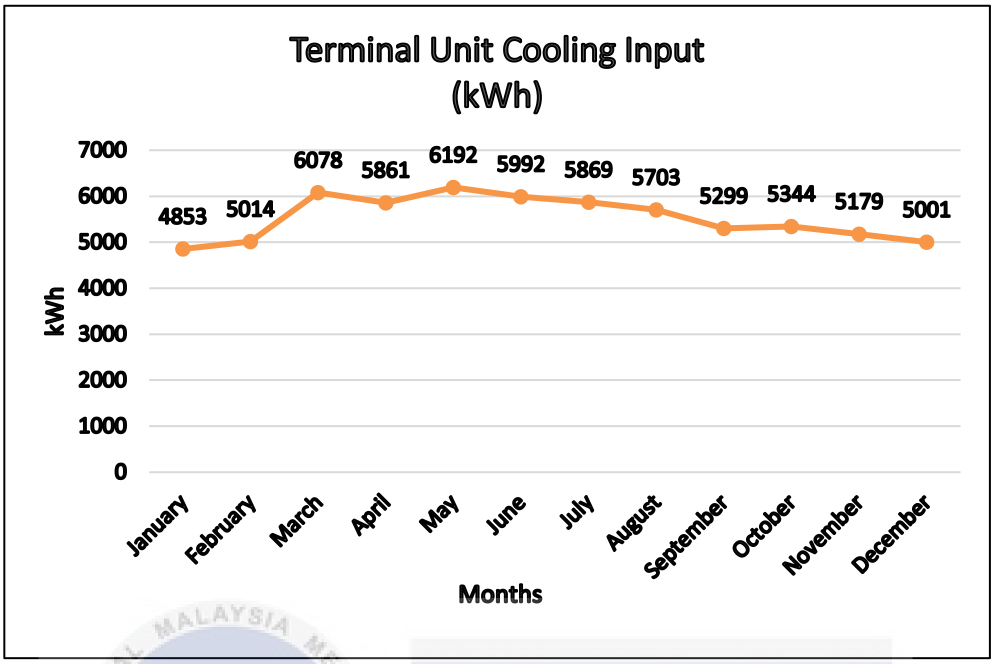
Walking through the numbers, noticeable how the cooling loads change in both Type A and Type B. The monsoon months of January, February, and December show that both types need less cooling, responding calmly to the cooler temperatures. However, in this quiet movement, Type B consistently has a bit more cooling load, suggesting some subtle differences in what's needed. As summer steps in during March and April, there's a gentle increase in cooling loads for both types, with Type B always a bit ahead. This suggests a growing need for cooling as the temperature rises, especially in spaces with more active people and lots of electrical equipment. In May and June, the cooling loads for both types reach their peak. However, the data for Type B, hitting as high of 150,327 kBTU in May.

Type A Cooling Load is lower since the occupants are ordinary individuals, and the amount of electric equipment is minimal. This is primarily because the building layout adheres to standard house spaces, featuring areas like a library, tearoom, and computer room. In contrast, Type B encompasses a multitude of spaces that emit latent heat from the human body, including a Gym, Sauna room, Exercise area, and a Music Equipment room. he building layout for Type B is notably abundant with various electric equipment, such as treadmills and numerous other electrical devices. As a result, building layouts and electrical equipment plays a crucial role when designing a bungalow and need a precise cooling load estimation to make sure reach a comfort level of human in the building.

4.3 Energy Consumption

Accurate cooling load estimations are pivotal for optimizing energy consumption in HVAC systems, crucial for efficiency and cost-effectiveness. Inaccuracies in these estimations can lead to challenges such as oversizing, where the system is larger than necessary, causing inefficient operation and waste of electric energy. But if undersizing may result in inadequate cooling, increased energy consumption, and compromised comfort. Both scenarios, whether oversizing or undersizing, introduce inefficiencies with economic implications.

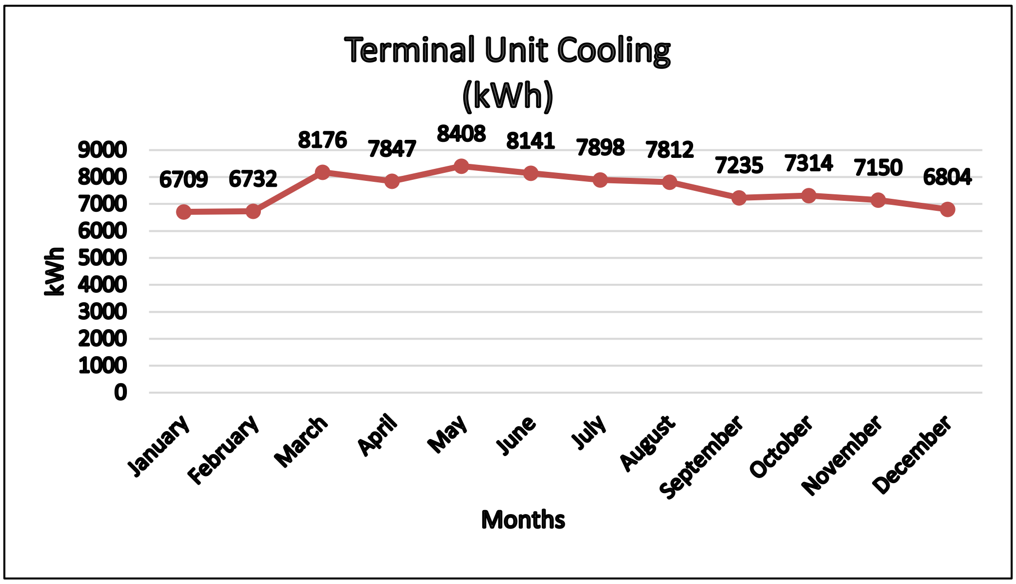
4.3.1 Type A Energy Consumption



4.4 Type A Energy Consumption

This analysis focuses on the monthly data for terminal unit cooling input, seeking to unveil insights into the energy consumption of Type A. Notably, the cooling input ranges from 4,853 kWh in January to 6,078 kWh in March, demonstrating a discernible increase as monsoon transitions into normal hot day in Malaysia. This upward trend continues through May, where the input reaches 6,192 kWh, indicating a peak during the warmer months. Comparing the terminal unit cooling input data with the previously analyzed cooling load for Type A reveals interesting insights. The months with higher terminal unit cooling input, such as March, May, and June, correspond to periods of increased cooling load, as observed in the cooling load data.

4.3.2 Type B Energy Consumption

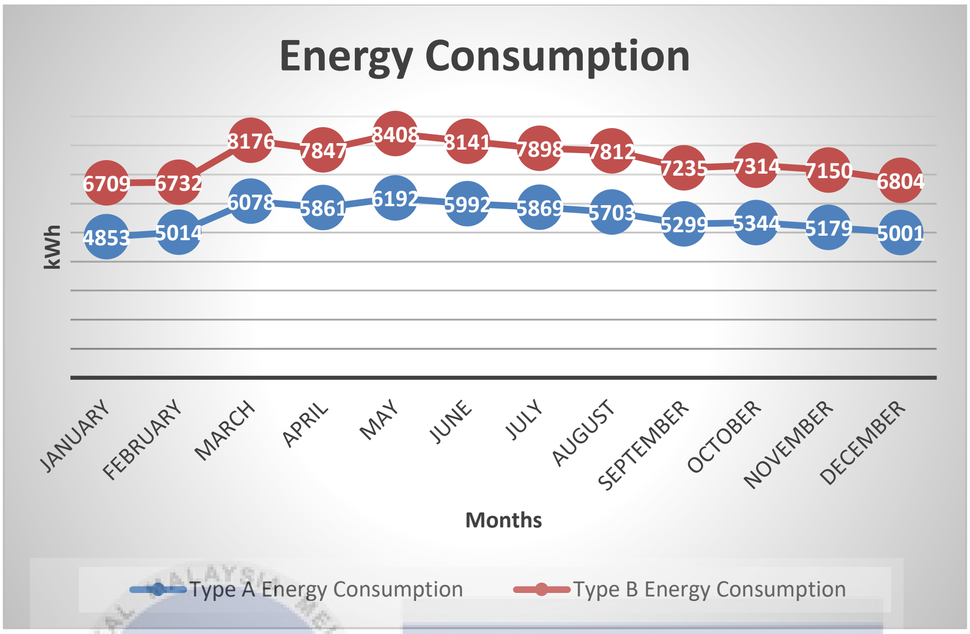


4.5 Type B Energy Consumption

The monthly data representing terminal unit cooling input for Type B offers a detailed perspective on the energy consumption patterns throughout the year. The journey begins in January with a modest 6,709 kWh of cooling input, marking the commencement of the year when the demand for cooling is relatively low. As the months progress, a strong trend arises, showcasing a gradual increase in terminal unit cooling input. By March, this input has risen to 8,176 kWh, signifying the initial surge in energy consumption as the monsoon transitions into the summer.

May is the most remarkable high for terminal unit cooling input with 8,408 kWh. Meanwhile, the months of June and July maintain elevated levels, with 8,141 kWh and 7,898 kWh, respectively, suggesting sustained demand for cooling during the warmer months. As the summer almost ends, the graph shows begin to fall by September, the input has decreased to 7,235 kWh, the cooling temperature start to moderate.

4.3.3 Comparison between Type A Energy Consumption and Type B Energy Consumption



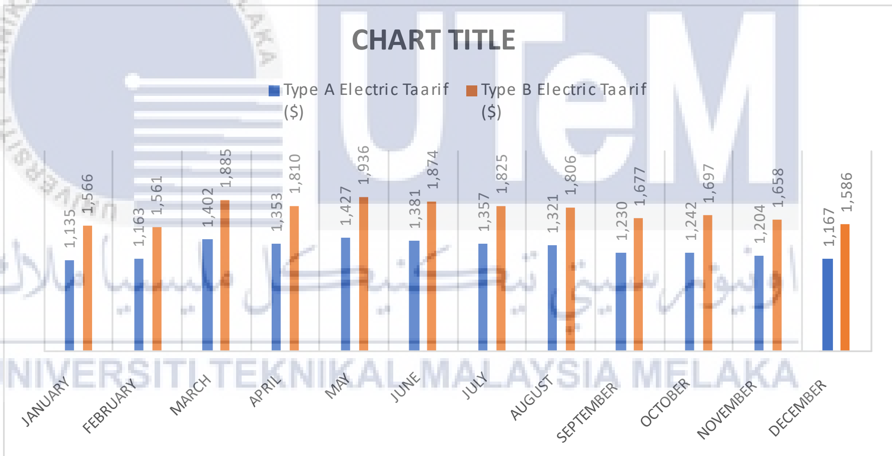
4.6 Type A and Type B Energy Consumption Analysis

This analysis focuses on the monthly energy consumption data for Type A and Type B, examining how the energy needs of these two categories vary throughout the year. Type A consumes 4,853 kWh, while Type B utilizes 6,709 kWh. This trend continues through February, March, and April, with Type A consistently consuming less energy than Type B. Notably, March and May mark significant increases in energy consumption for both types, with Type B consistently surpassing Type A.

The summer months of June, July, and August witness a slight decrease in energy consumption for both types, indicating a response to the warmer weather. However, Type B continues to have a higher energy consumption compared to Type A during these months. As the temperatures moderate in September and October, both types experience a reduction in energy needs. Analyzing the energy consumption alongside the previously examined terminal unit cooling input provides valuable insights. For both types, the months with higher terminal unit cooling input, such as March, May, and June, coincide with elevated energy consumption.

In conclusion, the analysis of energy consumption patterns for Type A and Type B provides a comprehensive understanding of their distinct needs throughout the year. While both types exhibit fluctuations in energy use in response to seasonal changes, Type B consistently demonstrates higher energy consumption compared to Type A, particularly during warmer months. During months of increased cooling load, both types register higher energy consumption, highlighting the interconnected nature of HVAC system dynamics.

4.4 Electric Tariff



4.7 Type A and Type B Electric Tariff Comparison Analysis

This detailed analysis presents the monthly electric cost projections for both Type A and Type B over the course of a year in Ringgit Malaysia (MYR). Building on the earlier examination of energy consumption patterns, the anticipated results indicate that Type B is expected to incur higher costs compared to Type A. However, it's noteworthy that the cost for Type B appears somewhat unusual upon closer inspection. The reason behind this peculiarity becomes evident when considering the HVAC system's significant contribution to the overall expenditure. Specifically, Type B employs a Variable Refrigerant Flow (VRF) system with a total horsepower of 34, surpassing the 23 horsepower utilized by the Type A system. This discrepancy in HVAC specifications accounts for the observed disparity in electric costs between the two building types within the Hourly Analysis Program (HAP).

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Overview

The exploration of cooling load estimation and energy consumption in diverse house layouts through human activity, employing the Hourly Analysis Program (HAP), has provided valuable insights into optimizing the energy performance of residential buildings. This research aimed to enhance our understanding of the intricate relationship between building design, human behavior, and energy consumption, with a focus on cooling loads. This chapter presents the concluding remarks drawn from the findings and suggests recommendations for future research and practical applications.

5.2 Conclusion

The project was carried out throughout two semesters and was successfully completed within the time period provided. The building layouts and human activity level were studied in this study. Using Hourly Analysis Program (HAP), the cooling load estimation and energy consumption for both Type A and Type B has successfully analysis and build a strong result between two variables. The estimation was then performed to determine and evaluate the cooling load outcome.

According to the project objective, the first goal is to calculate cooling load estimation in Hourly Analysis Program (HAP). This goal was completely met during the first session of this project, when the South Lagenda Bungalow cooling load estimation data for both Type A and Type B is obtained. While the second objective is fulfilled during the analyzing data by comparing cooling load and energy consumption in South Lagenda Bungalow. The final goal was achieved when the result of the analysis proven the factor human activities and building layouts can affect the cooling load estimation neither energy consumption in the building.

Finally, this project was completed successfully because all the objective were met. The calculation by Hourly Analysis Program (HAP) results shows that the cooling load estimation and energy consumption by Type B is more likely higher than Type A cooling load estimation and energy consumption.

5.3 Recommendation

Based on the analysis outcomes, building envelope design must take into account in controlling heat transfer since material also make a strong impact in cooling loads of the building. Further research should explore innovative materials and construction techniques for building envelopes that enhance insulation, minimize thermal bridging, and promote energy efficiency to the homeowner. Moreover, promote passive cooling strategies in residential building design. Techniques such as natural ventilation, shading devices, and cool roof technologies can significantly reduce the reliance on active cooling systems. As a result, the development of high-performance windows, improved insulation materials, energy efficiency in electrical equipment and the incorporation of passive design strategies to reduce reliance on mechanical cooling systems.

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APPENDICES

APPENDIX A Gannt Chart

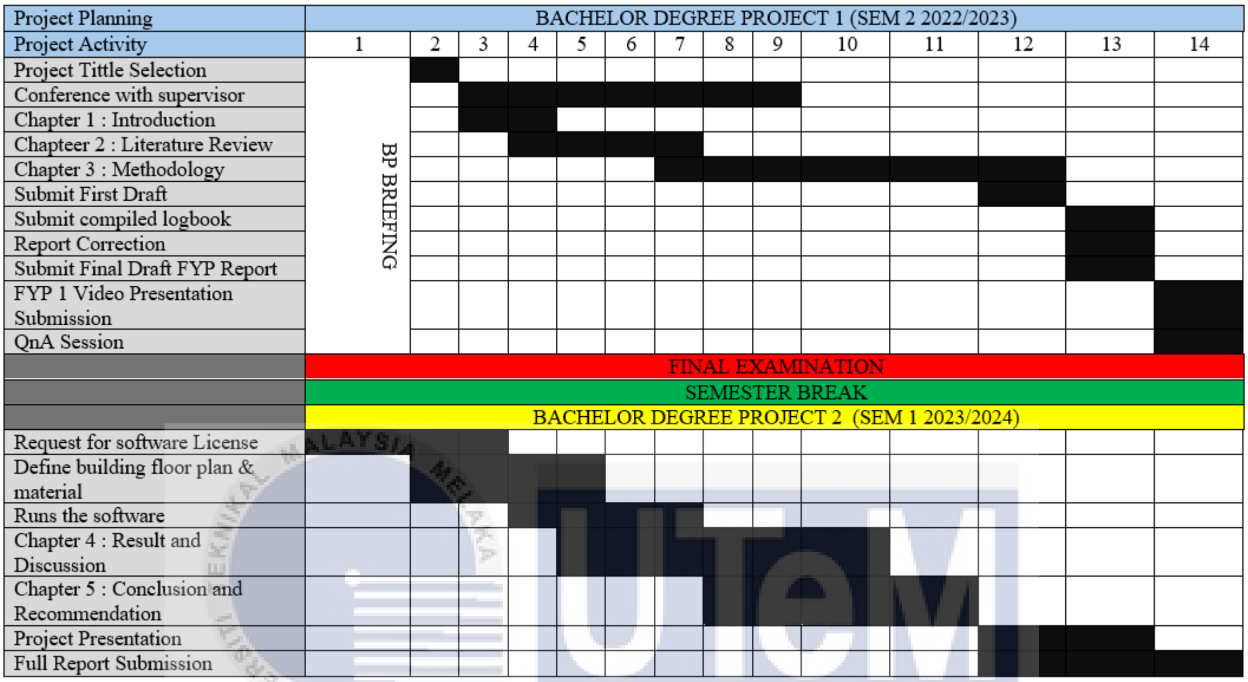

Figure 5.1 Gannt Chart

APPENDIX B Turnitin

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APPENDIX C

Type A Cooling Load Estimation Result

DOAS Sizing Summary for SOUTHBAY LAGENDA BUNGALOW (NORMAL)
(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(NORMAL))

Project: South_Lagenda_Human_Activities 01/13/2024
Prepared by: Shahul 2:05 PM

Air System Information

Air System Name **SOUTHBAY LAGENDA BUNGALOW (NORMAL)**
Equipment Class **TERM**
Air System Type **VRF**

Number of zones **20**
Floor Area **4819.0** sqft
Location **Penang Intl, Malaysia**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**

Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for SOUTHBAY LAGENDA BUNGALOW (NORMAL)
(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(NORMAL))

Project: South_Lagenda_Human_Activities 01/13/2024
Prepared by: Shahul 2:05 PM

Air System Information

Air System Name **SOUTHBAY LAGENDA BUNGALOW (NORMAL)**
Equipment Class **TERM**
Air System Type **VRF**
Number of zones **20**
Floor Area **4819.0** sqft
Location **Penang Intl, Malaysia**

Sizing Calculation Information

Calculation Months **Jan to Dec**
Sizing Data **Calculated**
Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (F)	Coil Leaving DB / WB (F)	Water Flow @ 10.0 F (gpm)	Time of Peak Coil Load	Zone CFM/sqft
EX LOBBY	8.2	5.3	78.2 / 68.8	58.5 / 58.5	-	May 19:00	2.43
GF-COMPUTER ROOM	12.4	9.5	77.9 / 67.1	58.4 / 58.4	-	June 16:00	2.72
GF-EX LIVING	19.6	15.7	77.5 / 66.9	59.0 / 58.9	-	January 17:00	1.68
GF-EX. FOYER	8.3	5.6	78.4 / 68.5	59.0 / 58.9	-	May 17:00	1.92
GF-KITCHEN	18.9	13.1	79.5 / 68.7	58.6 / 58.5	-	June 14:00	1.64
GF-LIBRARY ROOM	10.3	7.6	78.1 / 67.5	58.6 / 58.6	-	January 17:00	1.38
GF-MECHANICAL ROOM	4.2	3.6	32.0 / 21.6	58.4 / 58.3	-	January 14:00	4.56
GF-NEW DINING	15.0	9.0	79.6 / 70.2	58.9 / 58.8	-	January 16:00	1.45
L1-Dresser Room	7.9	6.3	78.2 / 67.0	58.6 / 58.6	-	June 16:00	1.46
L1-Dresser Room 2	3.0	2.0	80.4 / 71.4	63.4 / 63.4	-	May 15:00	1.00
L1-Entertainment Room	13.0	6.3	78.3 / 71.7	58.8 / 58.8	-	June 18:00	1.82
L1-EX. HALL	6.8	3.9	79.7 / 70.6	59.0 / 58.9	-	June 17:00	1.17
L1-Musical Room	14.7	6.7	80.0 / 73.6	59.8 / 59.8	-	May 16:00	1.57
L1-SON BEDROOM 1 (1)	10.8	8.8	78.0 / 67.1	59.3 / 59.3	-	May 13:00	1.28
L1-SON BEDROOM 2	8.1	7.1	77.3 / 66.4	59.5 / 59.4	-	January 15:00	1.63
L2-EX LOBBY	11.8	9.1	78.2 / 67.3	58.6 / 58.6	-	May 17:00	1.41
L2-Guest Room	16.3	13.8	77.4 / 66.2	58.5 / 58.5	-	January 16:00	1.47
L2-MASTER BEDROOM	15.3	13.6	77.4 / 65.9	58.6 / 58.5	-	June 15:00	1.70
L2-Relax Corner	18.6	15.6	77.4 / 66.4	58.8 / 58.8	-	January 14:00	2.07
L2-TEA ROOM	11.8	10.0	77.4 / 66.2	58.4 / 58.4	-	January 15:00	2.53

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (F)	Htg Coil Water Flow @20.0 F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
EX LOBBY	0.0	0.0 / 0.0	0.00	243	0.018	0.014	36
GF-COMPUTER ROOM	0.0	0.0 / 0.0	0.00	443	0.033	0.026	40
GF-EX LIVING	0.0	0.0 / 0.0	0.00	768	0.057	0.045	77
GF-EX. FOYER	0.0	0.0 / 0.0	0.00	261	0.019	0.015	33
GF-KITCHEN	0.0	0.0 / 0.0	0.00	569	0.042	0.033	108
GF-LIBRARY ROOM	0.0	0.0 / 0.0	0.00	355	0.026	0.021	61
GF-MECHANICAL ROOM	0.0	0.0 / 0.0	0.00	177	0.013	0.010	0
GF-NEW DINING	0.0	0.0 / 0.0	0.00	392	0.029	0.023	124
L1-Dresser Room	0.0	0.0 / 0.0	0.00	292	0.022	0.017	32
L1-Dresser Room 2	0.0	0.0 / 0.0	0.00	105	0.008	0.006	26
L1-Entertainment Room	0.0	0.0 / 0.0	0.00	293	0.022	0.017	40
L1-EX. HALL	0.0	0.0 / 0.0	0.00	173	0.013	0.010	39
L1-Musical Room	0.0	0.0 / 0.0	0.00	301	0.022	0.018	72
L1-SON BEDROOM 1 (1)	0.0	0.0 / 0.0	0.00	429	0.032	0.025	40
L1-SON BEDROOM 2	0.0	0.0 / 0.0	0.00	359	0.027	0.021	23
L2-EX LOBBY	0.0	0.0 / 0.0	0.00	419	0.031	0.025	48

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (F)	Htg Coil Water Flow @20.0 F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
L2-Guest Room	0.0	0.0 / 0.0	0.00	664	0.049	0.039	52
L2-MASTER BEDROOM	0.0	0.0 / 0.0	0.00	655	0.048	0.038	33
L2-Relax Corner	0.0	0.0 / 0.0	0.00	760	0.056	0.044	57
L2-TEA ROOM	0.0	0.0 / 0.0	0.00	477	0.035	0.028	36

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	214.0	17.8	0.0
Estimated Piping / Line Losses	0.0	0.0	0.0
Total Required ODU Capacity	214.0	17.8	0.0

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (sqft)
EX LOBBY	4.9	May 19:00	0.0	100.1
GF-COMPUTER ROOM	8.9	June 16:00	0.0	162.6
GF-EX LIVING	15.5	December 17:00	0.0	456.7
GF-EX. FOYER	5.3	May 18:00	0.0	136.1
GF-KITCHEN	11.5	June 14:00	0.0	348.0
GF-LIBRARY ROOM	7.1	January 17:00	0.0	256.4
GF-MECHANICAL ROOM	3.6	January 14:00	0.0	38.9
GF-NEW DINING	7.9	December 17:00	0.0	269.6
L1-Dresser Room	5.9	June 16:00	0.0	199.8
L1-Dresser Room 2	1.7	January 20:00	0.0	105.5
L1-Entertainment Room	5.9	June 20:00	0.0	160.6
L1-EX. HALL	3.5	June 21:00	0.0	147.3
L1-Musical Room	6.1	January 20:00	0.0	192.2
L1-SON BEDROOM 1 (1)	8.6	May 13:00	0.0	335.9
L1-SON BEDROOM 2	7.2	December 15:00	0.0	220.6
L2-EX LOBBY	8.4	May 18:00	0.0	297.4
L2-Guest Room	13.4	January 16:00	0.0	450.5
L2-MASTER BEDROOM	13.2	June 16:00	0.0	384.8
L2-Relax Corner	15.3	January 15:00	0.0	367.2
L2-TEA ROOM	9.6	January 15:00	0.0	188.8

Zone Sizing Summary for SOUTHBAY LAGENDA BUNGALOW (NORMAL)
(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(NORMAL))

Project: South_Lagenda_Human_Activities 01/13/2024
Prepared by: Shahul 2:05 PM

Space Loads and Airflows

Zone Name / Space Name	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (sqft)	Space CFM/sqft
EX LOBBY						
EX LOBBY	4.9	May 19:00	243	0.0	100.1	2.43
GF-COMPUTER ROOM						
GF-COMPUTER ROOM	8.9	June 16:00	443	0.0	162.6	2.72
GF-EX LIVING						
GF-EX LIVING	15.5	December 17:00	768	0.0	456.7	1.68
GF-EX. FOYER						
GF-EX. FOYER	5.3	May 18:00	261	0.0	136.1	1.92
GF-KITCHEN						
GF-KITCHEN	11.5	June 14:00	569	0.0	348.0	1.64
GF-LIBRARY ROOM						
GF-LIBRARY ROOM	7.1	January 17:00	355	0.0	256.4	1.38
GF-MECHANICAL ROOM						
GF-MECHANICAL ROOM	3.6	January 14:00	177	0.0	38.9	4.56
GF-NEW DINING						
GF-NEW DINING	7.9	December 17:00	392	0.0	269.6	1.45
L1-Dresser Room						
L1-Dresser Room	5.9	June 16:00	292	0.0	199.8	1.46
L1-Dresser Room 2						
L1-Dresser Room 2	1.7	January 20:00	105	0.0	105.5	1.00
L1-Entertainment Room						
L1-Entertainment Room	5.9	June 20:00	293	0.0	160.6	1.82
L1-EX. HALL						
L1-EX. HALL	3.5	June 21:00	173	0.0	147.3	1.17
L1-Musical Room						
L1-Musical Room	6.1	January 20:00	301	0.0	192.2	1.57
L1-SON BEDROOM 1 (1)						
L1-SON BEDROOM 1 (1)	8.6	May 13:00	429	0.0	335.9	1.28
L1-SON BEDROOM 2						
L1-SON BEDROOM 2	7.2	December 15:00	359	0.0	220.6	1.63
L2-EX LOBBY						
L2-EX LOBBY	8.4	May 18:00	419	0.0	297.4	1.41
L2-Guest Room						
L2-Guest Room	13.4	January 16:00	664	0.0	450.5	1.47
L2-MASTER BEDROOM						
L2-MASTER BEDROOM	13.2	June 16:00	655	0.0	384.8	1.70
L2-Relax Corner						
L2-Relax Corner	15.3	January 15:00	760	0.0	367.2	2.07
L2-TEA ROOM						
L2-TEA ROOM	9.6	January 15:00	477	0.0	188.8	2.53

Space Heat Balance Summary for SOUTHBAY LAGENDA BUNGALOW (NORMAL)

(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(NORMAL))

Project: South_Lagenda_Human_Activities 01/13/2024
Prepared by: Shahul 2:05 PM

Table 1. Heat Balance Loads for Space EX LOBBY in Zone EX LOBBY

	DESIGN COOLING - MAY 19:00			DESIGN HEATING		
	OA DB / WB 87.4 F / 78.1 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 72.0 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	120 sqft	1434	-	120 sqft	-1	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	100 sqft	300	-	100 sqft	0	-
Interior Wall Convection	508 sqft	1463	-	508 sqft	1	-
Ceiling Convection	100 sqft	466	-	100 sqft	0	-
Overhead Lighting Convection	84 W	179	-	0 W	0	-
Task Lighting Convection	25 W	38	-	0 W	0	-
Electric Equipment Convection	110 W	282	-	0 W	0	-
People Convection	6	504	1620	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	233	81	0%	0	0
>> Total Space Loads	**-**	**4899**	**1701**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 2. Heat Balance Loads for Space GF-COMPUTER ROOM in Zone GF-COMPUTER ROOM

	DESIGN COOLING - JUNE 16:00			DESIGN HEATING		
	OA DB / WB 91.0 F / 79.0 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 71.4 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	91 sqft	1105	-	91 sqft	0	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	30 sqft	499	-	30 sqft	4	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	163 sqft	846	-	163 sqft	-1	-
Interior Wall Convection	669 sqft	2336	-	669 sqft	-2	-
Ceiling Convection	162 sqft	1105	-	162 sqft	-1	-
Overhead Lighting Convection	153 W	326	-	0 W	0	-
Task Lighting Convection	25 W	38	-	0 W	0	-
Electric Equipment Convection	700 W	1791	-	0 W	0	-
People Convection	6	441	1230	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	424	62	0%	0	0
>> Total Space Loads	**-**	**8911**	**1292**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Space Heat Balance Summary for SOUTHBAY LAGENDA BUNGALOW (NORMAL)

(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(NORMAL))

Project: South_Lagenda_Human_Activities 01/13/2024
Prepared by: Shahul 2:05 PM

Table 3. Heat Balance Loads for Space GF-EX LIVING in Zone GF-EX LIVING

	DESIGN COOLING - DECEMBER 17:00			DESIGN HEATING		
	OA DB / WB 82.1 F / 73.8 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 71.3 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	503 sqft	5077	-	503 sqft	1	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	60 sqft	819	-	60 sqft	8	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	457 sqft	2364	-	457 sqft	-2	-
Interior Wall Convection	602 sqft	1874	-	602 sqft	-3	-
Ceiling Convection	457 sqft	2805	-	457 sqft	-3	-
Overhead Lighting Convection	384 W	818	-	0 W	0	-
Task Lighting Convection	15 W	23	-	0 W	0	-
Electric Equipment Convection	100 W	256	-	0 W	0	-
People Convection	10	690	1200	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	736	60	0%	0	0
>> Total Space Loads	**-**	**15462**	**1260**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Space Heat Balance Summary for SOUTHBAY LAGENDA BUNGALOW (NORMAL)
(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(NORMAL))

Project: South_Lagenda_Human_Activities 01/13/2024
Prepared by: Shahul 2:05 PM

Table 4. Heat Balance Loads for Space GF-EX. FOYER in Zone GF-EX. FOYER

	DESIGN COOLING - MAY 18:00			DESIGN HEATING		
	OA DB / WB 89.0 F / 78.5 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 71.8 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	148 sqft	1455	-	148 sqft	-1	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	44 sqft	466	-	44 sqft	1	-
Floor Convection	136 sqft	341	-	136 sqft	0	-
Interior Wall Convection	425 sqft	1230	-	425 sqft	1	-
Ceiling Convection	136 sqft	677	-	136 sqft	0	-
Overhead Lighting Convection	114 W	244	-	0 W	0	-
Task Lighting Convection	15 W	23	-	0 W	0	-
Electric Equipment Convection	60 W	154	-	0 W	0	-
People Convection	5	420	1350	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	250	68	0%	0	0
>> Total Space Loads	**-**	**5258**	**1418**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 5. Heat Balance Loads for Space GF-KITCHEN in Zone GF-KITCHEN

	DESIGN COOLING - JUNE 14:00			DESIGN HEATING		
	OA DB / WB 91.7 F / 79.2 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 71.5 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	508 sqft	4668	-	508 sqft	3	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	348 sqft	771	-	348 sqft	-1	-
Interior Wall Convection	478 sqft	1043	-	478 sqft	0	-
Ceiling Convection	348 sqft	1377	-	348 sqft	-1	-
Overhead Lighting Convection	209 W	445	-	0 W	0	-
Task Lighting Convection	35 W	53	-	0 W	0	-
Electric Equipment Convection	800 W	2047	-	0 W	0	-
People Convection	6	504	1620	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	545	81	0%	0	0
>> Total Space Loads	**-**	**11454**	**1701**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 6. Heat Balance Loads for Space GF-LIBRARY ROOM in Zone GF-LIBRARY ROOM

	DESIGN COOLING - JANUARY 17:00			DESIGN HEATING		
	OA DB / WB 85.1 F / 75.8 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 71.5 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	312 sqft	2646	-	312 sqft	3	-
Roof Convection	12 sqft	85	-	12 sqft	-1	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	256 sqft	506	-	256 sqft	-1	-
Interior Wall Convection	573 sqft	1003	-	573 sqft	0	-
Ceiling Convection	245 sqft	928	-	245 sqft	-1	-
Overhead Lighting Convection	246 W	525	-	0 W	0	-
Task Lighting Convection	50 W	75	-	0 W	0	-
Electric Equipment Convection	240 W	614	-	0 W	0	-
People Convection	6	414	720	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	340	36	0%	0	0
>> Total Space Loads	**-**	**7136**	**756**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 7. Heat Balance Loads for Space GF-MECHANICAL ROOM in Zone GF-MECHANICAL ROOM

	DESIGN COOLING - JANUARY 14:00			DESIGN HEATING		
	OA DB / WB 86.7 F / 76.2 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 71.2 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	129 sqft	1646	-	129 sqft	2	-
Roof Convection	33 sqft	356	-	33 sqft	-1	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	44 sqft	338	-	44 sqft	0	-
Floor Convection	39 sqft	103	-	39 sqft	0	-
Interior Wall Convection	173 sqft	461	-	173 sqft	-1	-
Ceiling Convection	6 sqft	27	-	6 sqft	0	-
Overhead Lighting Convection	17 W	36	-	0 W	0	-
Task Lighting Convection	4 W	6	-	0 W	0	-
Electric Equipment Convection	100 W	256	-	0 W	0	-
People Convection	2	168	540	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	170	27	0%	0	0
>> Total Space Loads	**-**	**3566**	**567**	**-**	**0**	**0**
Key:	**Positive values are cooling loads** **Negative values are heating loads**			**Positive values are heating loads** **Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 8. Heat Balance Loads for Space GF-NEW DINING in Zone GF-NEW DINING

	DESIGN COOLING - DECEMBER 17:00			DESIGN HEATING		
	OA DB / WB 82.1 F / 73.8 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 71.4 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	188 sqft	2149	-	188 sqft	6	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	270 sqft	644	-	270 sqft	-2	-
Interior Wall Convection	685 sqft	1469	-	685 sqft	-2	-
Ceiling Convection	269 sqft	1259	-	269 sqft	-2	-
Overhead Lighting Convection	162 W	345	-	0 W	0	-
Task Lighting Convection	25 W	38	-	0 W	0	-
Electric Equipment Convection	300 W	768	-	0 W	0	-
People Convection	10	840	2700	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	376	135	0%	0	0
>> Total Space Loads	**-**	**7887**	**2835**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 9. Heat Balance Loads for Space L1-Dresser Room in Zone L1-Dresser Room

	DESIGN COOLING - JUNE 16:00			DESIGN HEATING		
	OA DB / WB 91.0 F / 79.0 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 71.5 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	142 sqft	1316	-	142 sqft	0	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	30 sqft	384	-	30 sqft	4	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	200 sqft	858	-	200 sqft	-1	-
Interior Wall Convection	580 sqft	1314	-	580 sqft	-2	-
Ceiling Convection	200 sqft	876	-	200 sqft	-1	-
Overhead Lighting Convection	82 W	175	-	0 W	0	-
Task Lighting Convection	10 W	15	-	0 W	0	-
Electric Equipment Convection	200 W	512	-	0 W	0	-
People Convection	2	138	240	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	279	12	0%	0	0
>> Total Space Loads	**-**	**5867**	**252**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 10. Heat Balance Loads for Space L1-Dresser Room 2 in Zone L1-Dresser Room 2

	DESIGN COOLING - JANUARY 20:00			DESIGN HEATING		
	OA DB / WB 81.1 F / 74.7 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 71.7 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	0 sqft	0	-	0 sqft	0	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	105 sqft	129	-	105 sqft	0	-
Interior Wall Convection	545 sqft	489	-	545 sqft	0	-
Ceiling Convection	106 sqft	241	-	106 sqft	0	-
Overhead Lighting Convection	43 W	92	-	0 W	0	-
Task Lighting Convection	10 W	15	-	0 W	0	-
Electric Equipment Convection	200 W	512	-	0 W	0	-
People Convection	2	138	240	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	81	12	0%	0	0
>> Total Space Loads	**-**	**1697**	**252**	**-**	**0**	**0**
Key:	**Positive values are cooling loads** **Negative values are heating loads**			**Positive values are heating loads** **Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 11. Heat Balance Loads for Space L1-Entertainment Room in Zone L1-Entertainment Room

	DESIGN COOLING - JUNE 20:00			DESIGN HEATING		
	OA DB / WB 86.1 F / 77.8 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 71.8 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	22 sqft	183	-	22 sqft	-1	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	161 sqft	503	-	161 sqft	-1	-
Interior Wall Convection	725 sqft	1986	-	725 sqft	1	-
Ceiling Convection	161 sqft	728	-	161 sqft	0	-
Overhead Lighting Convection	95 W	202	-	0 W	0	-
Task Lighting Convection	25 W	38	-	0 W	0	-
Electric Equipment Convection	400 W	1024	-	0 W	0	-
People Convection	6	945	5550	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	280	278	0%	0	0
>> Total Space Loads	**-**	**5888**	**5828**	**-**	**0**	**0**
Key:	**Positive values are cooling loads** **Negative values are heating loads**			**Positive values are heating loads** **Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Space Heat Balance Summary for SOUTHBAY LAGENDA BUNGALOW (NORMAL)

(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(NORMAL))

Project: South_Lagenda_Human_Activities 01/13/2024
Prepared by: Shahul 2:05 PM

Table 12. Heat Balance Loads for Space L1-EX. HALL in Zone L1-EX. HALL

	DESIGN COOLING - JUNE 21:00			DESIGN HEATING		
	OA DB / WB 85.2 F / 77.6 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 71.8 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	0 sqft	0	-	0 sqft	0	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	147 sqft	346	-	147 sqft	0	-
Interior Wall Convection	779 sqft	1386	-	779 sqft	1	-
Ceiling Convection	147 sqft	451	-	147 sqft	-1	-
Overhead Lighting Convection	124 W	264	-	0 W	0	-
Task Lighting Convection	50 W	75	-	0 W	0	-
Electric Equipment Convection	110 W	282	-	0 W	0	-
People Convection	6	504	1620	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	165	81	0%	0	0
>> Total Space Loads	**-**	**3473**	**1701**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 13. Heat Balance Loads for Space L1-Musical Room in Zone L1-Musical Room

	DESIGN COOLING - JANUARY 20:00			DESIGN HEATING		
	OA DB / WB 81.1 F / 74.7 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 71.6 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	0 sqft	0	-	0 sqft	0	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	192 sqft	584	-	192 sqft	0	-
Interior Wall Convection	735 sqft	2022	-	735 sqft	0	-
Ceiling Convection	192 sqft	1022	-	192 sqft	0	-
Overhead Lighting Convection	173 W	369	-	0 W	0	-
Task Lighting Convection	15 W	23	-	0 W	0	-
Electric Equipment Convection	185 W	473	-	0 W	0	-
People Convection	6	1278	6540	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	289	327	0%	0	0
>> Total Space Loads	**-**	**6059**	**6867**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 14. Heat Balance Loads for Space L1-SON BEDROOM 1 (1) in Zone L1-SON BEDROOM 1 (1

	DESIGN COOLING - MAY 13:00			DESIGN HEATING		
	OA DB / WB 91.1 F / 79.1 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 71.6 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	642 sqft	5056	-	642 sqft	2	-
Roof Convection	6 sqft	55	-	6 sqft	0	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	336 sqft	663	-	336 sqft	-1	-
Interior Wall Convection	482 sqft	792	-	482 sqft	0	-
Ceiling Convection	330 sqft	1085	-	330 sqft	-1	-
Overhead Lighting Convection	138 W	294	-	0 W	0	-
Task Lighting Convection	5 W	8	-	0 W	0	-
Electric Equipment Convection	50 W	128	-	0 W	0	-
People Convection	2	138	240	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	411	12	0%	0	0
>> Total Space Loads	**-**	**8629**	**252**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 15. Heat Balance Loads for Space L1-SON BEDROOM 2 in Zone L1-SON BEDROOM 2

	DESIGN COOLING - DECEMBER 15:00			DESIGN HEATING		
	OA DB / WB 83.7 F / 74.2 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 71.2 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	203 sqft	2095	-	203 sqft	2	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	30 sqft	452	-	30 sqft	6	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	221 sqft	1265	-	221 sqft	-2	-
Interior Wall Convection	534 sqft	1461	-	534 sqft	-4	-
Ceiling Convection	220 sqft	1146	-	220 sqft	-2	-
Overhead Lighting Convection	90 W	193	-	0 W	0	-
Task Lighting Convection	8 W	12	-	0 W	0	-
Electric Equipment Convection	50 W	128	-	0 W	0	-
People Convection	2	138	240	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	344	12	0%	0	0
>> Total Space Loads	**-**	**7234**	**252**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 16. Heat Balance Loads for Space L2-EX LOBBY in Zone L2-EX LOBBY

	DESIGN COOLING - MAY 18:00			DESIGN HEATING		
	OA DB / WB 89.0 F / 78.5 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 71.8 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	122 sqft	1208	-	122 sqft	0	-
Roof Convection	297 sqft	2748	-	297 sqft	-2	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	297 sqft	535	-	297 sqft	-1	-
Interior Wall Convection	1256 sqft	2282	-	1256 sqft	3	-
Ceiling Convection	0 sqft	0	-	0 sqft	0	-
Overhead Lighting Convection	250 W	533	-	0 W	0	-
Task Lighting Convection	25 W	38	-	0 W	0	-
Electric Equipment Convection	110 W	282	-	0 W	0	-
People Convection	6	414	720	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	402	36	0%	0	0
>> Total Space Loads	**-**	**8442**	**756**	**-**	**0**	**0**
Key:	**Positive values are cooling loads** **Negative values are heating loads**			**Positive values are heating loads** **Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 17. Heat Balance Loads for Space L2-Guest Room in Zone L2-Guest Room

	DESIGN COOLING - JANUARY 16:00			DESIGN HEATING		
	OA DB / WB 86.0 F / 76.0 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 71.5 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	354 sqft	3299	-	354 sqft	7	-
Roof Convection	451 sqft	4419	-	451 sqft	-7	-
Window Convection	30 sqft	396	-	30 sqft	8	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	451 sqft	1743	-	451 sqft	-3	-
Interior Wall Convection	891 sqft	2077	-	891 sqft	-4	-
Ceiling Convection	0 sqft	0	-	0 sqft	0	-
Overhead Lighting Convection	185 W	394	-	0 W	0	-
Task Lighting Convection	15 W	23	-	0 W	0	-
Electric Equipment Convection	10 W	26	-	0 W	0	-
People Convection	5	345	600	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	636	30	0%	0	0
>> Total Space Loads	**-**	**13357**	**630**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 18. Heat Balance Loads for Space L2-MASTER BEDROOM in Zone L2-MASTER BEDROOM

	DESIGN COOLING - JUNE 16:00			DESIGN HEATING		
	OA DB / WB 91.0 F / 79.0 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 71.6 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	504 sqft	4543	-	504 sqft	2	-
Roof Convection	385 sqft	4395	-	385 sqft	-5	-
Window Convection	30 sqft	410	-	30 sqft	5	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	385 sqft	1383	-	385 sqft	-1	-
Interior Wall Convection	507 sqft	1296	-	507 sqft	-1	-
Ceiling Convection	0 sqft	0	-	0 sqft	0	-
Overhead Lighting Convection	158 W	336	-	0 W	0	-
Task Lighting Convection	15 W	23	-	0 W	0	-
Electric Equipment Convection	10 W	26	-	0 W	0	-
People Convection	2	138	240	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	627	12	0%	0	0
>> Total Space Loads	**-**	**13177**	**252**	**-**	**0**	**0**
Key:	**Positive values are cooling loads** **Negative values are heating loads**			**Positive values are heating loads** **Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 19. Heat Balance Loads for Space L2-Relax Corner in Zone L2-Relax Corner

	DESIGN COOLING - JANUARY 15:00			DESIGN HEATING		
	OA DB / WB 86.7 F / 76.2 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 71.4 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	480 sqft	5188	-	480 sqft	6	-
Roof Convection	367 sqft	3953	-	367 sqft	-7	-
Window Convection	30 sqft	472	-	30 sqft	6	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	367 sqft	1733	-	367 sqft	-3	-
Interior Wall Convection	510 sqft	1512	-	510 sqft	-2	-
Ceiling Convection	0 sqft	0	-	0 sqft	0	-
Overhead Lighting Convection	217 W	462	-	0 W	0	-
Task Lighting Convection	25 W	38	-	0 W	0	-
Electric Equipment Convection	285 W	729	-	0 W	0	-
People Convection	7	483	840	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	728	42	0%	0	0
>> Total Space Loads	**-**	**15298**	**882**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Space Heat Balance Summary for SOUTHBAY LAGENDA BUNGALOW (NORMAL)

(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(NORMAL))

Project: South_Lagenda_Human_Activities 01/13/2024
Prepared by: Shahul 2:05 PM

Table 20. Heat Balance Loads for Space L2-TEA ROOM in Zone L2-TEA ROOM

	DESIGN COOLING - JANUARY 15:00			DESIGN HEATING		
	OA DB / WB 86.7 F / 76.2 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 76.6 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 76.6 F			INDOOR DB 71.3 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	209 sqft	2493	-	209 sqft	1	-
Roof Convection	189 sqft	2176	-	189 sqft	-4	-
Window Convection	30 sqft	551	-	30 sqft	6	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	189 sqft	1422	-	189 sqft	-1	-
Interior Wall Convection	487 sqft	1761	-	487 sqft	-2	-
Ceiling Convection	0 sqft	0	-	0 sqft	0	-
Overhead Lighting Convection	111 W	237	-	0 W	0	-
Task Lighting Convection	15 W	23	-	0 W	0	-
Electric Equipment Convection	50 W	128	-	0 W	0	-
People Convection	5	345	600	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	457	30	0%	0	0
>> Total Space Loads	**-**	**9595**	**630**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Hourly Air System Design Day Loads for SOUTHBAY LAGENDA BUNGALOW (NORMAL)

(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(NORMAL))

Project: South_Lagenda_Human_Activities 01/13/2024
Prepared by: Shahul 2:05 PM

DESIGN MONTH: JULY								
Hour	OA Temp (F)	DOAS Airflow (CFM)	DOAS Heating Coil (MBH)	DOAS Cooling Coil (MBH)	Dehumid. Reheat Coil (MBH)	Terminal Cooling Coil (MBH)	Terminal Heating Coil Sensible (MBH)
00:00	80.6	0	0.0	0.0	0.0	100.6	0.0
01:00	79.9	0	0.0	0.0	0.0	94.9	0.0
02:00	79.5	0	0.0	0.0	0.0	89.4	0.0
03:00	79.2	0	0.0	0.0	0.0	84.9	0.0
04:00	78.8	0	0.0	0.0	0.0	81.2	0.0
05:00	78.6	0	0.0	0.0	0.0	87.4	0.0
06:00	78.8	0	0.0	0.0	0.0	89.3	0.0
07:00	79.6	0	0.0	0.0	0.0	94.0	0.0
08:00	81.5	0	0.0	0.0	0.0	114.5	0.0
09:00	83.6	0	0.0	0.0	0.0	131.6	0.0
10:00	85.5	0	0.0	0.0	0.0	150.1	0.0
11:00	87.1	0	0.0	0.0	0.0	167.6	0.0
12:00	88.3	0	0.0	0.0	0.0	180.5	0.0
13:00	89.1	0	0.0	0.0	0.0	189.9	0.0
14:00	89.7	0	0.0	0.0	0.0	196.7	0.0
15:00	89.7	0	0.0	0.0	0.0	200.5	0.0
16:00	89.0	0	0.0	0.0	0.0	201.7	0.0
17:00	88.1	0	0.0	0.0	0.0	200.8	0.0
18:00	87.0	0	0.0	0.0	0.0	195.3	0.0
19:00	85.4	0	0.0	0.0	0.0	183.2	0.0
20:00	84.1	0	0.0	0.0	0.0	171.8	0.0
21:00	83.2	0	0.0	0.0	0.0	160.1	0.0
22:00	82.2	0	0.0	0.0	0.0	148.0	0.0
23:00	81.4	0	0.0	0.0	0.0	121.0	0.0

Hourly Zone Loads for SOUTHBAY LAGENDA BUNGALOW (NORMAL)

(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(NORMAL))

Project: South_Lagenda_Human_Activities 01/13/2024
Prepared by: Shahul 2:05 PM

ZONE: EX LOBBY									
DESIGN MONTH: JULY									
Hour	O A Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	74	243	2836	2979	5040	0	0
01:00	79.9	76.6	76	243	2634	2761	4795	0	0
02:00	79.5	76.6	77	243	2507	2613	4605	0	0
03:00	79.2	76.6	78	243	2408	2502	4456	0	0
04:00	78.8	76.6	79	243	2330	2414	4336	0	0
05:00	78.6	76.6	78	243	2519	2569	4657	0	0
06:00	78.8	76.6	78	243	2578	2620	4746	0	0
07:00	79.6	76.6	77	243	2617	2657	4891	0	0
08:00	81.5	76.6	77	243	2656	2696	5067	0	0
09:00	83.6	76.6	77	243	2726	2769	5309	0	0
10:00	85.5	76.6	76	243	2827	2872	5567	0	0
11:00	87.1	76.6	75	243	2966	3012	5859	0	0
12:00	88.3	76.6	74	243	3099	3146	6078	0	0
13:00	89.1	76.6	73	243	3234	3279	6284	0	0
14:00	89.7	76.6	72	243	3364	3405	6464	0	0
15:00	89.7	76.6	70	243	3528	3564	6695	0	0
16:00	89.0	76.6	68	243	3804	3824	7046	0	0
17:00	88.1	76.6	66	243	4168	4156	7447	0	0
18:00	87.0	76.6	63	243	4516	4468	7769	0	0
19:00	85.4	76.6	62	243	4702	4642	7852	0	0
20:00	84.1	76.6	62	243	4564	4544	7568	0	0
21:00	83.2	76.6	65	243	4221	4258	7119	0	0
22:00	82.2	76.6	67	243	3895	3963	6708	0	0
23:00	81.4	76.6	71	243	3378	3492	5988	0	0

ZONE: GF-COMPUTER ROOM									
DESIGN MONTH: JULY									
Hour	O A Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	73	443	4769	4956	6666	0	0
01:00	79.9	76.6	74	443	4548	4712	6585	0	0
02:00	79.5	76.6	75	443	4401	4539	6383	0	0
03:00	79.2	76.6	76	443	4280	4401	6215	0	0
04:00	78.8	76.6	76	443	4177	4285	6070	0	0
05:00	78.6	76.6	75	443	4520	4583	6639	0	0
06:00	78.8	76.6	74	443	4679	4726	6789	0	0
07:00	79.6	76.6	73	443	4942	4999	7347	0	0
08:00	81.5	76.6	70	443	5513	5576	8226	0	0
09:00	83.6	76.6	68	443	6111	6158	9025	0	0
10:00	85.5	76.6	65	443	6667	6691	9728	0	0
11:00	87.1	76.6	63	443	7171	7168	10345	0	0
12:00	88.3	76.6	62	443	7523	7503	10732	0	0
13:00	89.1	76.6	61	443	7810	7775	11063	0	0
14:00	89.7	76.6	60	443	8045	7999	11324	0	0
15:00	89.7	76.6	59	443	8225	8173	11500	0	0
16:00	89.0	76.6	58	443	8303	8255	11524	0	0
17:00	88.1	76.6	59	443	8244	8215	11383	0	0
18:00	87.0	76.6	60	443	7962	7970	10939	0	0
19:00	85.4	76.6	62	443	7337	7412	10129	0	0
20:00	84.1	76.6	64	443	6917	7016	9698	0	0
21:00	83.2	76.6	65	443	6601	6701	9298	0	0
22:00	82.2	76.6	66	443	6329	6427	8949	0	0
23:00	81.4	76.6	69	443	5664	5802	8003	0	0

ZONE: GF-EX LIVING
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	81	768	4715	5464	7304	0	0
01:00	79.9	76.6	83	768	4068	4939	6761	0	0
02:00	79.5	76.6	84	768	3658	4527	6263	0	0
03:00	79.2	76.6	85	768	3339	4186	5845	0	0
04:00	78.8	76.6	86	768	3085	3900	5489	0	0
05:00	78.6	76.6	85	768	4266	4614	7063	0	0
06:00	78.8	76.6	84	768	4391	4590	6593	0	0
07:00	79.6	76.6	84	768	4396	4631	6857	0	0
08:00	81.5	76.6	84	768	4654	4891	7520	0	0
09:00	83.6	76.6	82	768	5139	5328	8388	0	0
10:00	85.5	76.6	81	768	5835	5919	9392	0	0
11:00	87.1	76.6	78	768	6557	6588	10411	0	0
12:00	88.3	76.6	76	768	7116	7223	11251	0	0
13:00	89.1	76.6	75	768	7682	7831	12075	0	0
14:00	89.7	76.6	72	768	8498	8657	13273	0	0
15:00	89.7	76.6	70	768	9261	9385	14009	0	0
16:00	89.0	76.6	69	768	9661	9760	14092	0	0
17:00	88.1	76.6	68	768	10026	10160	14869	0	0
18:00	87.0	76.6	66	768	10697	10731	15080	0	0
19:00	85.4	76.6	68	768	9889	10019	13574	0	0
20:00	84.1	76.6	70	768	9120	9327	12703	0	0
21:00	83.2	76.6	72	768	8364	8593	11675	0	0
22:00	82.2	76.6	74	768	7664	7894	10764	0	0
23:00	81.4	76.6	78	768	5945	6354	8251	0	0

ZONE: GF-EX. FOYER
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	75	261	2654	2830	4540	0	0
01:00	79.9	76.6	77	261	2447	2606	4281	0	0
02:00	79.5	76.6	79	261	2302	2440	4073	0	0
03:00	79.2	76.6	80	261	2185	2308	3904	0	0
04:00	78.8	76.6	81	261	2089	2200	3764	0	0
05:00	78.6	76.6	80	261	2339	2403	4202	0	0
06:00	78.8	76.6	80	261	2363	2418	4176	0	0
07:00	79.6	76.6	80	261	2394	2451	4326	0	0
08:00	81.5	76.6	79	261	2477	2537	4572	0	0
09:00	83.6	76.6	78	261	2599	2664	4872	0	0
10:00	85.5	76.6	77	261	2758	2827	5194	0	0
11:00	87.1	76.6	75	261	2947	3018	5532	0	0
12:00	88.3	76.6	74	261	3128	3197	5797	0	0
13:00	89.1	76.6	72	261	3303	3367	6037	0	0
14:00	89.7	76.6	70	261	3664	3711	6624	0	0
15:00	89.7	76.6	67	261	4125	4122	7090	0	0
16:00	89.0	76.6	64	261	4528	4485	7504	0	0
17:00	88.1	76.6	62	261	4886	4803	7820	0	0
18:00	87.0	76.6	61	261	5007	4921	7803	0	0
19:00	85.4	76.6	62	261	4681	4675	7322	0	0
20:00	84.1	76.6	64	261	4426	4464	7028	0	0
21:00	83.2	76.6	66	261	4076	4152	6559	0	0
22:00	82.2	76.6	68	261	3736	3835	6132	0	0
23:00	81.4	76.6	73	261	3118	3276	5270	0	0

Hourly Zone Loads for SOUTHBAY LAGENDA BUNGALOW (NORMAL)

(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(NORMAL))

Project: South_Lagenda_Human_Activities 01/13/2024
Prepared by: Shahul 2:05 PM

ZONE: GF-KITCHEN
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	71	569	6446	6709	10337	0	0
01:00	79.9	76.6	73	569	6036	6274	9950	0	0
02:00	79.5	76.6	74	569	5736	5932	9448	0	0
03:00	79.2	76.6	76	569	5489	5651	9030	0	0
04:00	78.8	76.6	77	569	5285	5417	8678	0	0
05:00	78.6	76.6	77	569	5114	5221	8396	0	0
06:00	78.8	76.6	77	569	5212	5283	8724	0	0
07:00	79.6	76.6	77	569	5278	5328	8956	0	0
08:00	81.5	76.6	77	569	5467	5535	9677	0	0
09:00	83.6	76.6	74	569	6197	6345	11471	0	0
10:00	85.5	76.6	69	569	7449	7622	13658	0	0
11:00	87.1	76.6	65	569	8896	8966	15662	0	0
12:00	88.3	76.6	61	569	10052	9975	16966	0	0
13:00	89.1	76.6	59	569	10737	10568	17668	0	0
14:00	89.7	76.6	58	569	10929	10759	17826	0	0
15:00	89.7	76.6	58	569	10881	10755	17760	0	0
16:00	89.0	76.6	58	569	10807	10719	17628	0	0
17:00	88.1	76.6	58	569	10716	10659	17424	0	0
18:00	87.0	76.6	59	569	10544	10524	17057	0	0
19:00	85.4	76.6	60	569	10206	10237	16407	0	0
20:00	84.1	76.6	61	569	9609	9709	15431	0	0
21:00	83.2	76.6	63	569	8885	9045	14368	0	0
22:00	82.2	76.6	66	569	8237	8425	13426	0	0
23:00	81.4	76.6	68	569	7710	7899	12644	0	0

ZONE: GF-LIBRARY ROOM
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	75	355	3192	3423	5080	0	0
01:00	79.9	76.6	77	355	2894	3187	4851	0	0
02:00	79.5	76.6	78	355	2705	3002	4586	0	0
03:00	79.2	76.6	79	355	2556	2849	4362	0	0
04:00	78.8	76.6	80	355	2436	2720	4171	0	0
05:00	78.6	76.6	78	355	3199	3224	5278	0	0
06:00	78.8	76.6	77	355	3322	3273	5095	0	0
07:00	79.6	76.6	77	355	3332	3297	5207	0	0
08:00	81.5	76.6	76	355	3416	3385	5543	0	0
09:00	83.6	76.6	75	355	3725	3712	6314	0	0
10:00	85.5	76.6	71	355	4219	4238	7260	0	0
11:00	87.1	76.6	68	355	4799	4810	8146	0	0
12:00	88.3	76.6	65	355	5278	5261	8743	0	0
13:00	89.1	76.6	64	355	5573	5536	9067	0	0
14:00	89.7	76.6	63	355	5674	5637	9155	0	0
15:00	89.7	76.6	63	355	5680	5655	9147	0	0
16:00	89.0	76.6	63	355	5674	5660	9106	0	0
17:00	88.1	76.6	63	355	5658	5653	9025	0	0
18:00	87.0	76.6	63	355	5594	5601	8846	0	0
19:00	85.4	76.6	64	355	5450	5473	8528	0	0
20:00	84.1	76.6	65	355	5219	5261	8116	0	0
21:00	83.2	76.6	66	355	4954	5010	7697	0	0
22:00	82.2	76.6	68	355	4711	4773	7321	0	0
23:00	81.4	76.6	72	355	3814	3959	5815	0	0

Hourly Zone Loads for SOUTHBAY LAGENDA BUNGALOW (NORMAL)
(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(NORMAL))

Project: South_Lagenda_Human_Activities 01/13/2024
Prepared by: Shahul 2:05 PM

ZONE: GF-MECHANICAL ROOM
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	83	177	1117	1191	1568	0	0
01:00	79.9	76.6	85	177	1014	1074	1506	0	0
02:00	79.5	76.6	87	177	940	986	1430	0	0
03:00	79.2	76.6	88	177	880	916	1368	0	0
04:00	78.8	76.6	88	177	831	859	1318	0	0
05:00	78.6	76.6	88	177	839	860	1352	0	0
06:00	78.8	76.6	88	177	855	876	1405	0	0
07:00	79.6	76.6	85	177	1064	1133	1920	0	0
08:00	81.5	76.6	78	177	1590	1697	2521	0	0
09:00	83.6	76.6	71	177	2097	2196	2995	0	0
10:00	85.5	76.6	66	177	2584	2647	3413	0	0
11:00	87.1	76.6	62	177	2944	2966	3662	0	0
12:00	88.3	76.6	61	177	3047	3064	3670	0	0
13:00	89.1	76.6	62	177	2943	2990	3560	0	0
14:00	89.7	76.6	63	177	2871	2928	3491	0	0
15:00	89.7	76.6	64	177	2743	2815	3366	0	0
16:00	89.0	76.6	65	177	2612	2697	3245	0	0
17:00	88.1	76.6	67	177	2468	2563	3103	0	0
18:00	87.0	76.6	69	177	2293	2396	2913	0	0
19:00	85.4	76.6	71	177	2078	2188	2697	0	0
20:00	84.1	76.6	73	177	1890	1996	2505	0	0
21:00	83.2	76.6	76	177	1709	1805	2316	0	0
22:00	82.2	76.6	78	177	1551	1636	2158	0	0
23:00	81.4	76.6	81	177	1372	1450	1960	0	0

ZONE: GF-NEW DINING
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	74	392	4713	4807	9729	0	0
01:00	79.9	76.6	75	392	4522	4614	9426	0	0
02:00	79.5	76.6	76	392	4401	4477	9150	0	0
03:00	79.2	76.6	76	392	4302	4366	8923	0	0
04:00	78.8	76.6	77	392	4218	4272	8725	0	0
05:00	78.6	76.6	77	392	4145	4192	8571	0	0
06:00	78.8	76.6	77	392	4263	4292	8950	0	0
07:00	79.6	76.6	77	392	4356	4374	9297	0	0
08:00	81.5	76.6	77	392	4443	4456	9758	0	0
09:00	83.6	76.6	76	392	4583	4594	10365	0	0
10:00	85.5	76.6	76	392	4764	4777	10994	0	0
11:00	87.1	76.6	75	392	4999	5013	11668	0	0
12:00	88.3	76.6	73	392	5205	5222	12164	0	0
13:00	89.1	76.6	72	392	5408	5424	12610	0	0
14:00	89.7	76.6	71	392	5593	5607	12965	0	0
15:00	89.7	76.6	71	392	5754	5763	13199	0	0
16:00	89.0	76.6	70	392	5882	5888	13296	0	0
17:00	88.1	76.6	69	392	5962	5967	13277	0	0
18:00	87.0	76.6	69	392	5987	5994	13134	0	0
19:00	85.4	76.6	69	392	5951	5963	12841	0	0
20:00	84.1	76.6	70	392	5843	5863	12482	0	0
21:00	83.2	76.6	70	392	5701	5729	12114	0	0
22:00	82.2	76.6	71	392	5565	5597	11767	0	0
23:00	81.4	76.6	72	392	5443	5478	11467	0	0

ZONE: L1-Dresser Room									
DESIGN MONTH: JULY									
Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	77	292	2280	2459	3044	0	0
01:00	79.9	76.6	79	292	2034	2245	2898	0	0
02:00	79.5	76.6	81	292	1888	2084	2708	0	0
03:00	79.2	76.6	82	292	1776	1957	2552	0	0
04:00	78.8	76.6	83	292	1685	1852	2420	0	0
05:00	78.6	76.6	83	292	1613	1765	2317	0	0
06:00	78.8	76.6	83	292	1648	1769	2406	0	0
07:00	79.6	76.6	82	292	1865	1979	2964	0	0
08:00	81.5	76.6	78	292	2581	2568	3922	0	0
09:00	83.6	76.6	73	292	3161	3112	4622	0	0
10:00	85.5	76.6	69	292	3638	3606	5261	0	0
11:00	87.1	76.6	66	292	4089	4046	5814	0	0
12:00	88.3	76.6	64	292	4446	4391	6221	0	0
13:00	89.1	76.6	62	292	4748	4678	6565	0	0
14:00	89.7	76.6	60	292	4999	4916	6840	0	0
15:00	89.7	76.6	59	292	5195	5104	7036	0	0
16:00	89.0	76.6	58	292	5291	5204	7079	0	0
17:00	88.1	76.6	58	292	5232	5170	6930	0	0
18:00	87.0	76.6	59	292	4898	4894	6396	0	0
19:00	85.4	76.6	63	292	4158	4256	5419	0	0
20:00	84.1	76.6	67	292	3715	3841	5006	0	0
21:00	83.2	76.6	69	292	3370	3490	4544	0	0
22:00	82.2	76.6	72	292	3071	3179	4145	0	0
23:00	81.4	76.6	74	292	2826	2918	3815	0	0

ZONE: L1-Dresser Room 2									
DESIGN MONTH: JULY									
Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	71	105	1207	1233	2008	0	0
01:00	79.9	76.6	72	105	1171	1196	2020	0	0
02:00	79.5	76.6	72	105	1162	1175	1981	0	0
03:00	79.2	76.6	73	105	1155	1159	1949	0	0
04:00	78.8	76.6	73	105	1148	1147	1922	0	0
05:00	78.6	76.6	73	105	1142	1136	1901	0	0
06:00	78.8	76.6	71	105	1354	1295	2270	0	0
07:00	79.6	76.6	70	105	1414	1341	2304	0	0
08:00	81.5	76.6	69	105	1445	1374	2408	0	0
09:00	83.6	76.6	68	105	1477	1408	2526	0	0
10:00	85.5	76.6	68	105	1502	1434	2620	0	0
11:00	87.1	76.6	67	105	1528	1460	2712	0	0
12:00	88.3	76.6	67	105	1535	1470	2752	0	0
13:00	89.1	76.6	67	105	1542	1480	2790	0	0
14:00	89.7	76.6	67	105	1548	1489	2819	0	0
15:00	89.7	76.6	66	105	1555	1499	2833	0	0
16:00	89.0	76.6	66	105	1562	1510	2830	0	0
17:00	88.1	76.6	66	105	1569	1520	2818	0	0
18:00	87.0	76.6	66	105	1576	1529	2796	0	0
19:00	85.4	76.6	66	105	1580	1537	2761	0	0
20:00	84.1	76.6	66	105	1583	1543	2732	0	0
21:00	83.2	76.6	66	105	1584	1546	2705	0	0
22:00	82.2	76.6	66	105	1583	1547	2676	0	0
23:00	81.4	76.6	67	105	1458	1432	2412	0	0

Hourly Zone Loads for SOUTHBAY LAGENDA BUNGALOW (NORMAL)

(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(NORMAL))

Project: South_Lagenda_Human_Activities 01/13/2024
Prepared by: Shahul 2:05 PM

ZONE: L1-Entertainment Room
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	77	293	4607	4663	10068	0	0
01:00	79.9	76.6	78	293	4443	4488	9823	0	0
02:00	79.5	76.6	79	293	4364	4389	9700	0	0
03:00	79.2	76.6	79	293	4301	4315	9599	0	0
04:00	78.8	76.6	80	293	4247	4252	9510	0	0
05:00	78.6	76.6	78	293	4481	4451	9885	0	0
06:00	78.8	76.6	78	293	4671	4623	10312	0	0
07:00	79.6	76.6	78	293	4810	4754	10723	0	0
08:00	81.5	76.6	78	293	4916	4855	11080	0	0
09:00	83.6	76.6	78	293	5030	4962	11459	0	0
10:00	85.5	76.6	78	293	5122	5050	11756	0	0
11:00	87.1	76.6	78	293	5224	5147	12053	0	0
12:00	88.3	76.6	78	293	5268	5193	12163	0	0
13:00	89.1	76.6	77	293	5311	5239	12259	0	0
14:00	89.7	76.6	77	293	5363	5292	12352	0	0
15:00	89.7	76.6	76	293	5434	5365	12446	0	0
16:00	89.0	76.6	76	293	5521	5450	12527	0	0
17:00	88.1	76.6	75	293	5609	5537	12593	0	0
18:00	87.0	76.6	75	293	5689	5618	12636	0	0
19:00	85.4	76.6	75	293	5751	5683	12637	0	0
20:00	84.1	76.6	74	293	5780	5717	12610	0	0
21:00	83.2	76.6	74	293	5774	5717	12552	0	0
22:00	82.2	76.6	74	293	5742	5692	12469	0	0
23:00	81.4	76.6	76	293	5409	5396	11950	0	0

ZONE: L1-EX. HALL
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	66	173	2905	2917	5348	0	0
01:00	79.9	76.6	68	173	2815	2826	5260	0	0
02:00	79.5	76.6	68	173	2771	2773	5177	0	0
03:00	79.2	76.6	69	173	2737	2733	5110	0	0
04:00	78.8	76.6	69	173	2708	2700	5050	0	0
05:00	78.6	76.6	69	173	2682	2670	5002	0	0
06:00	78.8	76.6	69	173	2777	2751	5242	0	0
07:00	79.6	76.6	69	173	2854	2818	5429	0	0
08:00	81.5	76.6	69	173	2912	2872	5624	0	0
09:00	83.6	76.6	68	173	2976	2932	5842	0	0
10:00	85.5	76.6	68	173	3026	2980	6015	0	0
11:00	87.1	76.6	68	173	3080	3032	6186	0	0
12:00	88.3	76.6	67	173	3103	3057	6265	0	0
13:00	89.1	76.6	67	173	3130	3084	6343	0	0
14:00	89.7	76.6	67	173	3162	3117	6413	0	0
15:00	89.7	76.6	66	173	3199	3153	6462	0	0
16:00	89.0	76.6	66	173	3236	3191	6487	0	0
17:00	88.1	76.6	66	173	3273	3228	6498	0	0
18:00	87.0	76.6	65	173	3307	3262	6492	0	0
19:00	85.4	76.6	65	173	3335	3291	6463	0	0
20:00	84.1	76.6	65	173	3355	3313	6435	0	0
21:00	83.2	76.6	64	173	3364	3324	6401	0	0
22:00	82.2	76.6	64	173	3361	3324	6353	0	0
23:00	81.4	76.6	65	173	3347	3312	6297	0	0

ZONE: L1-Musical Room

DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	79	301	1938	2202	3135	0	0
01:00	79.9	76.6	81	301	1709	1962	2932	0	0
02:00	79.5	76.6	82	301	1628	1838	2743	0	0
03:00	79.2	76.6	83	301	1573	1755	2597	0	0
04:00	78.8	76.6	84	301	1530	1689	2474	0	0
05:00	78.6	76.6	84	301	1493	1633	2375	0	0
06:00	78.8	76.6	84	301	1546	1650	2470	0	0
07:00	79.6	76.6	84	301	1580	1657	2549	0	0
08:00	81.5	76.6	87	301	4421	4267	11826	0	0
09:00	83.6	76.6	84	301	5078	4860	13113	0	0
10:00	85.5	76.6	82	301	5260	5075	13475	0	0
11:00	87.1	76.6	81	301	5360	5197	13751	0	0
12:00	88.3	76.6	81	301	5417	5272	13932	0	0
13:00	89.1	76.6	81	301	5468	5338	14092	0	0
14:00	89.7	76.6	80	301	5518	5399	14217	0	0
15:00	89.7	76.6	80	301	5566	5456	14290	0	0
16:00	89.0	76.6	80	301	5609	5507	14308	0	0
17:00	88.1	76.6	79	301	5647	5551	14295	0	0
18:00	87.0	76.6	79	301	5678	5588	14249	0	0
19:00	85.4	76.6	79	301	5700	5616	14158	0	0
20:00	84.1	76.6	79	301	5710	5631	14076	0	0
21:00	83.2	76.6	79	301	5711	5637	13999	0	0
22:00	82.2	76.6	79	301	5705	5635	13917	0	0
23:00	81.4	76.6	74	301	2876	3014	5022	0	0

ZONE: L1-SON BEDROOM 1 (1)

DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	81	429	2122	2918	3417	0	0
01:00	79.9	76.6	83	429	1726	2503	2975	0	0
02:00	79.5	76.6	85	429	1436	2167	2585	0	0
03:00	79.2	76.6	87	429	1210	1888	2262	0	0
04:00	78.8	76.6	89	429	1033	1658	1992	0	0
05:00	78.6	76.6	88	429	1367	1819	2505	0	0
06:00	78.8	76.6	89	429	1336	1711	2169	0	0
07:00	79.6	76.6	89	429	1268	1624	2136	0	0
08:00	81.5	76.6	89	429	1349	1771	2712	0	0
09:00	83.6	76.6	84	429	2137	2678	4567	0	0
10:00	85.5	76.6	76	429	4041	4216	6801	0	0
11:00	87.1	76.6	67	429	5996	5790	8598	0	0
12:00	88.3	76.6	61	429	7352	6977	9711	0	0
13:00	89.1	76.6	58	429	8053	7596	10121	0	0
14:00	89.7	76.6	57	429	8033	7659	9933	0	0
15:00	89.7	76.6	58	429	7683	7456	9599	0	0
16:00	89.0	76.6	59	429	7342	7229	9301	0	0
17:00	88.1	76.6	60	429	7031	7000	8981	0	0
18:00	87.0	76.6	61	429	6676	6716	8548	0	0
19:00	85.4	76.6	63	429	6198	6310	7907	0	0
20:00	84.1	76.6	66	429	5532	5717	7020	0	0
21:00	83.2	76.6	69	429	4798	5034	6111	0	0
22:00	82.2	76.6	73	429	4057	4399	5329	0	0
23:00	81.4	76.6	77	429	2824	3497	3985	0	0

Hourly Zone Loads for SOUTHBAY LAGENDA BUNGALOW (NORMAL)

(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(NORMAL))

Project: South_Lagenda_Human_Activities 01/13/2024
Prepared by: Shahul 2:05 PM

ZONE: L1-SON BEDROOM 2									
DESIGN MONTH: JULY									
Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	85	359	992	1484	1657	0	0
01:00	79.9	76.6	86	359	866	1319	1476	0	0
02:00	79.5	76.6	88	359	765	1183	1329	0	0
03:00	79.2	76.6	88	359	678	1068	1204	0	0
04:00	78.8	76.6	89	359	604	966	1094	0	0
05:00	78.6	76.6	90	359	868	1116	1240	0	0
06:00	78.8	76.6	90	359	876	1076	1208	0	0
07:00	79.6	76.6	91	359	874	1090	1275	0	0
08:00	81.5	76.6	89	359	1320	1510	2337	0	0
09:00	83.6	76.6	86	359	1640	1788	2636	0	0
10:00	85.5	76.6	84	359	1966	2086	3044	0	0
11:00	87.1	76.6	82	359	2327	2393	3441	0	0
12:00	88.3	76.6	80	359	2680	2681	3780	0	0
13:00	89.1	76.6	78	359	2982	2938	4076	0	0
14:00	89.7	76.6	77	359	3179	3159	4315	0	0
15:00	89.7	76.6	76	359	3312	3317	4445	0	0
16:00	89.0	76.6	75	359	3373	3395	4463	0	0
17:00	88.1	76.6	75	359	3334	3370	4345	0	0
18:00	87.0	76.6	76	359	3192	3240	4088	0	0
19:00	85.4	76.6	78	359	2934	3002	3729	0	0
20:00	84.1	76.6	79	359	2670	2801	3490	0	0
21:00	83.2	76.6	80	359	2428	2606	3236	0	0
22:00	82.2	76.6	82	359	2210	2421	3005	0	0
23:00	81.4	76.6	83	359	1326	1745	1939	0	0

ZONE: L2-EX LOBBY									
DESIGN MONTH: JULY									
Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	75	419	3693	3971	5218	0	0
01:00	79.9	76.6	78	419	3217	3538	4797	0	0
02:00	79.5	76.6	80	419	2913	3210	4410	0	0
03:00	79.2	76.6	82	419	2680	2949	4094	0	0
04:00	78.8	76.6	83	419	2492	2736	3832	0	0
05:00	78.6	76.6	81	419	3224	3239	4978	0	0
06:00	78.8	76.6	80	419	3228	3234	4643	0	0
07:00	79.6	76.6	80	419	3175	3217	4699	0	0
08:00	81.5	76.6	80	419	3195	3256	4927	0	0
09:00	83.6	76.6	79	419	3412	3480	5487	0	0
10:00	85.5	76.6	77	419	3899	3921	6292	0	0
11:00	87.1	76.6	74	419	4515	4531	7238	0	0
12:00	88.3	76.6	70	419	5165	5197	8133	0	0
13:00	89.1	76.6	67	419	5838	5853	8956	0	0
14:00	89.7	76.6	64	419	6457	6443	9652	0	0
15:00	89.7	76.6	61	419	7023	6980	10269	0	0
16:00	89.0	76.6	59	419	7525	7454	10757	0	0
17:00	88.1	76.6	58	419	7875	7790	11028	0	0
18:00	87.0	76.6	57	419	7976	7909	10987	0	0
19:00	85.4	76.6	58	419	7741	7729	10526	0	0
20:00	84.1	76.6	60	419	7138	7211	9666	0	0
21:00	83.2	76.6	63	419	6413	6548	8754	0	0
22:00	82.2	76.6	66	419	5781	5932	7974	0	0
23:00	81.4	76.6	71	419	4497	4732	6060	0	0

ZONE: L2-Guest Room
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	82	664	3006	3859	4221	0	0
01:00	79.9	76.6	85	664	2500	3280	3604	0	0
02:00	79.5	76.6	86	664	2133	2811	3109	0	0
03:00	79.2	76.6	88	664	1844	2428	2705	0	0
04:00	78.8	76.6	89	664	1614	2113	2372	0	0
05:00	78.6	76.6	89	664	1431	1855	2105	0	0
06:00	78.8	76.6	90	664	2074	2406	3353	0	0
07:00	79.6	76.6	90	664	2187	2489	3640	0	0
08:00	81.5	76.6	89	664	2345	2733	4207	0	0
09:00	83.6	76.6	87	664	2754	3283	5241	0	0
10:00	85.5	76.6	84	664	3596	4192	6668	0	0
11:00	87.1	76.6	79	664	4967	5347	8249	0	0
12:00	88.3	76.6	75	664	6527	6570	9732	0	0
13:00	89.1	76.6	71	664	7619	7708	11010	0	0
14:00	89.7	76.6	68	664	8616	8699	12068	0	0
15:00	89.7	76.6	65	664	9434	9491	12840	0	0
16:00	89.0	76.6	63	664	9982	10028	13259	0	0
17:00	88.1	76.6	63	664	10146	10221	13221	0	0
18:00	87.0	76.6	63	664	9857	10004	12654	0	0
19:00	85.4	76.6	65	664	9070	9326	11528	0	0
20:00	84.1	76.6	68	664	8015	8354	10159	0	0
21:00	83.2	76.6	71	664	6926	7298	8835	0	0
22:00	82.2	76.6	75	664	4988	5625	6079	0	0
23:00	81.4	76.6	79	664	3846	4687	5093	0	0

ZONE: L2-MASTER BEDROOM
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	81	655	2584	3422	3698	0	0
01:00	79.9	76.6	83	655	2038	2803	3056	0	0
02:00	79.5	76.6	84	655	1657	2311	2546	0	0
03:00	79.2	76.6	85	655	1372	1916	2139	0	0
04:00	78.8	76.6	87	655	1157	1599	1810	0	0
05:00	78.6	76.6	87	655	994	1345	1551	0	0
06:00	78.8	76.6	89	655	1180	1463	1679	0	0
07:00	79.6	76.6	91	655	1298	1633	1883	0	0
08:00	81.5	76.6	90	655	1860	2381	3615	0	0
09:00	83.6	76.6	85	655	3059	3719	5736	0	0
10:00	85.5	76.6	78	655	5274	5633	8182	0	0
11:00	87.1	76.6	71	655	7413	7646	10350	0	0
12:00	88.3	76.6	65	655	9299	9384	12032	0	0
13:00	89.1	76.6	61	655	10758	10675	13172	0	0
14:00	89.7	76.6	58	655	11626	11469	13793	0	0
15:00	89.7	76.6	57	655	12037	11892	14082	0	0
16:00	89.0	76.6	56	655	12075	11996	14007	0	0
17:00	88.1	76.6	57	655	11682	11723	13471	0	0
18:00	87.0	76.6	59	655	10706	10931	12248	0	0
19:00	85.4	76.6	63	655	9025	9490	10300	0	0
20:00	84.1	76.6	68	655	7504	8075	8701	0	0
21:00	83.2	76.6	72	655	6154	6724	7175	0	0
22:00	82.2	76.6	76	655	4656	5285	5619	0	0
23:00	81.4	76.6	79	655	3492	4294	4599	0	0

Hourly Zone Loads for SOUTHBAY LAGENDA BUNGALOW (NORMAL)

(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(NORMAL))

Project: South_Lagenda_Human_Activities 01/13/2024
Prepared by: Shahul 2:05 PM

ZONE: L2-Relax Corner
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	84	760	3825	4331	5299	0	0
01:00	79.9	76.6	86	760	3294	3803	4883	0	0
02:00	79.5	76.6	88	760	2953	3392	4423	0	0
03:00	79.2	76.6	89	760	2686	3061	4049	0	0
04:00	78.8	76.6	90	760	2476	2793	3744	0	0
05:00	78.6	76.6	89	760	3015	3159	4606	0	0
06:00	78.8	76.6	89	760	3057	3154	4395	0	0
07:00	79.6	76.6	89	760	3099	3218	4651	0	0
08:00	81.5	76.6	87	760	3396	3602	5530	0	0
09:00	83.6	76.6	84	760	4318	4631	7350	0	0
10:00	85.5	76.6	79	760	5865	6220	9586	0	0
11:00	87.1	76.6	74	760	7530	7951	11685	0	0
12:00	88.3	76.6	69	760	9114	9453	13284	0	0
13:00	89.1	76.6	66	760	10325	10550	14355	0	0
14:00	89.7	76.6	64	760	11033	11193	14895	0	0
15:00	89.7	76.6	63	760	11317	11472	15047	0	0
16:00	89.0	76.6	63	760	11278	11464	14857	0	0
17:00	88.1	76.6	64	760	10892	11137	14261	0	0
18:00	87.0	76.6	66	760	10158	10476	13243	0	0
19:00	85.4	76.6	69	760	9110	9495	11861	0	0
20:00	84.1	76.6	72	760	8024	8429	10507	0	0
21:00	83.2	76.6	75	760	7052	7432	9321	0	0
22:00	82.2	76.6	77	760	6264	6594	8353	0	0
23:00	81.4	76.6	81	760	4992	5331	6524	0	0

ZONE: L2-TEA ROOM
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	76.6	86	477	2293	2509	3236	0	0
01:00	79.9	76.6	87	477	1984	2231	2984	0	0
02:00	79.5	76.6	88	477	1787	2020	2743	0	0
03:00	79.2	76.6	89	477	1635	1850	2545	0	0
04:00	78.8	76.6	90	477	1514	1710	2380	0	0
05:00	78.6	76.6	89	477	1804	1901	2816	0	0
06:00	78.8	76.6	89	477	1815	1898	2724	0	0
07:00	79.6	76.6	89	477	1855	1966	2947	0	0
08:00	81.5	76.6	88	477	2085	2226	3469	0	0
09:00	83.6	76.6	85	477	2532	2685	4245	0	0
10:00	85.5	76.6	82	477	3126	3355	5227	0	0
11:00	87.1	76.6	78	477	3854	4140	6258	0	0
12:00	88.3	76.6	74	477	4612	4892	7125	0	0
13:00	89.1	76.6	71	477	5269	5511	7795	0	0
14:00	89.7	76.6	69	477	5751	5955	8232	0	0
15:00	89.7	76.6	68	477	6019	6201	8416	0	0
16:00	89.0	76.6	68	477	6069	6250	8348	0	0
17:00	88.1	76.6	68	477	5878	6079	8007	0	0
18:00	87.0	76.6	70	477	5465	5692	7391	0	0
19:00	85.4	76.6	73	477	4857	5105	6571	0	0
20:00	84.1	76.6	75	477	4306	4551	5893	0	0
21:00	83.2	76.6	78	477	3836	4057	5300	0	0
22:00	82.2	76.6	80	477	3454	3645	4812	0	0
23:00	81.4	76.6	83	477	2811	3004	3871	0	0

APPENDIX D

Type B Cooling Load Estimation Result

DOAS Sizing Summary for SOUTHBAY LAGENDA BUNGALOW (ACTIVE)
(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(ACTIVE))

Project: South_Lagenda_Human_Activities 01/12/2024
Prepared by: Shahul 3:50 PM

Air System Information

Air System Name **SOUTHBAY LAGENDA BUNGALOW (ACTIVE)**
Equipment Class --**TERM**
Air System Type--- **VRF**

Number of zones--- **20**
Floor Area--**4819.4**sqft
Location---------------------------------- **Penang Intl, Malaysia**

Sizing Calculation Information

Calculation Months --------------------------------**Jan to Dec**
Sizing Data --**Calculated**

Zone CFM Sizing-------------- **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

NOTE: No other data is applicable for a Terminal Units air system without a Dedicated Outdoor Air System (DOAS).

Zone Sizing Summary for SOUTHBAY LAGENDA BUNGALOW (ACTIVE)

(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(ACTIVE))

Project: South_Lagenda_Human_Activities 01/12/2024
Prepared by: Shahul 3:50 PM

Air System Information

Air System Name **SOUTHBAY LAGENDA BUNGALOW (ACTIVE)**
Number of zones **20**

Equipment Class .... **TERM**
Air System Type .... **VRF**
Floor Area .... **4819.4** sqft
Location .... **Penang Intl, Malaysia**

Sizing Calculation Information

Calculation Months .... **Jan to Dec**
Sizing Data .... **Calculated**
Zone CFM Sizing **Sum of space airflow rates**
Space CFM Sizing **Individual peak space loads**

Terminal Unit Sizing Data - Cooling

Zone Name	Total Coil Load (MBH)	Sens Coil Load (MBH)	Coil Entering DB / WB (F)	Coil Leaving DB / WB (F)	Water Flow @ 10.0 F (gpm)	Time of Peak Coil Load	Zone CFM/sqft
EX LOBBY	11.6	6.9	77.3 / 69.0	58.4 / 58.4	-	May 19:00	3.31
GF-EX LIVING	18.3	14.6	75.9 / 66.3	59.0 / 58.9	-	January 17:00	1.71
GF-EX. FOYER	9.9	6.8	76.9 / 67.7	58.8 / 58.7	-	May 17:00	2.50
GF-Golf Simulation Room	30.3	16.4	78.9 / 71.1	59.8 / 59.8	-	May 14:00	3.04
GF-Gymnasium	28.4	14.4	80.2 / 72.2	58.4 / 58.4	-	June 16:00	3.68
GF-KITCHEN	28.6	22.4	76.5 / 66.3	58.4 / 58.3	-	June 14:00	3.22
GF-MECHANICAL ROOM	5.0	4.0	32.0 / 21.6	58.3 / 58.2	-	January 14:00	5.50
GF-NEW DINING	16.3	10.1	78.0 / 69.0	58.7 / 58.6	-	January 16:00	1.76
L1-Dresser Room	7.1	5.5	77.1 / 66.7	58.7 / 58.6	-	June 16:00	1.37
L1-Dresser Room 2	2.8	1.8	79.3 / 71.3	64.0 / 64.0	-	May 15:00	1.00
L1-Entertaiment Room	30.9	14.8	80.5 / 73.1	58.8 / 58.7	-	May 16:00	3.85
L1-EX. HALL	7.6	4.3	78.5 / 70.3	59.0 / 59.0	-	June 17:00	1.36
L1-Sauna Room	18.0	9.8	78.0 / 70.4	59.1 / 59.1	-	May 16:00	2.43
L1-SON BEDROOM 1	11.5	9.9	76.1 / 65.8	59.0 / 58.9	-	May 13:00	1.56
L1-SON BEDROOM 2	8.3	7.2	75.9 / 65.8	59.2 / 59.2	-	January 15:00	1.78
L2-EX LOBBY	13.2	9.6	76.7 / 67.0	58.5 / 58.5	-	May 17:00	1.62
L2-Exercise Area	28.1	18.8	76.7 / 67.6	58.4 / 58.3	-	January 16:00	2.07
L2-MASTER BEDROOM	16.0	14.2	75.9 / 65.3	58.5 / 58.5	-	June 15:00	1.91
L2-Relax Corner	30.4	19.0	76.0 / 67.9	58.4 / 58.4	-	January 15:00	2.68
L2-TEA ROOM	13.1	10.0	76.7 / 66.7	58.4 / 58.3	-	January 15:00	2.62

Terminal Unit Sizing Data - Heating, Fan, Ventilation

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (F)	Htg Coil Water Flow @20.0 F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
EX LOBBY	0.0	0.0 / 0.0	0.00	331	0.024	0.019	56
GF-EX LIVING	0.0	0.0 / 0.0	0.00	781	0.058	0.046	57
GF-EX. FOYER	0.0	0.0 / 0.0	0.00	340	0.025	0.020	38
GF-Golf Simulation Room	0.0	0.0 / 0.0	0.00	779	0.057	0.046	175
GF-Gymnasium	0.0	0.0 / 0.0	0.00	598	0.044	0.035	189
GF-KITCHEN	0.0	0.0 / 0.0	0.00	1121	0.083	0.066	87
GF-MECHANICAL ROOM	0.0	0.0 / 0.0	0.00	214	0.016	0.013	0
GF-NEW DINING	0.0	0.0 / 0.0	0.00	476	0.035	0.028	124
L1-Dresser Room	0.0	0.0 / 0.0	0.00	274	0.020	0.016	32
L1-Dresser Room 2	0.0	0.0 / 0.0	0.00	106	0.008	0.006	26
L1-Entertaiment Room	0.0	0.0 / 0.0	0.00	619	0.046	0.036	210
L1-EX. HALL	0.0	0.0 / 0.0	0.00	200	0.015	0.012	44
L1-Sauna Room	0.0	0.0 / 0.0	0.00	470	0.035	0.028	85
L1-SON BEDROOM 1	0.0	0.0 / 0.0	0.00	522	0.038	0.031	30
L1-SON BEDROOM 2	0.0	0.0 / 0.0	0.00	393	0.029	0.023	23
L2-EX LOBBY	0.0	0.0 / 0.0	0.00	481	0.035	0.028	48
L2-Exercise Area	0.0	0.0 / 0.0	0.00	933	0.069	0.055	127

Zone Name	Heating Coil Load (MBH)	Heating Coil Ent/Lvg DB (F)	Htg Coil Water Flow @20.0 F (gpm)	Fan Design Airflow (CFM)	Fan Motor (BHP)	Fan Motor (kW)	OA Vent Design Airflow (CFM)
L2-MASTER BEDROOM	0.0	0.0 / 0.0	0.00	740	0.055	0.043	33
L2-Relax Corner	0.0	0.0 / 0.0	0.00	979	0.072	0.057	72
L2-TEA ROOM	0.0	0.0 / 0.0	0.00	494	0.036	0.029	64

VRF Outdoor Unit Sizing Data

	Cooling [MBH]	Cooling [Tons]	Heating [MBH]
Peak Coincident Indoor Unit Loads	318.2	26.5	0.0
Estimated Piping / Line Losses	0.0	0.0	0.0
Total Required ODU Capacity	318.2	26.5	0.0

Note: VRF piping / line losses are based on typical loss factors for this class of equipment. Actual line loss varies widely from one product to another. Therefore, when selecting equipment it is critical to consult manufacturer's guidance to utilize actual line loss data.

Zone Peak Sensible Loads

Zone Name	Zone Cooling Sensible (MBH)	Time of Peak Sensible Cooling Load	Zone Heating Load (MBH)	Zone Floor Area (sqft)
EX LOBBY	6.2	May 19:00	0.0	100.1
GF-EX LIVING	14.5	December 17:00	0.0	456.7
GF-EX. FOYER	6.3	May 18:00	0.0	136.1
GF-Golf Simulation Room	14.5	January 17:00	0.0	256.4
GF-Gymnasium	11.1	June 16:00	0.0	162.6
GF-KITCHEN	20.8	June 14:00	0.0	348.0
GF-MECHANICAL ROOM	4.0	January 14:00	0.0	38.9
GF-NEW DINING	8.8	December 17:00	0.0	269.6
L1-Dresser Room	5.1	June 16:00	0.0	200.1
L1-Dresser Room 2	1.5	January 20:00	0.0	105.6
L1-Entertaiment Room	11.5	June 20:00	0.0	160.7
L1-EX. HALL	3.7	June 21:00	0.0	147.3
L1-Sauna Room	8.7	January 20:00	0.0	193.5
L1-SON BEDROOM 1	9.7	May 13:00	0.0	334.7
L1-SON BEDROOM 2	7.3	December 16:00	0.0	220.4
L2-EX LOBBY	8.9	May 18:00	0.0	297.4
L2-Exercise Area	17.3	January 16:00	0.0	450.5
L2-MASTER BEDROOM	13.7	June 16:00	0.0	386.6
L2-Relax Corner	18.2	January 15:00	0.0	365.3
L2-TEA ROOM	9.2	January 15:00	0.0	188.8

Zone Sizing Summary for SOUTHBAY LAGENDA BUNGALOW (ACTIVE)

(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(ACTIVE))

Project: South_Lagenda_Human_Activities 01/12/2024
Prepared by: Shahul 3:50 PM

Space Loads and Airflows

Zone Name / Space Name	Cooling Sensible (MBH)	Time of Peak Sensible Load	Air Flow (CFM)	Heating Load (MBH)	Floor Area (sqft)	Space CFM/sqft
EX LOBBY						
EX LOBBY	6.2	May 19:00	331	0.0	100.1	3.31
GF-EX LIVING						
GF-EX LIVING	14.5	December 17:00	781	0.0	456.7	1.71
GF-EX. FOYER						
GF-EX. FOYER	6.3	May 18:00	340	0.0	136.1	2.50
GF-Golf Simulation Room						
GF-Golf Simulation Room	14.5	January 17:00	779	0.0	256.4	3.04
GF-Gymnasium						
GF-Gymnasium	11.1	June 16:00	598	0.0	162.6	3.68
GF-KITCHEN						
GF-KITCHEN	20.8	June 14:00	1121	0.0	348.0	3.22
GF-MECHANICAL ROOM						
GF-MECHANICAL ROOM	4.0	January 14:00	214	0.0	38.9	5.50
GF-NEW DINING						
GF-NEW DINING	8.8	December 17:00	476	0.0	269.6	1.76
L1-Dresser Room						
L1-Dresser Room	5.1	June 16:00	274	0.0	200.1	1.37
L1-Dresser Room 2						
L1-Dresser Room 2	1.5	January 20:00	106	0.0	105.6	1.00
L1-Entertaiment Room						
L1-Entertaiment Room	11.5	June 20:00	619	0.0	160.7	3.85
L1-EX. HALL						
L1-EX. HALL	3.7	June 21:00	200	0.0	147.3	1.36
L1-Sauna Room						
L1-Sauna Room	8.7	January 20:00	470	0.0	193.5	2.43
L1-SON BEDROOM 1						
L1-SON BEDROOM 1	9.7	May 13:00	522	0.0	334.7	1.56
L1-SON BEDROOM 2						
L1-SON BEDROOM 2	7.3	December 16:00	393	0.0	220.4	1.78
L2-EX LOBBY						
L2-EX LOBBY	8.9	May 18:00	481	0.0	297.4	1.62
L2-Exercise Area						
L2-Exercise Area	17.3	January 16:00	933	0.0	450.5	2.07
L2-MASTER BEDROOM						
L2-MASTER BEDROOM	13.7	June 16:00	740	0.0	386.6	1.91
L2-Relax Corner						
L2-Relax Corner	18.2	January 15:00	979	0.0	365.3	2.68
L2-TEA ROOM						
L2-TEA ROOM	9.2	January 15:00	494	0.0	188.8	2.62

Space Heat Balance Summary for SOUTHBAY LAGENDA BUNGALOW (ACTIVE)
(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(ACTIVE))

Project: South_Lagenda_Human_Activities — 01/12/2024
Prepared by: Shahul — 3:50 PM

Table 1. Heat Balance Loads for Space EX LOBBY in Zone EX LOBBY

	DESIGN COOLING - MAY 19:00			DESIGN HEATING		
	OA DB / WB 87.4 F / 78.1 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 72.0 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	120 sqft	1659	-	120 sqft	-1	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	100 sqft	385	-	100 sqft	0	-
Interior Wall Convection	508 sqft	1904	-	508 sqft	1	-
Ceiling Convection	100 sqft	590	-	100 sqft	0	-
Overhead Lighting Convection	84 W	179	-	0 W	0	-
Task Lighting Convection	15 W	23	-	0 W	0	-
Electric Equipment Convection	110 W	282	-	0 W	0	-
People Convection	10	840	2700	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	293	135	0%	0	0
>> Total Space Loads	**-**	**6155**	**2835**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Space Heat Balance Summary for SOUTHBAY LAGENDA BUNGALOW (ACTIVE)

(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(ACTIVE))

Project: South_Lagenda_Human_Activities — 01/12/2024
Prepared by: Shahul — 3:50 PM

Table 2. Heat Balance Loads for Space GF-EX LIVING in Zone GF-EX LIVING

	DESIGN COOLING - DECEMBER 17:00			DESIGN HEATING		
	OA DB / WB 82.1 F / 73.8 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 71.5 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	503 sqft	5117	-	503 sqft	5	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	60 sqft	570	-	60 sqft	3	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	457 sqft	2033	-	457 sqft	-2	-
Interior Wall Convection	602 sqft	1680	-	602 sqft	-2	-
Ceiling Convection	457 sqft	2538	-	457 sqft	-3	-
Overhead Lighting Convection	384 W	818	-	0 W	0	-
Task Lighting Convection	25 W	38	-	0 W	0	-
Electric Equipment Convection	200 W	512	-	0 W	0	-
People Convection	6	504	1620	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	690	81	0%	0	0
>> Total Space Loads	**-**	**14500**	**1701**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 3. Heat Balance Loads for Space GF-EX. FOYER in Zone GF-EX. FOYER

	DESIGN COOLING - MAY 18:00			DESIGN HEATING		
	OA DB / WB 89.0 F / 78.5 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 71.8 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	148 sqft	1636	-	148 sqft	-1	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	44 sqft	529	-	44 sqft	1	-
Floor Convection	136 sqft	377	-	136 sqft	0	-
Interior Wall Convection	425 sqft	1389	-	425 sqft	1	-
Ceiling Convection	136 sqft	787	-	136 sqft	0	-
Overhead Lighting Convection	114 W	244	-	0 W	0	-
Task Lighting Convection	20 W	30	-	0 W	0	-
Electric Equipment Convection	200 W	512	-	0 W	0	-
People Convection	6	504	1620	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	300	81	0%	0	0
>> Total Space Loads	**-**	**6307**	**1701**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Space Heat Balance Summary for SOUTHBAY LAGENDA BUNGALOW (ACTIVE)

(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(ACTIVE))

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Prepared by: Shahul | 3:50 PM

Table 4. Heat Balance Loads for Space GF-Golf Simulation Room in Zone GF-Golf Simulation Room

	DESIGN COOLING - JANUARY 17:00			DESIGN HEATING		
	OA DB / WB 85.1 F / 75.8 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 71.6 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	312 sqft	3785	-	312 sqft	3	-
Roof Convection	12 sqft	122	-	12 sqft	0	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	256 sqft	1108	-	256 sqft	-1	-
Interior Wall Convection	573 sqft	2164	-	573 sqft	0	-
Ceiling Convection	245 sqft	1785	-	245 sqft	-1	-
Overhead Lighting Convection	231 W	492	-	0 W	0	-
Task Lighting Convection	40 W	60	-	0 W	0	-
Electric Equipment Convection	1000 W	2559	-	0 W	0	-
People Convection	8	1704	8720	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	689	436	0%	0	0
>> Total Space Loads	**-**	**14469**	**9156**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 5. Heat Balance Loads for Space GF-Gymnasium in Zone GF-Gymnasium

	DESIGN COOLING - JUNE 16:00			DESIGN HEATING		
	OA DB / WB 91.0 F / 79.0 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 71.6 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	91 sqft	1334	-	91 sqft	1	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	30 sqft	411	-	30 sqft	2	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	163 sqft	1045	-	163 sqft	-1	-
Interior Wall Convection	669 sqft	3418	-	669 sqft	-1	-
Ceiling Convection	162 sqft	1524	-	162 sqft	-1	-
Overhead Lighting Convection	146 W	312	-	0 W	0	-
Task Lighting Convection	40 W	60	-	0 W	0	-
Electric Equipment Convection	300 W	768	-	0 W	0	-
People Convection	8	1704	8720	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	529	436	0%	0	0
>> Total Space Loads	**-**	**11105**	**9156**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Space Heat Balance Summary for SOUTHBAY LAGENDA BUNGALOW (ACTIVE)
(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(ACTIVE))

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Table 6. Heat Balance Loads for Space GF-KITCHEN in Zone GF-KITCHEN

	DESIGN COOLING - JUNE 14:00			DESIGN HEATING		
	OA DB / WB 91.7 F / 79.2 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 71.6 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	508 sqft	6058	-	508 sqft	4	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	348 sqft	1152	-	348 sqft	-1	-
Interior Wall Convection	478 sqft	1581	-	478 sqft	-1	-
Ceiling Convection	348 sqft	1944	-	348 sqft	-1	-
Overhead Lighting Convection	379 W	809	-	0 W	0	-
Task Lighting Convection	50 W	75	-	0 W	0	-
Electric Equipment Convection	3000 W	7677	-	0 W	0	-
People Convection	6	531	2730	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	991	137	0%	0	0
>> Total Space Loads	**-**	**20817**	**2867**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 7. Heat Balance Loads for Space GF-MECHANICAL ROOM in Zone GF-MECHANICAL ROOM

	DESIGN COOLING - JANUARY 14:00			DESIGN HEATING		
	OA DB / WB 86.7 F / 76.2 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 71.2 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	129 sqft	1776	-	129 sqft	2	-
Roof Convection	33 sqft	381	-	33 sqft	-1	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	44 sqft	377	-	44 sqft	0	-
Floor Convection	39 sqft	104	-	39 sqft	0	-
Interior Wall Convection	173 sqft	511	-	173 sqft	-1	-
Ceiling Convection	6 sqft	27	-	6 sqft	0	-
Overhead Lighting Convection	17 W	36	-	0 W	0	-
Task Lighting Convection	4 W	6	-	0 W	0	-
Electric Equipment Convection	150 W	384	-	0 W	0	-
People Convection	2	177	910	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	189	46	0%	0	0
>> Total Space Loads	**-**	**3968**	**956**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 8. Heat Balance Loads for Space GF-NEW DINING in Zone GF-NEW DINING

	DESIGN COOLING - DECEMBER 17:00			DESIGN HEATING		
	OA DB / WB 82.1 F / 73.8 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 71.5 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	188 sqft	2322	-	188 sqft	7	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	270 sqft	674	-	270 sqft	-2	-
Interior Wall Convection	685 sqft	1591	-	685 sqft	-2	-
Ceiling Convection	270 sqft	1337	-	270 sqft	-2	-
Overhead Lighting Convection	162 W	345	-	0 W	0	-
Task Lighting Convection	15 W	23	-	0 W	0	-
Electric Equipment Convection	500 W	1280	-	0 W	0	-
People Convection	10	840	2700	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	421	135	0%	0	0
>> Total Space Loads	**-**	**8832**	**2835**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 9. Heat Balance Loads for Space L1-Dresser Room in Zone L1-Dresser Room

	DESIGN COOLING - JUNE 16:00			DESIGN HEATING		
	OA DB / WB 91.0 F / 79.0 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 71.6 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	142 sqft	1318	-	142 sqft	1	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	30 sqft	238	-	30 sqft	1	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	200 sqft	724	-	200 sqft	-1	-
Interior Wall Convection	579 sqft	1156	-	579 sqft	-1	-
Ceiling Convection	200 sqft	770	-	200 sqft	-1	-
Overhead Lighting Convection	82 W	175	-	0 W	0	-
Task Lighting Convection	10 W	15	-	0 W	0	-
Electric Equipment Convection	120 W	307	-	0 W	0	-
People Convection	2	138	240	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	242	12	0%	0	0
>> Total Space Loads	**-**	**5084**	**252**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 10. Heat Balance Loads for Space L1-Dresser Room 2 in Zone L1-Dresser Room 2

	DESIGN COOLING - JANUARY 20:00			DESIGN HEATING		
	OA DB / WB 81.1 F / 74.7 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 71.8 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	0 sqft	0	-	0 sqft	0	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	106 sqft	118	-	106 sqft	0	-
Interior Wall Convection	545 sqft	472	-	545 sqft	0	-
Ceiling Convection	106 sqft	244	-	106 sqft	0	-
Overhead Lighting Convection	43 W	92	-	0 W	0	-
Task Lighting Convection	10 W	15	-	0 W	0	-
Electric Equipment Convection	120 W	307	-	0 W	0	-
People Convection	2	138	240	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	69	12	0%	0	0
>> Total Space Loads	**-**	**1456**	**252**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 11. Heat Balance Loads for Space L1-Entertaiment Room in Zone L1-Entertaiment Room

	DESIGN COOLING - JUNE 20:00			DESIGN HEATING		
	OA DB / WB 86.1 F / 77.8 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 71.9 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	22 sqft	264	-	22 sqft	0	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	161 sqft	934	-	161 sqft	-1	-
Interior Wall Convection	725 sqft	3818	-	725 sqft	1	-
Ceiling Convection	161 sqft	1397	-	161 sqft	0	-
Overhead Lighting Convection	145 W	308	-	0 W	0	-
Task Lighting Convection	30 W	45	-	0 W	0	-
Electric Equipment Convection	800 W	2047	-	0 W	0	-
People Convection	10	2130	10900	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	547	545	0%	0	0
>> Total Space Loads	**-**	**11491**	**11445**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Space Heat Balance Summary for SOUTHBAY LAGENDA BUNGALOW (ACTIVE)
(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(ACTIVE))

Project: South_Lagenda_Human_Activities 01/12/2024
Prepared by: Shahul 3:50 PM

Table 12. Heat Balance Loads for Space L1-EX. HALL in Zone L1-EX. HALL

	DESIGN COOLING - JUNE 21:00			DESIGN HEATING		
	OA DB / WB 85.2 F / 77.6 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 71.8 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	0 sqft	0	-	0 sqft	0	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	147 sqft	372	-	147 sqft	0	-
Interior Wall Convection	779 sqft	1513	-	779 sqft	1	-
Ceiling Convection	147 sqft	483	-	147 sqft	0	-
Overhead Lighting Convection	124 W	264	-	0 W	0	-
Task Lighting Convection	25 W	38	-	0 W	0	-
Electric Equipment Convection	110 W	282	-	0 W	0	-
People Convection	7	588	1890	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	177	95	0%	0	0
>> Total Space Loads	**-**	**3716**	**1985**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 13. Heat Balance Loads for Space L1-Sauna Room in Zone L1-Sauna Room

	DESIGN COOLING - JANUARY 20:00			DESIGN HEATING		
	OA DB / WB 81.1 F / 74.7 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 71.7 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	0 sqft	0	-	0 sqft	0	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	194 sqft	609	-	194 sqft	0	-
Interior Wall Convection	737 sqft	2176	-	737 sqft	0	-
Ceiling Convection	194 sqft	1126	-	194 sqft	0	-
Overhead Lighting Convection	176 W	375	-	0 W	0	-
Task Lighting Convection	10 W	15	-	0 W	0	-
Electric Equipment Convection	1200 W	3071	-	0 W	0	-
People Convection	6	945	5550	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	416	278	0%	0	0
>> Total Space Loads	**-**	**8733**	**5828**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 14. Heat Balance Loads for Space L1-SON BEDROOM 1 in Zone L1-SON BEDROOM 1

	DESIGN COOLING - MAY 13:00			DESIGN HEATING		
	OA DB / WB 91.1 F / 79.1 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 71.6 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	641 sqft	5546	-	641 sqft	3	-
Roof Convection	6 sqft	60	-	6 sqft	0	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	335 sqft	706	-	335 sqft	-1	-
Interior Wall Convection	481 sqft	834	-	481 sqft	-1	-
Ceiling Convection	329 sqft	1116	-	329 sqft	-1	-
Overhead Lighting Convection	137 W	293	-	0 W	0	-
Task Lighting Convection	15 W	23	-	0 W	0	-
Electric Equipment Convection	200 W	512	-	0 W	0	-
People Convection	2	138	240	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	461	12	0%	0	0
>> Total Space Loads	**-**	**9688**	**252**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 15. Heat Balance Loads for Space L1-SON BEDROOM 2 in Zone L1-SON BEDROOM 2

	DESIGN COOLING - DECEMBER 16:00			DESIGN HEATING		
	OA DB / WB 83.0 F / 74.0 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 71.4 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	203 sqft	2267	-	203 sqft	4	-
Roof Convection	0 sqft	0	-	0 sqft	0	-
Window Convection	30 sqft	275	-	30 sqft	2	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	220 sqft	1034	-	220 sqft	-2	-
Interior Wall Convection	534 sqft	1401	-	534 sqft	-3	-
Ceiling Convection	220 sqft	1103	-	220 sqft	-1	-
Overhead Lighting Convection	90 W	193	-	0 W	0	-
Task Lighting Convection	15 W	23	-	0 W	0	-
Electric Equipment Convection	200 W	512	-	0 W	0	-
People Convection	2	138	240	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	347	12	0%	0	0
>> Total Space Loads	**-**	**7293**	**252**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 16. Heat Balance Loads for Space L2-EX LOBBY in Zone L2-EX LOBBY

	DESIGN COOLING - MAY 18:00			DESIGN HEATING		
	OA DB / WB 89.0 F / 78.5 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 71.9 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	122 sqft	1298	-	122 sqft	0	-
Roof Convection	297 sqft	2935	-	297 sqft	-1	-
Window Convection	0 sqft	0	-	0 sqft	0	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	297 sqft	567	-	297 sqft	-1	-
Interior Wall Convection	1256 sqft	2482	-	1256 sqft	2	-
Ceiling Convection	0 sqft	0	-	0 sqft	0	-
Overhead Lighting Convection	250 W	533	-	0 W	0	-
Task Lighting Convection	25 W	38	-	0 W	0	-
Electric Equipment Convection	55 W	141	-	0 W	0	-
People Convection	6	504	1620	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	425	81	0%	0	0
>> Total Space Loads	**-**	**8922**	**1701**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 17. Heat Balance Loads for Space L2-Exercise Area in Zone L2-Exercise Area

	DESIGN COOLING - JANUARY 16:00			DESIGN HEATING		
	OA DB / WB 86.0 F / 76.0 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 71.6 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	354 sqft	3881	-	354 sqft	9	-
Roof Convection	451 sqft	5088	-	451 sqft	-6	-
Window Convection	30 sqft	314	-	30 sqft	3	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	451 sqft	1993	-	451 sqft	-3	-
Interior Wall Convection	891 sqft	2697	-	891 sqft	-3	-
Ceiling Convection	0 sqft	0	-	0 sqft	0	-
Overhead Lighting Convection	405 W	864	-	0 W	0	-
Task Lighting Convection	50 W	75	-	0 W	0	-
Electric Equipment Convection	200 W	512	-	0 W	0	-
People Convection	5	1065	5450	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	825	273	0%	0	0
>> Total Space Loads	**-**	**17316**	**5723**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 18. Heat Balance Loads for Space L2-MASTER BEDROOM in Zone L2-MASTER BEDROOM

	DESIGN COOLING - JUNE 16:00			DESIGN HEATING		
	OA DB / WB 91.0 F / 79.0 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 71.7 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	505 sqft	4800	-	505 sqft	4	-
Roof Convection	387 sqft	4573	-	387 sqft	-4	-
Window Convection	30 sqft	275	-	30 sqft	2	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	387 sqft	1256	-	387 sqft	-1	-
Interior Wall Convection	508 sqft	1292	-	508 sqft	0	-
Ceiling Convection	0 sqft	0	-	0 sqft	0	-
Overhead Lighting Convection	159 W	338	-	0 W	0	-
Task Lighting Convection	15 W	23	-	0 W	0	-
Electric Equipment Convection	150 W	384	-	0 W	0	-
People Convection	2	138	240	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	654	12	0%	0	0
>> Total Space Loads	**-**	**13733**	**252**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 19. Heat Balance Loads for Space L2-Relax Corner in Zone L2-Relax Corner

	DESIGN COOLING - JANUARY 15:00			DESIGN HEATING		
	OA DB / WB 86.7 F / 76.2 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 71.5 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	479 sqft	5996	-	479 sqft	9	-
Roof Convection	365 sqft	4563	-	365 sqft	-6	-
Window Convection	30 sqft	374	-	30 sqft	2	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	365 sqft	1973	-	365 sqft	-3	-
Interior Wall Convection	509 sqft	1945	-	509 sqft	-2	-
Ceiling Convection	0 sqft	0	-	0 sqft	0	-
Overhead Lighting Convection	216 W	459	-	0 W	0	-
Task Lighting Convection	30 W	45	-	0 W	0	-
Electric Equipment Convection	150 W	384	-	0 W	0	-
People Convection	10	1575	9250	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	866	463	0%	0	0
>> Total Space Loads	**-**	**18180**	**9713**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

Table 20. Heat Balance Loads for Space L2-TEA ROOM in Zone L2-TEA ROOM

	DESIGN COOLING - JANUARY 15:00			DESIGN HEATING		
	OA DB / WB 86.7 F / 76.2 F			OA DB / WB 73.6 F / 61.4 F		
	OCCUPIED T-STAT 75.2 F			OCCUPIED T-STAT 70.0 F		
	INDOOR DB 75.2 F			INDOOR DB 71.5 F		
Space Heat Balance Component	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**	**Details**	**Sensible [BTU/hr]**	**Latent [BTU/hr]**
Exterior Wall Convection	209 sqft	2541	-	209 sqft	3	-
Roof Convection	189 sqft	2192	-	189 sqft	-3	-
Window Convection	30 sqft	366	-	30 sqft	2	-
Skylight Convection	0 sqft	0	-	0 sqft	0	-
Door Convection	0 sqft	0	-	0 sqft	0	-
Floor Convection	189 sqft	1260	-	189 sqft	-1	-
Interior Wall Convection	487 sqft	1632	-	487 sqft	-1	-
Ceiling Convection	0 sqft	0	-	0 sqft	0	-
Overhead Lighting Convection	113 W	241	-	0 W	0	-
Task Lighting Convection	20 W	30	-	0 W	0	-
Electric Equipment Convection	55 W	141	-	0 W	0	-
People Convection	4	336	1080	0	0	0
Infiltration	0 CFM	0	0	0 CFM	0	0
Miscellaneous Equipment	-	0	0	-	0	0
Air Internal Energy Change	0.0F	0		-	0	0
Safety Factor	5% / 5%	437	54	0%	0	0
>> Total Space Loads	**-**	**9177**	**1134**	**-**	**0**	**0**
Key:	**Positive values are cooling loads Negative values are heating loads**			**Positive values are heating loads Negative values are cooling loads**		

Note 1: Surface convection line items show the combined effects of conductive heat gain to the surface and radiative heat gains absorbed at the surface which are then convected to room air.

Note 2: Lighting, equipment, and people line items include only the direct convective heat gain from the heat source to the room air. The radiative portion of the heat gain is first absorbed by surfaces in the room and then later convected from the surface to the air. Therefore the effect of the radiative portion of the heat gain is found in the surface convection line items.

Note 3: Solar heat gain is absorbed by surfaces in the room, re-radiated to other surfaces, and finally convected from the surfaces to room air. Therefore, the effect of solar heat gain is found in the surface convection line items.

DESIGN MONTH: JULY							
Hour	OA Temp (F)	DOAS Airflow (CFM)	DOAS Heating Coil (MBH)	DOAS Cooling Coil (MBH)	Dehumid. Reheat Coil (MBH)	Terminal Cooling Coil (MBH)	Terminal Heating Coil Sensible (MBH)
00:00	80.6	0	0.0	0.0	0.0	130.0	0.0
01:00	79.9	0	0.0	0.0	0.0	123.8	0.0
02:00	79.5	0	0.0	0.0	0.0	117.4	0.0
03:00	79.2	0	0.0	0.0	0.0	112.2	0.0
04:00	78.8	0	0.0	0.0	0.0	107.8	0.0
05:00	78.6	0	0.0	0.0	0.0	112.4	0.0
06:00	78.8	0	0.0	0.0	0.0	173.1	0.0
07:00	79.6	0	0.0	0.0	0.0	191.6	0.0
08:00	81.5	0	0.0	0.0	0.0	208.9	0.0
09:00	83.6	0	0.0	0.0	0.0	227.2	0.0
10:00	85.5	0	0.0	0.0	0.0	247.5	0.0
11:00	87.1	0	0.0	0.0	0.0	266.8	0.0
12:00	88.3	0	0.0	0.0	0.0	280.8	0.0
13:00	89.1	0	0.0	0.0	0.0	291.0	0.0
14:00	89.7	0	0.0	0.0	0.0	298.1	0.0
15:00	89.7	0	0.0	0.0	0.0	302.2	0.0
16:00	89.0	0	0.0	0.0	0.0	303.5	0.0
17:00	88.1	0	0.0	0.0	0.0	302.5	0.0
18:00	87.0	0	0.0	0.0	0.0	296.9	0.0
19:00	85.4	0	0.0	0.0	0.0	284.9	0.0
20:00	84.1	0	0.0	0.0	0.0	272.5	0.0
21:00	83.2	0	0.0	0.0	0.0	260.0	0.0
22:00	82.2	0	0.0	0.0	0.0	185.4	0.0
23:00	81.4	0	0.0	0.0	0.0	155.8	0.0

Hourly Zone Loads for SOUTHBAY LAGENDA BUNGALOW (ACTIVE)

(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(ACTIVE))

Project: South_Lagenda_Human_Activities
Prepared by: Shahul

01/12/2024
3:51 PM

ZONE: EX LOBBY									
DESIGN MONTH: JULY									
Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	83	331	1690	1919	2853	0	0
01:00	79.9	75.2	85	331	1507	1676	2547	0	0
02:00	79.5	75.2	86	331	1375	1505	2300	0	0
03:00	79.2	75.2	88	331	1271	1374	2108	0	0
04:00	78.8	75.2	88	331	1167	1271	1949	0	0
05:00	78.6	75.2	87	331	1367	1416	2274	0	0
06:00	78.8	75.2	83	331	3193	3210	7432	0	0
07:00	79.6	75.2	80	331	3639	3627	7800	0	0
08:00	81.5	75.2	79	331	3765	3770	8048	0	0
09:00	83.6	75.2	78	331	3852	3871	8310	0	0
10:00	85.5	75.2	78	331	3958	3986	8592	0	0
11:00	87.1	75.2	77	331	4095	4128	8891	0	0
12:00	88.3	75.2	76	331	4244	4278	9163	0	0
13:00	89.1	75.2	75	331	4395	4427	9413	0	0
14:00	89.7	75.2	74	331	4537	4567	9626	0	0
15:00	89.7	75.2	73	331	4718	4743	9880	0	0
16:00	89.0	75.2	71	331	5021	5027	10252	0	0
17:00	88.1	75.2	69	331	5412	5386	10678	0	0
18:00	87.0	75.2	67	331	5776	5717	11007	0	0
19:00	85.4	75.2	66	331	5957	5892	11063	0	0
20:00	84.1	75.2	67	331	5788	5769	10723	0	0
21:00	83.2	75.2	68	331	5409	5452	10207	0	0
22:00	82.2	75.2	73	331	3003	3305	4684	0	0
23:00	81.4	75.2	79	331	2074	2378	3392	0	0

ZONE: GF-EX LIVING									
DESIGN MONTH: JULY									
Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	83	781	3520	4506	5151	0	0
01:00	79.9	75.2	85	781	2979	3985	4749	0	0
02:00	79.5	75.2	86	781	2596	3560	4272	0	0
03:00	79.2	75.2	88	781	2294	3206	3870	0	0
04:00	78.8	75.2	89	781	2054	2908	3529	0	0
05:00	78.6	75.2	87	781	3222	3611	5056	0	0
06:00	78.8	75.2	86	781	4353	4367	7139	0	0
07:00	79.6	75.2	86	781	4547	4512	7363	0	0
08:00	81.5	75.2	85	781	4734	4737	7822	0	0
09:00	83.6	75.2	84	781	5111	5102	8477	0	0
10:00	85.5	75.2	82	781	5688	5618	9290	0	0
11:00	87.1	75.2	80	781	6245	6222	10131	0	0
12:00	88.3	75.2	79	781	6782	6828	10889	0	0
13:00	89.1	75.2	77	781	7327	7410	11612	0	0
14:00	89.7	75.2	75	781	8043	8133	12581	0	0
15:00	89.7	75.2	73	781	8747	8813	13279	0	0
16:00	89.0	75.2	71	781	9223	9267	13534	0	0
17:00	88.1	75.2	70	781	9625	9687	14193	0	0
18:00	87.0	75.2	69	781	10250	10231	14473	0	0
19:00	85.4	75.2	70	781	9708	9770	13413	0	0
20:00	84.1	75.2	71	781	9048	9189	12656	0	0
21:00	83.2	75.2	73	781	8335	8513	11753	0	0
22:00	82.2	75.2	75	781	6741	7017	8319	0	0
23:00	81.4	75.2	79	781	4642	5306	5856	0	0

Hourly Zone Loads for SOUTHBAY LAGENDA BUNGALOW (ACTIVE)
(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(ACTIVE))

Project: South_Lagenda_Human_Activities 01/12/2024
Prepared by: Shahul 3:51 PM

ZONE: GF-EX. FOYER
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	79	340	2323	2563	3277	0	0
01:00	79.9	75.2	81	340	2103	2297	3013	0	0
02:00	79.5	75.2	82	340	1934	2091	2757	0	0
03:00	79.2	75.2	84	340	1796	1925	2547	0	0
04:00	78.8	75.2	85	340	1676	1787	2371	0	0
05:00	78.6	75.2	83	340	1905	1967	2775	0	0
06:00	78.8	75.2	82	340	2859	2892	5512	0	0
07:00	79.6	75.2	80	340	3082	3110	5750	0	0
08:00	81.5	75.2	79	340	3233	3271	6023	0	0
09:00	83.6	75.2	78	340	3399	3444	6337	0	0
10:00	85.5	75.2	77	340	3592	3644	6673	0	0
11:00	87.1	75.2	75	340	3811	3865	7021	0	0
12:00	88.3	75.2	74	340	4021	4074	7317	0	0
13:00	89.1	75.2	73	340	4223	4272	7589	0	0
14:00	89.7	75.2	71	340	4622	4651	8202	0	0
15:00	89.7	75.2	68	340	5118	5097	8694	0	0
16:00	89.0	75.2	66	340	5548	5489	9130	0	0
17:00	88.1	75.2	64	340	5928	5833	9462	0	0
18:00	87.0	75.2	63	340	6054	5959	9445	0	0
19:00	85.4	75.2	64	340	5707	5695	8948	0	0
20:00	84.1	75.2	65	340	5436	5469	8632	0	0
21:00	83.2	75.2	67	340	5063	5134	8145	0	0
22:00	82.2	75.2	70	340	3627	3846	4935	0	0
23:00	81.4	75.2	75	340	2787	3052	3801	0	0

ZONE: GF-Golf Simulation Room
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	77	779	9639	9893	21405	0	0
01:00	79.9	75.2	78	779	9272	9518	20876	0	0
02:00	79.5	75.2	79	779	9065	9278	20466	0	0
03:00	79.2	75.2	79	779	8901	9092	20141	0	0
04:00	78.8	75.2	80	779	8768	8942	19867	0	0
05:00	78.6	75.2	80	779	8656	8817	19660	0	0
06:00	78.8	75.2	80	779	9006	9122	20661	0	0
07:00	79.6	75.2	80	779	9290	9377	21505	0	0
08:00	81.5	75.2	79	779	9606	9681	22584	0	0
09:00	83.6	75.2	78	779	10237	10302	24225	0	0
10:00	85.5	75.2	76	779	11073	11109	25940	0	0
11:00	87.1	75.2	74	779	11951	11935	27545	0	0
12:00	88.3	75.2	73	779	12530	12480	28455	0	0
13:00	89.1	75.2	72	779	12836	12778	28957	0	0
14:00	89.7	75.2	72	779	12896	12855	29100	0	0
15:00	89.7	75.2	72	779	12860	12842	29054	0	0
16:00	89.0	75.2	72	779	12827	12826	28907	0	0
17:00	88.1	75.2	72	779	12793	12803	28688	0	0
18:00	87.0	75.2	72	779	12701	12725	28320	0	0
19:00	85.4	75.2	73	779	12511	12558	27749	0	0
20:00	84.1	75.2	73	779	12217	12290	27097	0	0
21:00	83.2	75.2	74	779	11892	11985	26461	0	0
22:00	82.2	75.2	75	779	11604	11707	25890	0	0
23:00	81.4	75.2	75	779	11362	11470	25408	0	0

Hourly Zone Loads for SOUTHBAY LAGENDA BUNGALOW (ACTIVE)

(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(ACTIVE))

Project: South_Lagenda_Human_Activities 01/12/2024
Prepared by: Shahul 3:51 PM

ZONE: GF-Gymnasium
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	81	598	3560	3885	7629	0	0
01:00	79.9	75.2	83	598	3286	3549	7031	0	0
02:00	79.5	75.2	84	598	3084	3297	6507	0	0
03:00	79.2	75.2	85	598	2918	3093	6082	0	0
04:00	78.8	75.2	86	598	2778	2922	5719	0	0
05:00	78.6	75.2	86	598	2659	2778	5436	0	0
06:00	78.8	75.2	88	598	6117	6196	17656	0	0
07:00	79.6	75.2	85	598	7113	7101	19628	0	0
08:00	81.5	75.2	83	598	7783	7757	21056	0	0
09:00	83.6	75.2	81	598	8370	8326	22391	0	0
10:00	85.5	75.2	79	598	8907	8846	23605	0	0
11:00	87.1	75.2	78	598	9386	9306	24653	0	0
12:00	88.3	75.2	76	598	9748	9658	25419	0	0
13:00	89.1	75.2	76	598	10044	9948	26038	0	0
14:00	89.7	75.2	75	598	10286	10187	26499	0	0
15:00	89.7	75.2	74	598	10478	10378	26769	0	0
16:00	89.0	75.2	74	598	10585	10493	26787	0	0
17:00	88.1	75.2	74	598	10577	10506	26581	0	0
18:00	87.0	75.2	74	598	10386	10353	26035	0	0
19:00	85.4	75.2	75	598	9906	9942	25012	0	0
20:00	84.1	75.2	76	598	9552	9621	24285	0	0
21:00	83.2	75.2	77	598	9267	9350	23649	0	0
22:00	82.2	75.2	74	598	5221	5637	11334	0	0
23:00	81.4	75.2	78	598	4259	4642	9120	0	0

ZONE: GF-KITCHEN
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	71	1121	12638	13048	17170	0	0
01:00	79.9	75.2	73	1121	12132	12485	17207	0	0
02:00	79.5	75.2	73	1121	11793	12076	16739	0	0
03:00	79.2	75.2	74	1121	11517	11751	16359	0	0
04:00	78.8	75.2	75	1121	11292	11488	16045	0	0
05:00	78.6	75.2	73	1121	12110	12219	17351	0	0
06:00	78.8	75.2	72	1121	12662	12719	17956	0	0
07:00	79.6	75.2	72	1121	13036	13067	18503	0	0
08:00	81.5	75.2	71	1121	13518	13559	19479	0	0
09:00	83.6	75.2	69	1121	14712	14794	21528	0	0
10:00	85.5	75.2	66	1121	16449	16513	23835	0	0
11:00	87.1	75.2	63	1121	18289	18232	25908	0	0
12:00	88.3	75.2	61	1121	19546	19382	27071	0	0
13:00	89.1	75.2	60	1121	20198	19994	27636	0	0
14:00	89.7	75.2	59	1121	20290	20118	27669	0	0
15:00	89.7	75.2	59	1121	20150	20034	27531	0	0
16:00	89.0	75.2	60	1121	20017	19942	27367	0	0
17:00	88.1	75.2	60	1121	19882	19838	27148	0	0
18:00	87.0	75.2	60	1121	19660	19650	26776	0	0
19:00	85.4	75.2	61	1121	19251	19285	26126	0	0
20:00	84.1	75.2	62	1121	18542	18631	25146	0	0
21:00	83.2	75.2	63	1121	17701	17838	24124	0	0
22:00	82.2	75.2	64	1121	16967	17124	23254	0	0
23:00	81.4	75.2	67	1121	15339	15587	21053	0	0

Hourly Zone Loads for SOUTHBAY LAGENDA BUNGALOW (ACTIVE)
(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(ACTIVE))

Project: South_Lagenda_Human_Activities 01/12/2024
Prepared by: Shahul 3:51 PM

ZONE: GF-MECHANICAL ROOM
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	80	214	1011	1099	1142	0	0
01:00	79.9	75.2	80	214	902	964	1007	0	0
02:00	79.5	75.2	80	214	822	865	908	0	0
03:00	79.2	75.2	80	214	759	788	830	0	0
04:00	78.8	75.2	80	214	707	726	769	0	0
05:00	78.6	75.2	80	214	712	723	766	0	0
06:00	78.8	75.2	80	214	725	733	776	0	0
07:00	79.6	75.2	80	214	919	986	1029	0	0
08:00	81.5	75.2	80	214	1834	1953	3061	0	0
09:00	83.6	75.2	74	214	2444	2536	3765	0	0
10:00	85.5	75.2	69	214	2970	3024	4196	0	0
11:00	87.1	75.2	66	214	3342	3357	4446	0	0
12:00	88.3	75.2	65	214	3444	3457	4455	0	0
13:00	89.1	75.2	65	214	3331	3376	4339	0	0
14:00	89.7	75.2	66	214	3252	3308	4264	0	0
15:00	89.7	75.2	67	214	3118	3190	4135	0	0
16:00	89.0	75.2	68	214	2984	3067	4010	0	0
17:00	88.1	75.2	70	214	2837	2929	3865	0	0
18:00	87.0	75.2	71	214	2657	2758	3672	0	0
19:00	85.4	75.2	73	214	2435	2544	3451	0	0
20:00	84.1	75.2	75	214	2241	2346	3254	0	0
21:00	83.2	75.2	78	214	2054	2151	3061	0	0
22:00	82.2	75.2	79	214	1892	1979	2901	0	0
23:00	81.4	75.2	80	214	1295	1389	1434	0	0

ZONE: GF-NEW DINING
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	74	476	5389	5496	10938	0	0
01:00	79.9	75.2	75	476	5181	5283	10680	0	0
02:00	79.5	75.2	76	476	5054	5138	10413	0	0
03:00	79.2	75.2	77	476	4951	5023	10195	0	0
04:00	78.8	75.2	77	476	4864	4927	10007	0	0
05:00	78.6	75.2	78	476	4789	4844	9862	0	0
06:00	78.8	75.2	77	476	4950	4982	10314	0	0
07:00	79.6	75.2	77	476	5096	5114	10735	0	0
08:00	81.5	75.2	77	476	5227	5238	11250	0	0
09:00	83.6	75.2	76	476	5405	5413	11896	0	0
10:00	85.5	75.2	75	476	5613	5622	12537	0	0
11:00	87.1	75.2	74	476	5872	5881	13215	0	0
12:00	88.3	75.2	73	476	6086	6099	13691	0	0
13:00	89.1	75.2	72	476	6295	6308	14120	0	0
14:00	89.7	75.2	71	476	6484	6495	14458	0	0
15:00	89.7	75.2	71	476	6646	6654	14676	0	0
16:00	89.0	75.2	70	476	6774	6779	14759	0	0
17:00	88.1	75.2	70	476	6854	6858	14729	0	0
18:00	87.0	75.2	70	476	6876	6883	14579	0	0
19:00	85.4	75.2	70	476	6834	6847	14284	0	0
20:00	84.1	75.2	70	476	6720	6742	13929	0	0
21:00	83.2	75.2	71	476	6573	6602	13570	0	0
22:00	82.2	75.2	71	476	6427	6461	13222	0	0
23:00	81.4	75.2	72	476	6277	6312	12886	0	0

Hourly Zone Loads for SOUTHBAY LAGENDA BUNGALOW (ACTIVE)

(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(ACTIVE))

Project: South_Lagenda_Human_Activities — 01/12/2024
Prepared by: Shahul — 3:51 PM

ZONE: L1-Dresser Room
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	81	274	1461	1816	2312	0	0
01:00	79.9	75.2	83	274	1275	1615	2126	0	0
02:00	79.5	75.2	84	274	1149	1462	1940	0	0
03:00	79.2	75.2	85	274	1050	1339	1787	0	0
04:00	78.8	75.2	86	274	971	1239	1660	0	0
05:00	78.6	75.2	87	274	908	1156	1558	0	0
06:00	78.8	75.2	86	274	1181	1329	1981	0	0
07:00	79.6	75.2	85	274	1329	1463	2226	0	0
08:00	81.5	75.2	80	274	2179	2148	3628	0	0
09:00	83.6	75.2	76	274	2741	2605	4147	0	0
10:00	85.5	75.2	72	274	3110	3013	4692	0	0
11:00	87.1	75.2	69	274	3476	3386	5177	0	0
12:00	88.3	75.2	67	274	3792	3697	5563	0	0
13:00	89.1	75.2	65	274	4066	3962	5888	0	0
14:00	89.7	75.2	63	274	4296	4184	6151	0	0
15:00	89.7	75.2	61	274	4484	4367	6348	0	0
16:00	89.0	75.2	61	274	4598	4483	6425	0	0
17:00	88.1	75.2	60	274	4591	4497	6349	0	0
18:00	87.0	75.2	61	274	4371	4324	5976	0	0
19:00	85.4	75.2	64	274	3819	3861	5230	0	0
20:00	84.1	75.2	67	274	3441	3520	4847	0	0
21:00	83.2	75.2	70	274	3120	3206	4418	0	0
22:00	82.2	75.2	72	274	2837	2920	4042	0	0
23:00	81.4	75.2	77	274	1939	2183	2628	0	0

ZONE: L1-Dresser Room 2
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	80	106	603	722	1193	0	0
01:00	79.9	75.2	82	106	570	668	1165	0	0
02:00	79.5	75.2	82	106	557	638	1117	0	0
03:00	79.2	75.2	83	106	549	618	1079	0	0
04:00	78.8	75.2	83	106	542	602	1047	0	0
05:00	78.6	75.2	84	106	536	589	1022	0	0
06:00	78.8	75.2	81	106	711	719	1343	0	0
07:00	79.6	75.2	80	106	768	764	1379	0	0
08:00	81.5	75.2	76	106	1135	1068	2199	0	0
09:00	83.6	75.2	74	106	1251	1157	2307	0	0
10:00	85.5	75.2	73	106	1280	1196	2398	0	0
11:00	87.1	75.2	72	106	1298	1221	2476	0	0
12:00	88.3	75.2	72	106	1303	1233	2522	0	0
13:00	89.1	75.2	72	106	1309	1244	2563	0	0
14:00	89.7	75.2	71	106	1317	1255	2594	0	0
15:00	89.7	75.2	71	106	1325	1266	2610	0	0
16:00	89.0	75.2	71	106	1333	1278	2608	0	0
17:00	88.1	75.2	71	106	1340	1289	2598	0	0
18:00	87.0	75.2	70	106	1346	1300	2578	0	0
19:00	85.4	75.2	70	106	1351	1308	2544	0	0
20:00	84.1	75.2	70	106	1354	1315	2516	0	0
21:00	83.2	75.2	70	106	1356	1319	2492	0	0
22:00	82.2	75.2	70	106	1351	1317	2453	0	0
23:00	81.4	75.2	75	106	827	905	1417	0	0

ZONE: L1-Entertaiment Room
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	80	619	4098	4295	8627	0	0
01:00	79.9	75.2	81	619	3910	4056	8273	0	0
02:00	79.5	75.2	82	619	3794	3905	7910	0	0
03:00	79.2	75.2	82	619	3701	3789	7622	0	0
04:00	78.8	75.2	83	619	3621	3690	7372	0	0
05:00	78.6	75.2	83	619	3623	3678	7343	0	0
06:00	78.8	75.2	84	619	8633	8621	23561	0	0
07:00	79.6	75.2	81	619	9904	9764	25772	0	0
08:00	81.5	75.2	79	619	10247	10130	26685	0	0
09:00	83.6	75.2	79	619	10435	10335	27475	0	0
10:00	85.5	75.2	78	619	10558	10469	28118	0	0
11:00	87.1	75.2	78	619	10677	10594	28694	0	0
12:00	88.3	75.2	78	619	10737	10663	29056	0	0
13:00	89.1	75.2	78	619	10802	10734	29372	0	0
14:00	89.7	75.2	77	619	10877	10812	29613	0	0
15:00	89.7	75.2	77	619	10973	10909	29757	0	0
16:00	89.0	75.2	77	619	11082	11018	29777	0	0
17:00	88.1	75.2	76	619	11188	11124	29728	0	0
18:00	87.0	75.2	76	619	11281	11219	29593	0	0
19:00	85.4	75.2	76	619	11350	11292	29335	0	0
20:00	84.1	75.2	76	619	11379	11327	29092	0	0
21:00	83.2	75.2	76	619	11368	11324	28839	0	0
22:00	82.2	75.2	72	619	6130	6445	13193	0	0
23:00	81.4	75.2	76	619	5031	5265	10595	0	0

ZONE: L1-EX. HALL
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	79	200	1182	1425	2301	0	0
01:00	79.9	75.2	81	200	1119	1325	2190	0	0
02:00	79.5	75.2	82	200	1079	1256	2076	0	0
03:00	79.2	75.2	83	200	1041	1201	1981	0	0
04:00	78.8	75.2	83	200	1005	1154	1895	0	0
05:00	78.6	75.2	80	200	1512	1500	2659	0	0
06:00	78.8	75.2	77	200	2874	2713	5985	0	0
07:00	79.6	75.2	73	200	3153	2997	6321	0	0
08:00	81.5	75.2	72	200	3224	3099	6498	0	0
09:00	83.6	75.2	71	200	3258	3150	6655	0	0
10:00	85.5	75.2	71	200	3277	3182	6784	0	0
11:00	87.1	75.2	71	200	3298	3210	6904	0	0
12:00	88.3	75.2	71	200	3318	3238	6997	0	0
13:00	89.1	75.2	70	200	3348	3272	7090	0	0
14:00	89.7	75.2	70	200	3385	3312	7172	0	0
15:00	89.7	75.2	69	200	3425	3355	7229	0	0
16:00	89.0	75.2	69	200	3467	3399	7258	0	0
17:00	88.1	75.2	69	200	3507	3441	7271	0	0
18:00	87.0	75.2	68	200	3544	3480	7265	0	0
19:00	85.4	75.2	68	200	3575	3514	7232	0	0
20:00	84.1	75.2	68	200	3597	3540	7204	0	0
21:00	83.2	75.2	68	200	3608	3555	7169	0	0
22:00	82.2	75.2	68	200	2287	2366	3765	0	0
23:00	81.4	75.2	76	200	1480	1678	2503	0	0

ZONE: L1-Sauna Room									
DESIGN MONTH: JULY									
Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	74	470	4378	4458	6449	0	0
01:00	79.9	75.2	75	470	4251	4300	6518	0	0
02:00	79.5	75.2	75	470	4178	4202	6356	0	0
03:00	79.2	75.2	76	470	4120	4125	6221	0	0
04:00	78.8	75.2	76	470	4068	4059	6102	0	0
05:00	78.6	75.2	77	470	4023	4001	6008	0	0
06:00	78.8	75.2	76	470	4217	4174	6390	0	0
07:00	79.6	75.2	77	470	6857	6767	14707	0	0
08:00	81.5	75.2	74	470	7472	7347	15800	0	0
09:00	83.6	75.2	73	470	7738	7615	16289	0	0
10:00	85.5	75.2	73	470	7892	7775	16647	0	0
11:00	87.1	75.2	72	470	8029	7915	16977	0	0
12:00	88.3	75.2	72	470	8085	7980	17144	0	0
13:00	89.1	75.2	71	470	8141	8045	17309	0	0
14:00	89.7	75.2	71	470	8196	8106	17435	0	0
15:00	89.7	75.2	71	470	8248	8163	17502	0	0
16:00	89.0	75.2	71	470	8295	8216	17510	0	0
17:00	88.1	75.2	71	470	8336	8262	17479	0	0
18:00	87.0	75.2	70	470	8370	8299	17411	0	0
19:00	85.4	75.2	70	470	8394	8326	17296	0	0
20:00	84.1	75.2	70	470	8407	8342	17195	0	0
21:00	83.2	75.2	70	470	8411	8347	17102	0	0
22:00	82.2	75.2	66	470	6270	6317	9899	0	0
23:00	81.4	75.2	69	470	5354	5418	7949	0	0

ZONE: L1-SON BEDROOM 1									
DESIGN MONTH: JULY									
Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	79	522	3278	3780	4097	0	0
01:00	79.9	75.2	81	522	2773	3344	3754	0	0
02:00	79.5	75.2	83	522	2440	2991	3386	0	0
03:00	79.2	75.2	85	522	2178	2700	3078	0	0
04:00	78.8	75.2	86	522	1973	2459	2822	0	0
05:00	78.6	75.2	87	522	1810	2258	2612	0	0
06:00	78.8	75.2	88	522	1762	2153	2571	0	0
07:00	79.6	75.2	88	522	1731	2081	2554	0	0
08:00	81.5	75.2	87	522	2176	2527	3794	0	0
09:00	83.6	75.2	82	522	3226	3568	5534	0	0
10:00	85.5	75.2	75	522	5118	5213	7665	0	0
11:00	87.1	75.2	67	522	6921	6870	9398	0	0
12:00	88.3	75.2	62	522	8381	8107	10476	0	0
13:00	89.1	75.2	60	522	9107	8733	10848	0	0
14:00	89.7	75.2	59	522	9067	8774	10637	0	0
15:00	89.7	75.2	60	522	8691	8542	10296	0	0
16:00	89.0	75.2	61	522	8334	8293	10001	0	0
17:00	88.1	75.2	62	522	8014	8047	9691	0	0
18:00	87.0	75.2	63	522	7649	7744	9272	0	0
19:00	85.4	75.2	64	522	7157	7319	8663	0	0
20:00	84.1	75.2	67	522	6467	6699	7810	0	0
21:00	83.2	75.2	70	522	5709	5988	6949	0	0
22:00	82.2	75.2	73	522	5048	5336	6217	0	0
23:00	81.4	75.2	76	522	4210	4518	4970	0	0

ZONE: L1-SON BEDROOM 2									
DESIGN MONTH: JULY									
Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	83	393	2060	2307	2589	0	0
01:00	79.9	75.2	84	393	1877	2141	2517	0	0
02:00	79.5	75.2	85	393	1762	2010	2373	0	0
03:00	79.2	75.2	86	393	1663	1898	2246	0	0
04:00	78.8	75.2	86	393	1577	1800	2133	0	0
05:00	78.6	75.2	87	393	1504	1715	2039	0	0
06:00	78.8	75.2	87	393	1521	1699	2078	0	0
07:00	79.6	75.2	87	393	1570	1728	2186	0	0
08:00	81.5	75.2	85	393	2056	2133	3127	0	0
09:00	83.6	75.2	83	393	2372	2387	3403	0	0
10:00	85.5	75.2	82	393	2677	2658	3772	0	0
11:00	87.1	75.2	80	393	2953	2943	4143	0	0
12:00	88.3	75.2	78	393	3182	3208	4449	0	0
13:00	89.1	75.2	77	393	3405	3450	4729	0	0
14:00	89.7	75.2	75	393	3612	3664	4964	0	0
15:00	89.7	75.2	74	393	3773	3828	5110	0	0
16:00	89.0	75.2	74	393	3867	3925	5161	0	0
17:00	88.1	75.2	74	393	3869	3933	5093	0	0
18:00	87.0	75.2	74	393	3776	3847	4904	0	0
19:00	85.4	75.2	75	393	3582	3662	4614	0	0
20:00	84.1	75.2	76	393	3408	3489	4396	0	0
21:00	83.2	75.2	77	393	3235	3311	4163	0	0
22:00	82.2	75.2	78	393	3069	3139	3945	0	0
23:00	81.4	75.2	80	393	2589	2700	3071	0	0

ZONE: L2-EX LOBBY									
DESIGN MONTH: JULY									
Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	81	481	2629	3166	3876	0	0
01:00	79.9	75.2	83	481	2238	2731	3413	0	0
02:00	79.5	75.2	85	481	1955	2392	3017	0	0
03:00	79.2	75.2	87	481	1730	2119	2695	0	0
04:00	78.8	75.2	88	481	1549	1898	2430	0	0
05:00	78.6	75.2	86	481	2336	2402	3558	0	0
06:00	78.8	75.2	84	481	3600	3419	6274	0	0
07:00	79.6	75.2	83	481	3740	3590	6325	0	0
08:00	81.5	75.2	82	481	3732	3671	6522	0	0
09:00	83.6	75.2	81	481	3904	3898	7027	0	0
10:00	85.5	75.2	79	481	4300	4338	7787	0	0
11:00	87.1	75.2	77	481	4889	4944	8684	0	0
12:00	88.3	75.2	73	481	5583	5627	9582	0	0
13:00	89.1	75.2	70	481	6285	6298	10400	0	0
14:00	89.7	75.2	68	481	6920	6898	11092	0	0
15:00	89.7	75.2	65	481	7497	7443	11703	0	0
16:00	89.0	75.2	63	481	8005	7925	12191	0	0
17:00	88.1	75.2	62	481	8358	8268	12461	0	0
18:00	87.0	75.2	61	481	8454	8384	12415	0	0
19:00	85.4	75.2	62	481	8207	8197	11956	0	0
20:00	84.1	75.2	64	481	7583	7662	11098	0	0
21:00	83.2	75.2	67	481	6837	6983	10196	0	0
22:00	82.2	75.2	70	481	4983	5271	6384	0	0
23:00	81.4	75.2	76	481	3382	3813	4304	0	0

Hourly Zone Loads for SOUTHBAY LAGENDA BUNGALOW (ACTIVE)
(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(ACTIVE))

Project: South_Lagenda_Human_Activities 01/12/2024
Prepared by: Shahul 3:51 PM

ZONE: L2-Exercise Area
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	81	933	7831	8200	15078	0	0
01:00	79.9	75.2	83	933	7216	7536	14321	0	0
02:00	79.5	75.2	84	933	6774	7038	13667	0	0
03:00	79.2	75.2	85	933	6418	6641	13137	0	0
04:00	78.8	75.2	86	933	6127	6318	12701	0	0
05:00	78.6	75.2	87	933	5886	6055	12359	0	0
06:00	78.8	75.2	87	933	5951	6099	12855	0	0
07:00	79.6	75.2	87	933	6060	6210	13411	0	0
08:00	81.5	75.2	86	933	6337	6517	14365	0	0
09:00	83.6	75.2	85	933	6930	7171	15873	0	0
10:00	85.5	75.2	83	933	7880	8181	17731	0	0
11:00	87.1	75.2	80	933	9126	9443	19779	0	0
12:00	88.3	75.2	77	933	10423	10708	21538	0	0
13:00	89.1	75.2	74	933	11673	11893	23098	0	0
14:00	89.7	75.2	71	933	12769	12916	24369	0	0
15:00	89.7	75.2	70	933	13647	13737	25289	0	0
16:00	89.0	75.2	68	933	14242	14306	25784	0	0
17:00	88.1	75.2	68	933	14445	14525	25765	0	0
18:00	87.0	75.2	68	933	14183	14325	25151	0	0
19:00	85.4	75.2	69	933	13406	13647	23877	0	0
20:00	84.1	75.2	72	933	12299	12627	22274	0	0
21:00	83.2	75.2	74	933	11144	11516	20705	0	0
22:00	82.2	75.2	76	933	10170	10537	19377	0	0
23:00	81.4	75.2	78	933	9381	9718	18276	0	0

ZONE: L2-MASTER BEDROOM
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	82	740	3999	4531	4928	0	0
01:00	79.9	75.2	85	740	3306	3905	4424	0	0
02:00	79.5	75.2	86	740	2857	3415	3935	0	0
03:00	79.2	75.2	88	740	2520	3024	3544	0	0
04:00	78.8	75.2	89	740	2263	2711	3230	0	0
05:00	78.6	75.2	90	740	2063	2461	2983	0	0
06:00	78.8	75.2	91	740	2004	2345	2973	0	0
07:00	79.6	75.2	90	740	2110	2460	3403	0	0
08:00	81.5	75.2	88	740	2677	3086	4520	0	0
09:00	83.6	75.2	84	740	3961	4376	6500	0	0
10:00	85.5	75.2	78	740	5987	6275	8897	0	0
11:00	87.1	75.2	71	740	8031	8299	11079	0	0
12:00	88.3	75.2	66	740	9965	10045	12765	0	0
13:00	89.1	75.2	62	740	11424	11330	13899	0	0
14:00	89.7	75.2	60	740	12269	12107	14505	0	0
15:00	89.7	75.2	59	740	12662	12516	14790	0	0
16:00	89.0	75.2	58	740	12710	12627	14740	0	0
17:00	88.1	75.2	59	740	12358	12387	14268	0	0
18:00	87.0	75.2	61	740	11480	11675	13189	0	0
19:00	85.4	75.2	64	740	9966	10378	11455	0	0
20:00	84.1	75.2	68	740	8466	8995	9862	0	0
21:00	83.2	75.2	72	740	7095	7642	8356	0	0
22:00	82.2	75.2	76	740	5989	6487	7146	0	0
23:00	81.4	75.2	79	740	5121	5542	6174	0	0

ZONE: L2-Relax Corner
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	88	979	2565	3464	4091	0	0
01:00	79.9	75.2	90	979	2066	2863	3438	0	0
02:00	79.5	75.2	92	979	1724	2402	2951	0	0
03:00	79.2	75.2	93	979	1463	2039	2571	0	0
04:00	78.8	75.2	94	979	1262	1751	2240	0	0
05:00	78.6	75.2	93	979	1940	2181	3196	0	0
06:00	78.8	75.2	94	979	5541	5487	15737	0	0
07:00	79.6	75.2	93	979	6109	6061	16815	0	0
08:00	81.5	75.2	92	979	6466	6579	17699	0	0
09:00	83.6	75.2	89	979	7373	7673	19488	0	0
10:00	85.5	75.2	85	979	8903	9321	21736	0	0
11:00	87.1	75.2	81	979	10707	11097	23867	0	0
12:00	88.3	75.2	77	979	12366	12638	25535	0	0
13:00	89.1	75.2	75	979	13580	13743	26636	0	0
14:00	89.7	75.2	74	979	14250	14369	27182	0	0
15:00	89.7	75.2	73	979	14501	14632	27339	0	0
16:00	89.0	75.2	73	979	14448	14622	27158	0	0
17:00	88.1	75.2	74	979	14062	14304	26584	0	0
18:00	87.0	75.2	75	979	13332	13655	25595	0	0
19:00	85.4	75.2	77	979	12284	12689	24240	0	0
20:00	84.1	75.2	79	979	11161	11609	22865	0	0
21:00	83.2	75.2	82	979	10149	10596	21663	0	0
22:00	82.2	75.2	81	979	5715	6348	8007	0	0
23:00	81.4	75.2	85	979	3598	4401	5090	0	0

ZONE: L2-TEA ROOM
DESIGN MONTH: JULY

Hour	OA Temp	Zone Temp	RH (%)	Zone Airflow (CFM)	Zone Sensible Load (BTU/hr)	Zone Sensible Conditioning	Terminal Cooling Coil (BTU/hr)	Terminal Heating Coil (BTU/hr)	Zone Heating Unit (BTU/hr)
00:00	80.6	75.2	84	494	2832	2993	4894	0	0
01:00	79.9	75.2	86	494	2590	2727	4595	0	0
02:00	79.5	75.2	87	494	2412	2524	4320	0	0
03:00	79.2	75.2	88	494	2239	2359	4093	0	0
04:00	78.8	75.2	89	494	2086	2224	3903	0	0
05:00	78.6	75.2	89	494	2031	2161	3849	0	0
06:00	78.8	75.2	89	494	2044	2158	3947	0	0
07:00	79.6	75.2	89	494	2110	2222	4199	0	0
08:00	81.5	75.2	88	494	2331	2437	4732	0	0
09:00	83.6	75.2	86	494	2687	2842	5554	0	0
10:00	85.5	75.2	83	494	3239	3463	6617	0	0
11:00	87.1	75.2	79	494	3965	4217	7762	0	0
12:00	88.3	75.2	76	494	4713	4946	8732	0	0
13:00	89.1	75.2	73	494	5361	5551	9489	0	0
14:00	89.7	75.2	71	494	5833	5984	9989	0	0
15:00	89.7	75.2	70	494	6103	6236	10220	0	0
16:00	89.0	75.2	69	494	6173	6308	10185	0	0
17:00	88.1	75.2	70	494	6018	6176	9863	0	0
18:00	87.0	75.2	71	494	5652	5841	9259	0	0
19:00	85.4	75.2	74	494	5099	5319	8420	0	0
20:00	84.1	75.2	76	494	4566	4792	7661	0	0
21:00	83.2	75.2	78	494	4103	4316	7000	0	0
22:00	82.2	75.2	80	494	3725	3915	6443	0	0
23:00	81.4	75.2	82	494	3358	3528	5882	0	0

APPENDIX E

Type A Energy Consumption

Annual Cost Summary

Project: South_Lagenda_Human_Activities
Prepared by: Shahul

01/13/2024
2:10 PM

Table 1. Annual Costs

Component	SOUTHBAY LAGENDA BUNGALOW-(NORMAL) ($)
Air System Fans	909
Cooling	14,472
Heating	0
Pumps	0
Heat Rejection Fans	0
HVAC Sub-Total	**15,381**
Lights	4,114
Electric Equipment	7,772
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	**11,886**
Grand Total	**27,268**

Table 2. Annual Cost per Unit Floor Area

Component	SOUTHBAY LAGENDA BUNGALOW-(NORMAL) ($/sqft)
Air System Fans	0.134
Cooling	2.132
Heating	0.000
Pumps	0.000
Heat Rejection Fans	0.000
HVAC Sub-Total	**2.266**
Lights	0.606
Electric Equipment	1.145
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	**1.751**
Grand Total	**4.018**
Gross Floor Area (sqft)	6786.8
Modeled Floor Area (sqft)	6786.8

Note: Values in this table are calculated using the Gross Floor Area.

Table 3. Component Cost as a Percentage of Total Cost

Component	SOUTHBAY LAGENDA BUNGALOW-(NORMAL) (%)
Air System Fans	3.3
Cooling	53.1
Heating	0.0
Pumps	0.0
Heat Rejection Fans	0.0
HVAC Sub-Total	**56.4**
Lights	15.1
Electric Equipment	28.5
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	**43.6**
Grand Total	**100.0**

Annual Energy and Emissions Summary

Project: South_Lagenda_Human_Activities 01/13/2024
Prepared by: Shahul 2:10 PM

Table 1. Annual Costs

Component	SOUTHBAY LAGENDA BUNGALOW-(NORMAL) ($)
HVAC Components	
Electric	15,381
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	**15,381**
Non-HVAC Components	
Electric	11,886
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	**11,886**
Grand Total	**27,268**

Table 2. Annual Energy Consumption

Component	SOUTHBAY LAGENDA BUNGALOW-(NORMAL)
HVAC Components	
Electric (kWh)	70,557
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	54,524
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	125,081
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Table 3. Annual Emissions

Component	SOUTHBAY LAGENDA BUNGALOW-(NORMAL)
CO2 Equivalent (lb)	0

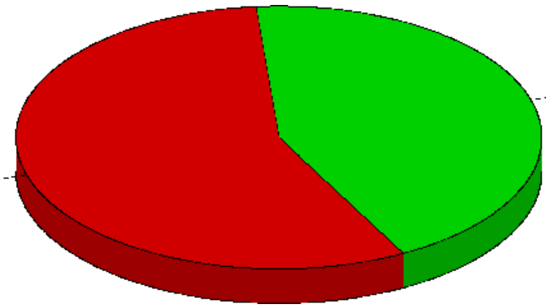
Table 4. Annual Cost per Unit Floor Area

Component	SOUTHBAY LAGENDA BUNGALOW-(NORMAL) ($/sqft)
HVAC Components	
Electric	2.266
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	**2.266**
Non-HVAC Components	
Electric	1.751
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	**1.751**
Grand Total	**4.018**
Gross Floor Area (sqft)	6786.8
Modeled Floor Area (sqft)	6786.8

Note: Values in this table are calculated using the Gross Floor Area.

Table 5. Component Cost as a Percentage of Total Cost

Component	SOUTHBAY LAGENDA BUNGALOW-(NORMAL) (%)
HVAC Components	
Electric	56.4
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	**56.4**
Non-HVAC Components	
Electric	43.6
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	**43.6**
Grand Total	**100.0**

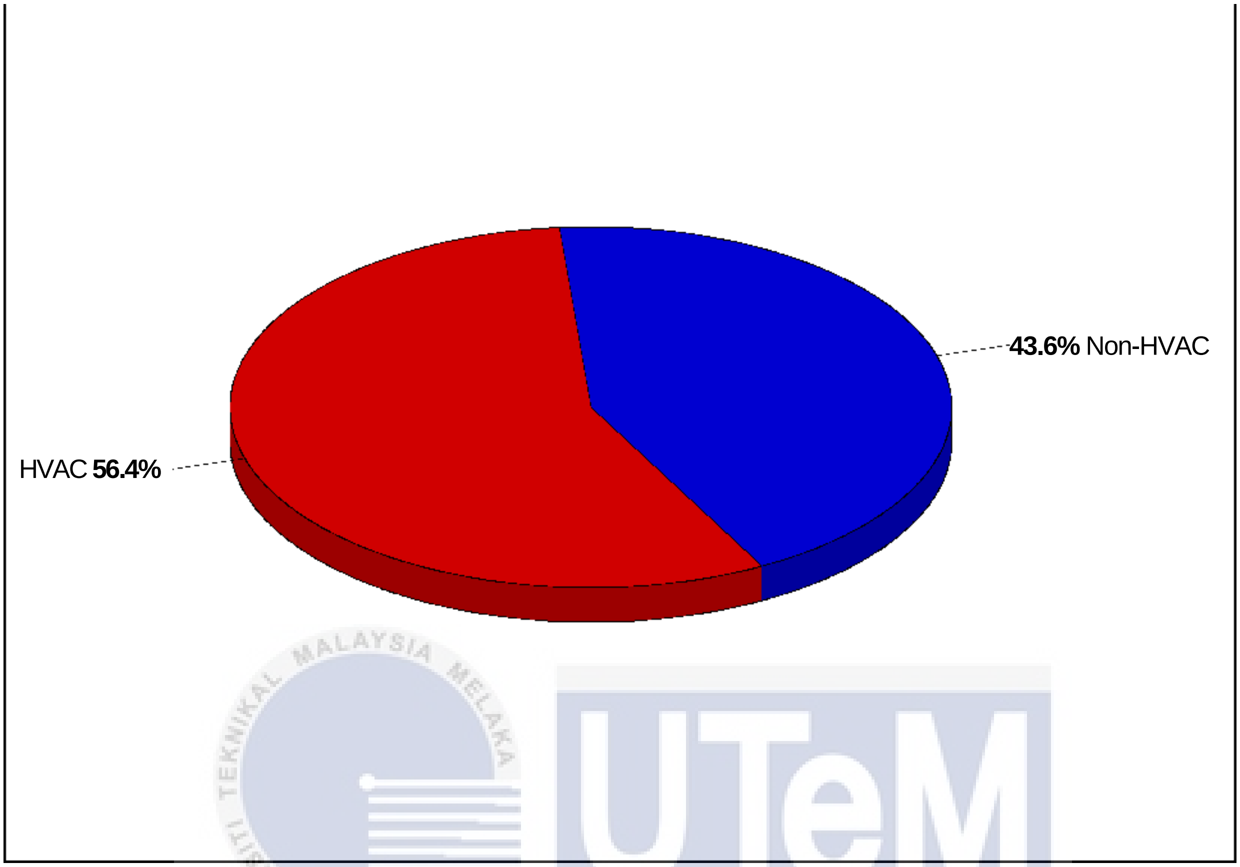


1. Annual Costs

Component	Annual Cost ($)	($/sqft)	Percent of Total (%)
HVAC Components			
Electric	15,381	2.266	56.4
Natural Gas	0	0.000	0.0
Fuel Oil	0	0.000	0.0
Propane	0	0.000	0.0
Remote Hot Water	0	0.000	0.0
Remote Steam	0	0.000	0.0
Remote Chilled Water	0	0.000	0.0
HVAC Sub-Total	**15,381**	**2.266**	**56.4**
Non-HVAC Components			
Electric	11,886	1.751	43.6
Natural Gas	0	0.000	0.0
Fuel Oil	0	0.000	0.0
Propane	0	0.000	0.0
Remote Hot Water	0	0.000	0.0
Remote Steam	0	0.000	0.0
Non-HVAC Sub-Total	**11,886**	**1.751**	**43.6**
Grand Total	**27,268**	**4.018**	**100.0**

Note: Cost per unit floor area is based on the gross building floor area.

Gross Floor Area ---------------------------- **6,786.8** sqft
Modeled Floor Area-------------------------- **6,786.8** sqft



1. Annual Costs

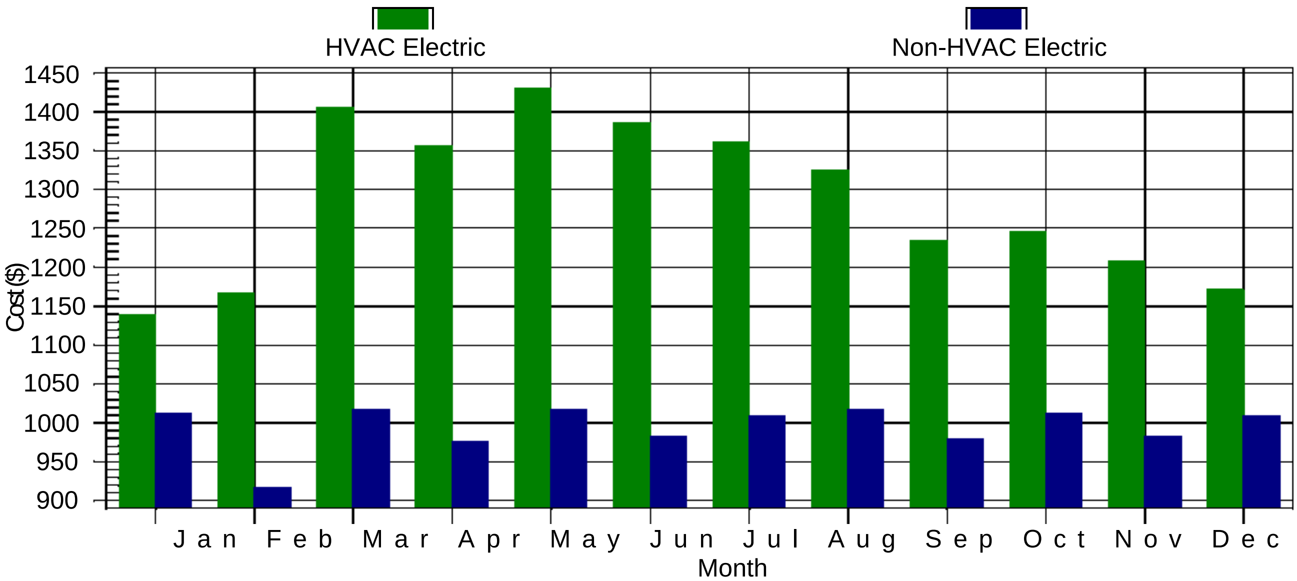
Component	Annual Cost ($)	($/sqft)	Percent of Total (%)
HVAC	15,381	2.266	56.4
Non-HVAC	11,886	1.751	43.6
Grand Total	**27,268**	**4.018**	**100.0**

Note: Cost per unit floor area is based on the gross building floor area.

Gross Floor Area ---------------------------------- **6,786.8** sqft
Modeled Floor Area------------------------------ **6,786.8** sqft

Monthly Energy Costs - SOUTHBAY LAGENDA BUNGALOW-(NORMAL)

Project: South_Lagenda_Human_Activities | 01/13/2024
Prepared by: Shahul | 2:10 PM



1.HVAC Costs

Month	Electric ($)	Natural Gas ($)	Fuel Oil ($)	Propane ($)	Remote Hot Water ($)	Remote Steam ($)	Remote Chilled Water ($)
January	1,135	0	0	0	0	0	0
February	1,163	0	0	0	0	0	0
March	1,402	0	0	0	0	0	0
April	1,353	0	0	0	0	0	0
May	1,427	0	0	0	0	0	0
June	1,381	0	0	0	0	0	0
July	1,357	0	0	0	0	0	0
August	1,321	0	0	0	0	0	0
September	1,230	0	0	0	0	0	0
October	1,242	0	0	0	0	0	0
November	1,204	0	0	0	0	0	0
December	1,167	0	0	0	0	0	0
Total	**15,381**	**0**	**0**	**0**	**0**	**0**	**0**

2.Non-HVAC Costs

Month	Electric ($)	Natural Gas ($)	Fuel Oil ($)	Propane ($)	Remote Hot Water ($)	Remote Steam ($)
January	1,009	0	0	0	0	0
February	912	0	0	0	0	0
March	1,013	0	0	0	0	0
April	972	0	0	0	0	0
May	1,013	0	0	0	0	0
June	979	0	0	0	0	0
July	1,006	0	0	0	0	0
August	1,013	0	0	0	0	0
September	976	0	0	0	0	0
October	1,009	0	0	0	0	0
November	979	0	0	0	0	0
December	1,006	0	0	0	0	0
Total	**11,886**	**0**	**0**	**0**	**0**	**0**

Monthly Energy Use by Component - SOUTHBAY LAGENDA BUNGALOW-(NORMAL)

Project: South_Lagenda_Human_Activities 01/13/2024
Prepared by: Shahul 2:10 PM

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	354	320	354	343	354	343	354	354	343	354	343	354
Cooling												
Electric (kWh)	4853	5014	6078	5861	6192	5992	5869	5703	5299	5344	5179	5001
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote CW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Heating												
Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Pumps (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Heat Rej. Fans (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Lighting (kWh)	1600	1449	1618	1529	1618	1561	1585	1618	1547	1600	1561	1585
Electric Eqpt. (kWh)	3028	2735	3028	2930	3028	2930	3028	3028	2930	3028	2930	3028
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Misc. Fuel												
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0

Monthly Simulation Results for SOUTHBAY LAGENDA BUNGALOW (NORMAL)

(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(NORMAL))

Project: South_Lagenda_Human_Activities 01/13/2024
Prepared by: Shahul 2:10 PM

Air System Simulation Results (Table 1) :

Month	Terminal Cooling Coil Load (kBTU)	Terminal Unit Clg Input	Terminal Fan (kWh)	Lighting (kWh)	Electric Equipment
January	91820	4853	354	1600	3028
February	90485	5014	320	1449	2735
March	106914	6078	354	1618	3028
April	104096	5861	343	1529	2930
May	110109	6192	354	1618	3028
June	107007	5992	343	1561	2930
July	107069	5869	354	1585	3028
August	104353	5703	354	1618	3028
September	98941	5299	343	1547	2930
October	101193	5344	354	1600	3028
November	98070	5179	343	1561	2930
December	95031	5001	354	1585	3028
Total	**1215088**	**66386**	**4170**	**18871**	**35653**

APPENDIX F

Type B Energy Consumption

Annual Cost Summary

Project: South_Lagenda_Human_Activities — 01/12/2024
Prepared by: Shahul — 3:55 PM

Table 1. Annual Costs

Component	SOUTHBAY LAGENDA BUNGALOW -(ACTIVE) ($)
Air System Fans	1,212
Cooling	19,669
Heating	0
Pumps	0
Heat Rejection Fans	0
HVAC Sub-Total	**20,882**
Lights	5,002
Electric Equipment	16,843
Misc. Electric	0
Misc. Fuel Use	0
Non-HVAC Sub-Total	**21,846**
Grand Total	**42,727**

Table 2. Annual Cost per Unit Floor Area

Component	SOUTHBAY LAGENDA BUNGALOW-(ACTIVE) ($/sqft)
Air System Fans	0.179
Cooling	2.898
Heating	0.000
Pumps	0.000
Heat Rejection Fans	0.000
HVAC Sub-Total	**3.077**
Lights	0.737
Electric Equipment	2.482
Misc. Electric	0.000
Misc. Fuel Use	0.000
Non-HVAC Sub-Total	**3.219**
Grand Total	**6.295**
Gross Floor Area (sqft)	6787.2
Modeled Floor Area (sqft)	6787.2

Note: Values in this table are calculated using the Gross Floor Area.

Table 3. Component Cost as a Percentage of Total Cost

Component	SOUTHBAY LAGENDA BUNGALOW -(ACTIVE) (%)
Air System Fans	2.8
Cooling	46.0
Heating	0.0
Pumps	0.0
Heat Rejection Fans	0.0
HVAC Sub-Total	**48.9**
Lights	11.7
Electric Equipment	39.4
Misc. Electric	0.0
Misc. Fuel Use	0.0
Non-HVAC Sub-Total	**51.1**
Grand Total	**100.0**

Table 1. Annual Costs

Component	SOUTHBAY LAGENDA BUNGALOW -(ACTIVE) ($)
HVAC Components	
Electric	20,882
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Remote CW	0
HVAC Sub-Total	**20,882**
Non-HVAC Components	
Electric	21,845
Natural Gas	0
Fuel Oil	0
Propane	0
Remote HW	0
Remote Steam	0
Non-HVAC Sub-Total	**21,845**
Grand Total	**42,727**

Table 2. Annual Energy Consumption

Component	SOUTHBAY LAGENDA BUNGALOW-(ACTIVE)
HVAC Components	
Electric (kWh)	95,787
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0
Non-HVAC Components	
Electric (kWh)	100,209
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Totals	
Electric (kWh)	195,996
Natural Gas (na)	0
Fuel Oil (na)	0
Propane (na)	0
Remote HW (na)	0
Remote Steam (na)	0
Remote CW (na)	0

Table 3. Annual Emissions

Component	SOUTHBAY LAGENDA BUNGALOW-(ACTIVE)
CO2 Equivalent (lb)	0

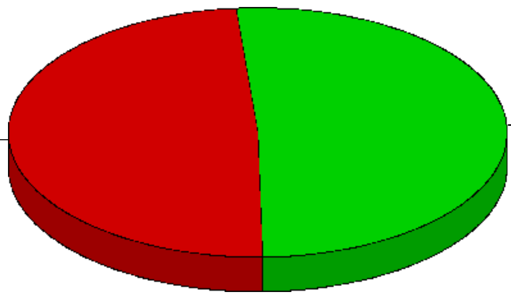
Table 4. Annual Cost per Unit Floor Area

Component	SOUTHBAY LAGENDA BUNGALOW-(ACTIVE) ($/sqft)
HVAC Components	
Electric	3.077
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Remote CW	0.000
HVAC Sub-Total	**3.077**
Non-HVAC Components	
Electric	3.219
Natural Gas	0.000
Fuel Oil	0.000
Propane	0.000
Remote HW	0.000
Remote Steam	0.000
Non-HVAC Sub-Total	**3.219**
Grand Total	**6.295**
Gross Floor Area (sqft)	6787.2
Modeled Floor Area (sqft)	6787.2

Note: Values in this table are calculated using the Gross Floor Area.

Table 5. Component Cost as a Percentage of Total Cost

Component	SOUTHBAY LAGENDA BUNGALOW -(ACTIVE) (%)
HVAC Components	
Electric	48.9
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Remote CW	0.0
HVAC Sub-Total	**48.9**
Non-HVAC Components	
Electric	51.1
Natural Gas	0.0
Fuel Oil	0.0
Propane	0.0
Remote HW	0.0
Remote Steam	0.0
Non-HVAC Sub-Total	**51.1**
Grand Total	**100.0**

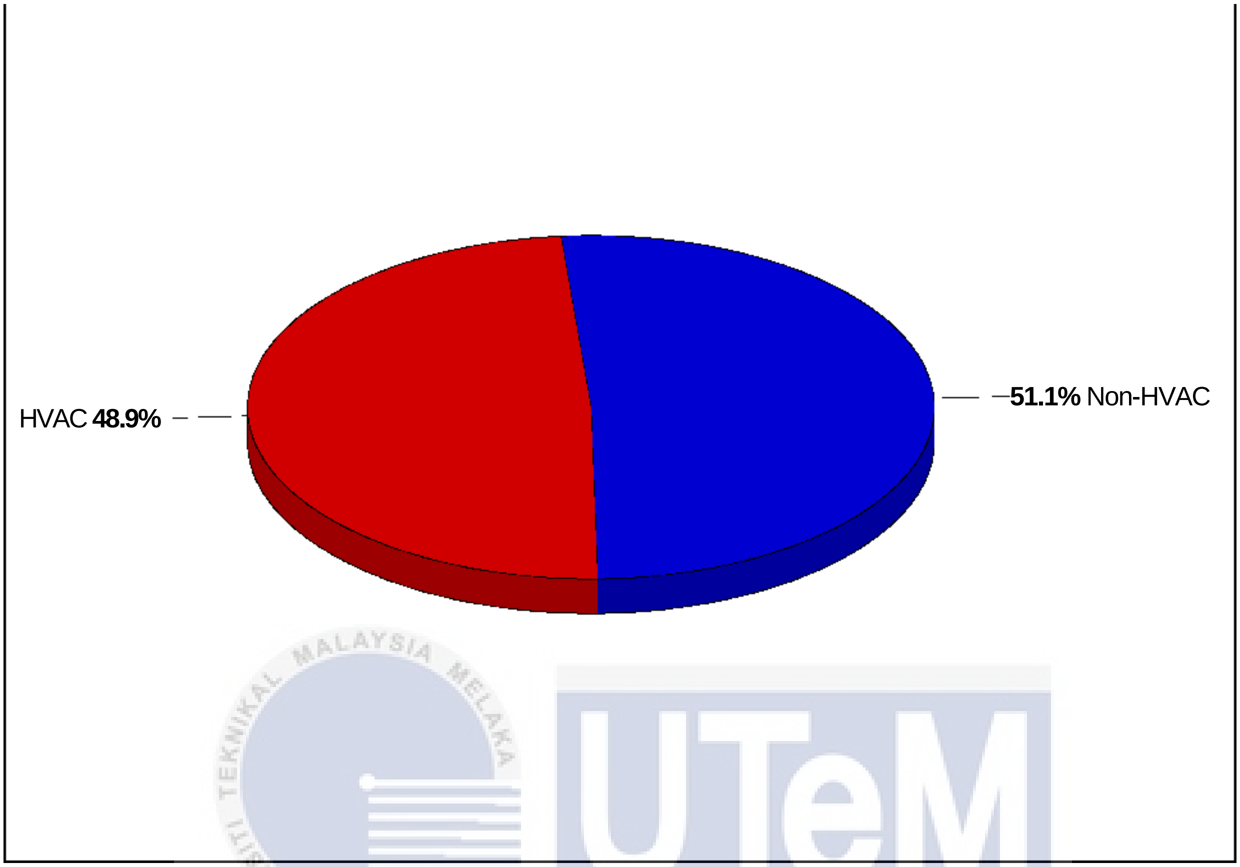


1. Annual Costs

Component	Annual Cost ($)	($/sqft)	Percent of Total (%)
HVAC Components			
Electric	20,882	3.077	48.9
Natural Gas	0	0.000	0.0
Fuel Oil	0	0.000	0.0
Propane	0	0.000	0.0
Remote Hot Water	0	0.000	0.0
Remote Steam	0	0.000	0.0
Remote Chilled Water	0	0.000	0.0
HVAC Sub-Total	**20,882**	**3.077**	**48.9**
Non-HVAC Components			
Electric	21,845	3.219	51.1
Natural Gas	0	0.000	0.0
Fuel Oil	0	0.000	0.0
Propane	0	0.000	0.0
Remote Hot Water	0	0.000	0.0
Remote Steam	0	0.000	0.0
Non-HVAC Sub-Total	**21,845**	**3.219**	**51.1**
Grand Total	**42,727**	**6.295**	**100.0**

Note: Cost per unit floor area is based on the gross building floor area.

Gross Floor Area ---------------------------- **6,787.2** sqft
Modeled Floor Area------------------------- **6,787.2** sqft

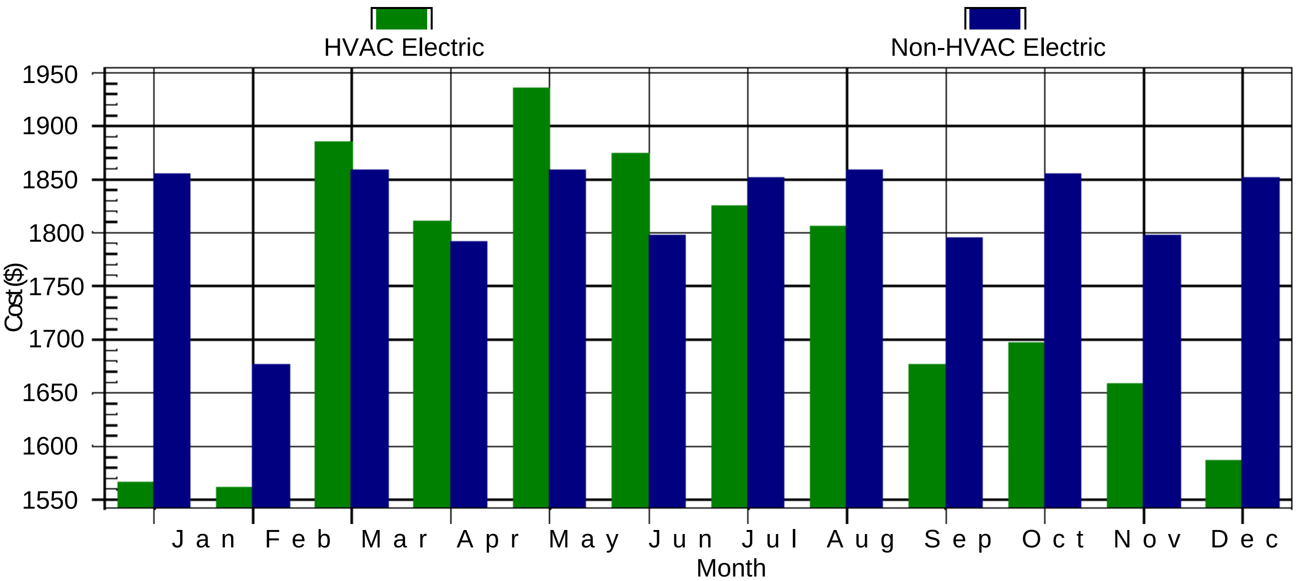


1. Annual Costs

Component	Annual Cost ($)	($/sqft)	Percent of Total (%)
HVAC	20,882	3.077	48.9
Non-HVAC	21,846	3.219	51.1
Grand Total	**42,727**	**6.295**	**100.0**

Note: Cost per unit floor area is based on the gross building floor area.

Gross Floor Area ---------------------------------- **6,787.2** sqft
Modeled Floor Area------------------------------ **6,787.2** sqft



1.HVAC Costs

Month	Electric ($)	Natural Gas ($)	Fuel Oil ($)	Propane ($)	Remote Hot Water ($)	Remote Steam ($)	Remote Chilled Water ($)
January	1,566	0	0	0	0	0	0
February	1,561	0	0	0	0	0	0
March	1,885	0	0	0	0	0	0
April	1,810	0	0	0	0	0	0
May	1,936	0	0	0	0	0	0
June	1,874	0	0	0	0	0	0
July	1,825	0	0	0	0	0	0
August	1,806	0	0	0	0	0	0
September	1,677	0	0	0	0	0	0
October	1,697	0	0	0	0	0	0
November	1,658	0	0	0	0	0	0
December	1,586	0	0	0	0	0	0
Total	**20,882**	**0**	**0**	**0**	**0**	**0**	**0**

2.Non-HVAC Costs

Month	Electric ($)	Natural Gas ($)	Fuel Oil ($)	Propane ($)	Remote Hot Water ($)	Remote Steam ($)
January	1,855	0	0	0	0	0
February	1,676	0	0	0	0	0
March	1,859	0	0	0	0	0
April	1,791	0	0	0	0	0
May	1,859	0	0	0	0	0
June	1,798	0	0	0	0	0
July	1,852	0	0	0	0	0
August	1,859	0	0	0	0	0
September	1,795	0	0	0	0	0
October	1,855	0	0	0	0	0
November	1,798	0	0	0	0	0
December	1,852	0	0	0	0	0
Total	**21,845**	**0**	**0**	**0**	**0**	**0**

Monthly Energy Use by Component - SOUTHBAY LAGENDA BUNGALOW-(ACTIVE)

Project: South_Lagenda_Human_Activities 01/12/2024
Prepared by: Shahul 3:55 PM

1. Monthly Energy Use by System Component

Component	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Air System Fans (kWh)	472	427	472	457	472	457	472	472	457	472	457	472
Cooling												
Electric (kWh)	6709	6732	8176	7847	8408	8141	7898	7812	7235	7314	7150	6804
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote CW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Heating												
Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0
Pumps (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Heat Rej. Fans (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Lighting (kWh)	1946	1761	1963	1865	1963	1896	1932	1963	1882	1946	1896	1932
Electric Eqpt. (kWh)	6562	5927	6562	6350	6562	6350	6562	6562	6350	6562	6350	6562
Misc. Electric (kWh)	0	0	0	0	0	0	0	0	0	0	0	0
Misc. Fuel												
Natural Gas (na)	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Oil (na)	0	0	0	0	0	0	0	0	0	0	0	0
Propane (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote HW (na)	0	0	0	0	0	0	0	0	0	0	0	0
Remote Steam (na)	0	0	0	0	0	0	0	0	0	0	0	0

Monthly Simulation Results for SOUTHBAY LAGENDA BUNGALOW (ACTIVE)

(In Alternative: SOUTHBAY LAGENDA BUNGALOW-(ACTIVE))

Project: South_Lagenda_Human_Activities 01/12/2024
Prepared by: Shahul 3:55 PM

Air System Simulation Results (Table 1) :

Month	Terminal Cooling Coil Load (kBTU)	Terminal Unit Clg Input	Terminal Fan (kWh)	Lighting (kWh)	Electric Equipment
January	125485	6709	472	1946	6562
February	122021	6732	427	1761	5927
March	144876	8176	472	1963	6562
April	140566	7847	457	1865	6350
May	150327	8408	472	1963	6562
June	146351	8141	457	1896	6350
July	145213	7898	472	1932	6562
August	142662	7812	472	1963	6562
September	135086	7235	457	1882	6350
October	138009	7314	472	1946	6562
November	134426	7150	457	1896	6350
December	128312	6804	472	1932	6562
Total	**1653333**	**90226**	**5561**	**22946**	**77263**