WIJIL WISESA

SEBELAS MARET UNIVERSITY DORMITORY

BACKGROUND

In the era of rapid globalization and technological advancements, higher education serves as a crucial avenue for students to realize their potential. Universities play a central role in shaping characters, broadening horizons, and honing skills to prepare students for real-world challenges.

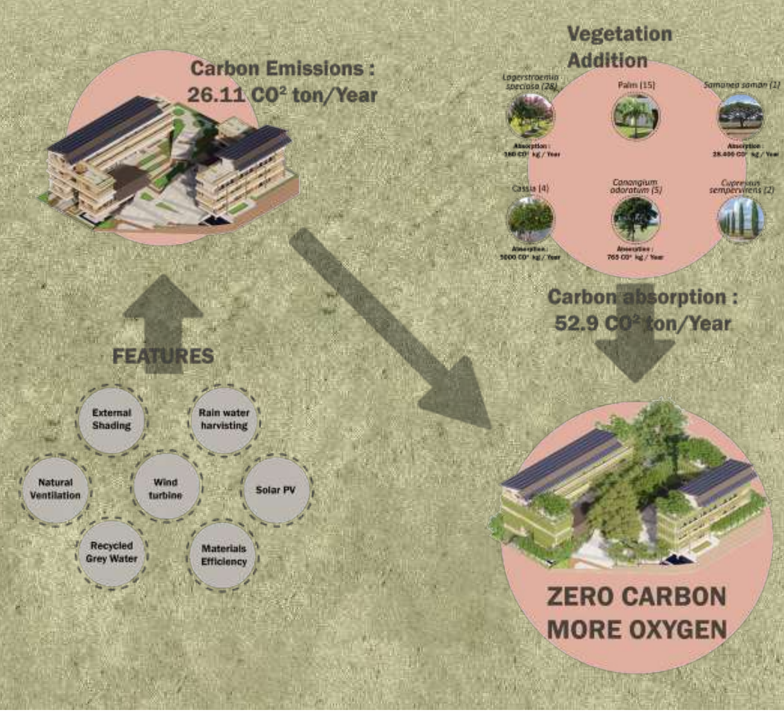
Our university is dedicated to enhancing the student experience. Transitioning from high school to campus life is vital for global perspectives and social skills.

With this in mind, we're constructing a dormitory that's a "second home," fostering security, comfort, and growth. This dormitory isn't just housing; it introduces sustainable development principles and shapes student characters.

To achieve this, the dormitory follows a zero net carbon approach, with solar panels as the primary renewable energy source and a carbon offset plan.

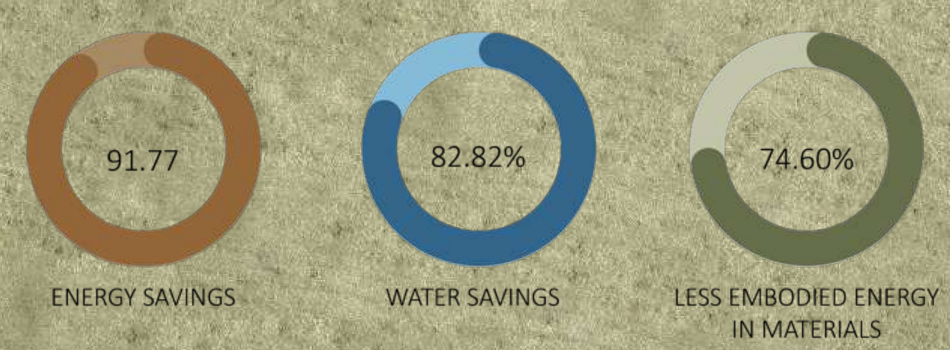
The site is within the existing university dormitory area, addressing challenges like unused buildings, a lack of greenery, and student disinterest.

Through this building, we provide a conducive environment to students and fulfill our environmental responsibility commitment in daily campus operations.

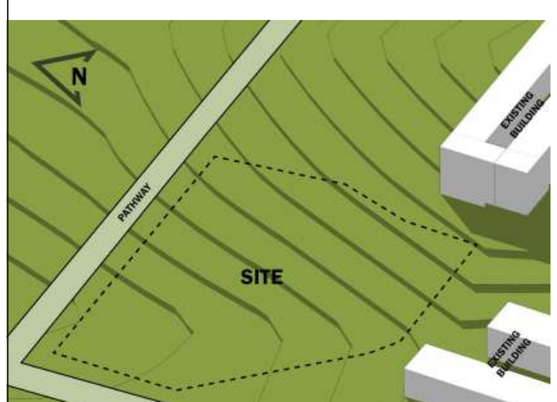


Based on the calculations from the Edge 2.15 application, this dormitory is estimated to generate around 26.11 tons of carbon annually. Consequently, various types of trees have been planted in a certain quantity, both those rooted in the ground and suspended plants. This results in a carbon absorption of 52.9 tons of carbon per year. From this data, it can be inferred that the building can achieve not only zero carbon emissions but also a carbon-positive status.

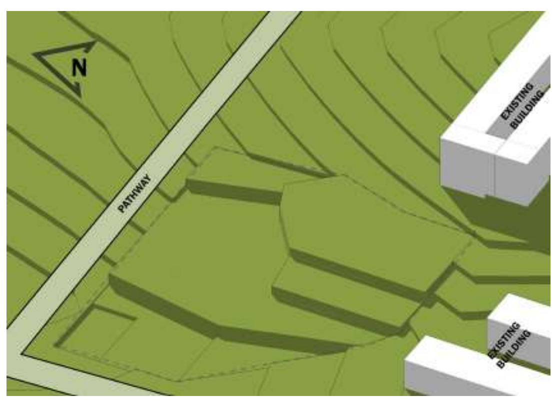
NORTH AND SOUTH BUILDING



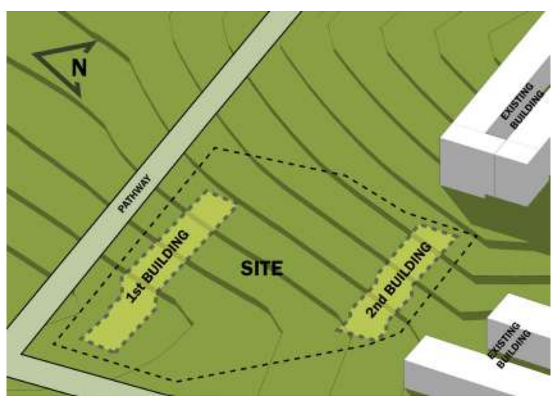
CONCEPT



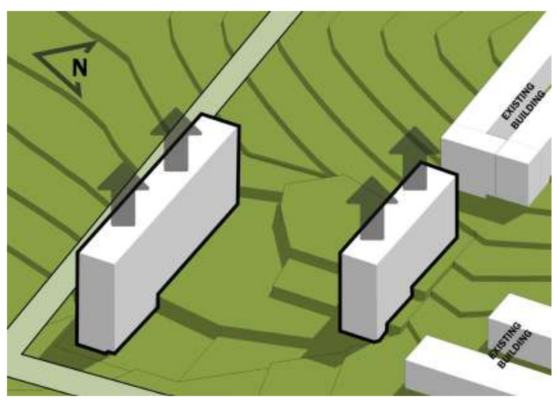
(1) The site is within the UNS dormitory area, near existing buildings and conveniently located by the road for easy construction and access.



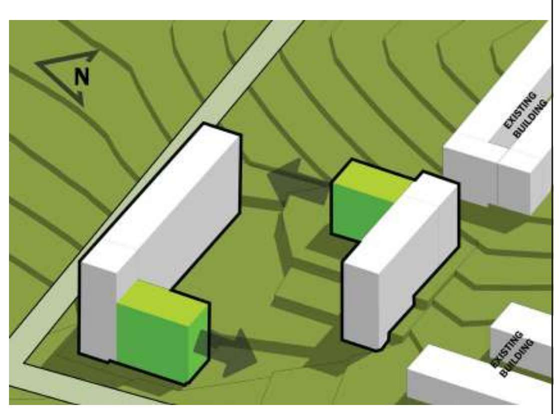
(2) Site processing is carried out using the cut and fill method to form different levels in the site.



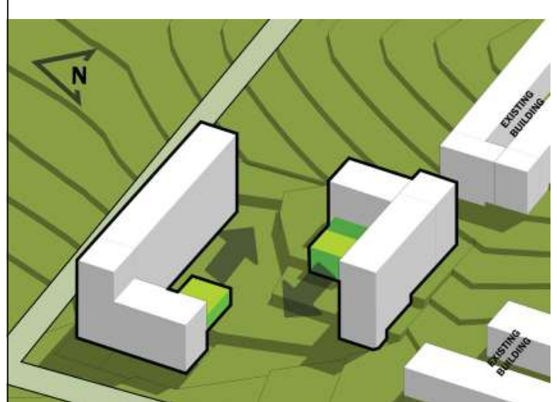
(3) The building consists of separate male and female buildings each at the edge of the site.



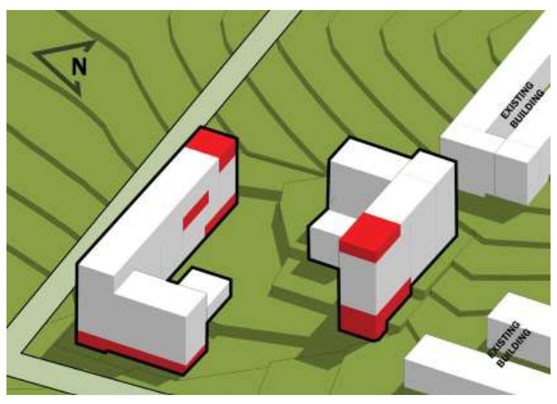
(4) The building is elevated by 4 floors in both buildings



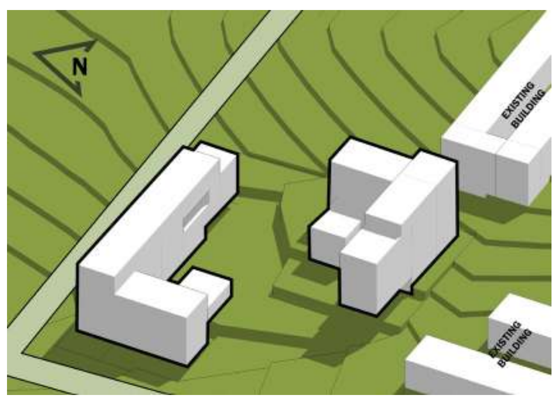
(5) Adding mass to each building, so that it seems to surround the site



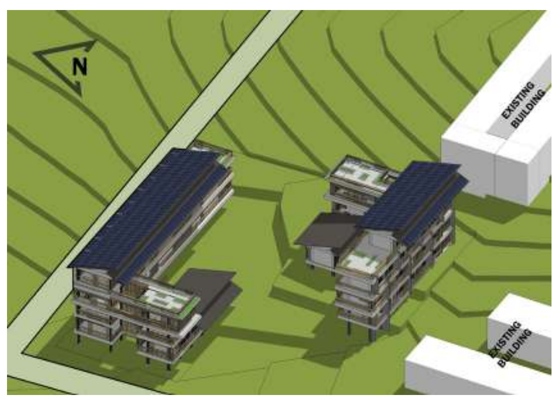
(6) Additions made in front of each building as additional rooms.



(7) For the purposes of open communal areas and utility areas, several parts of the building were reduced.



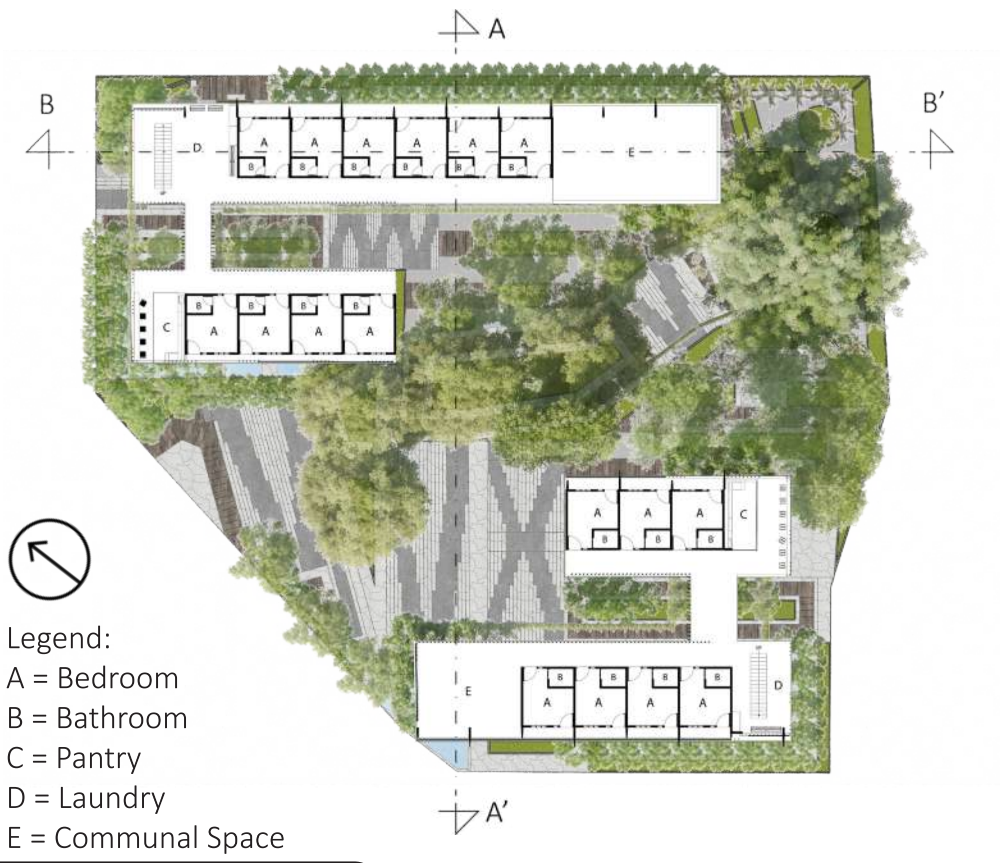
(8) It is determined that the building for men is to the north and the building for women is to the south.



(9) Processing of the building facade and addition of a sloping roof are carried out with consideration of energy efficiency in the building.

(10) landscape processing by adding accessibility, communal areas, and vegetation placement area plans.

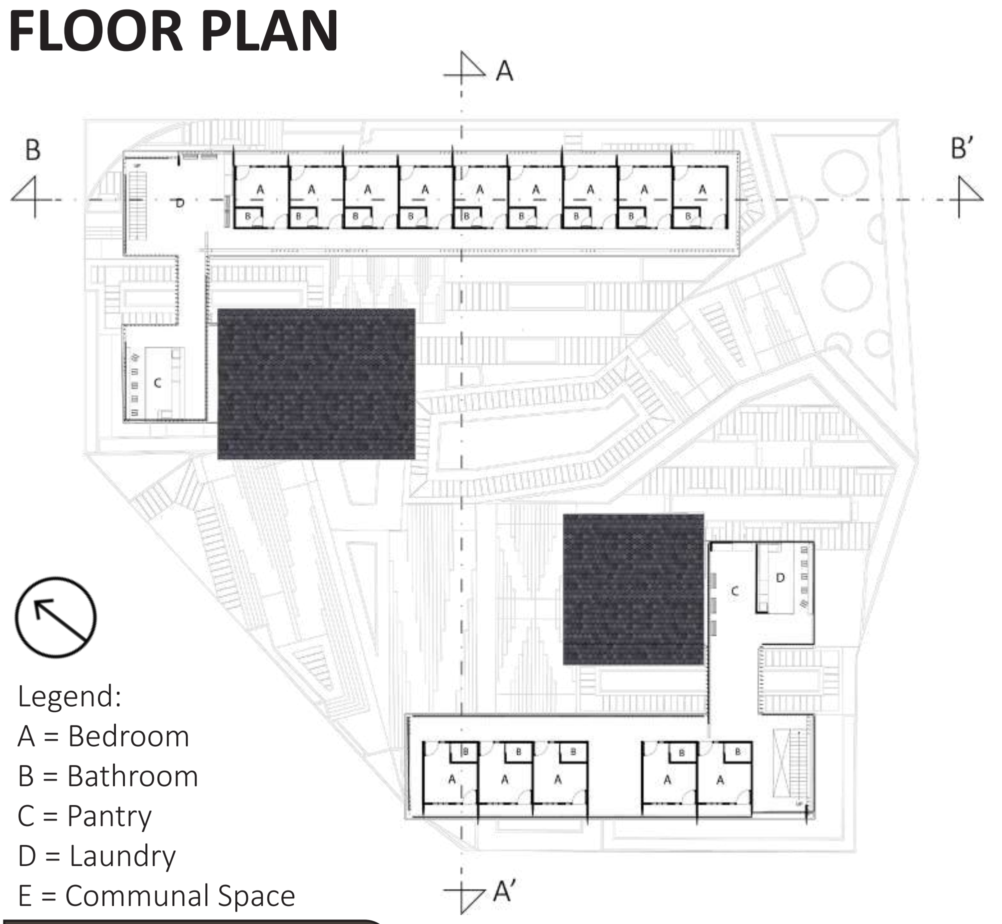
SITEPLAN



Legend:
A = Bedroom
B = Bathroom
C = Pantry
D = Laundry
E = Communal Space

GROUND FLOOR

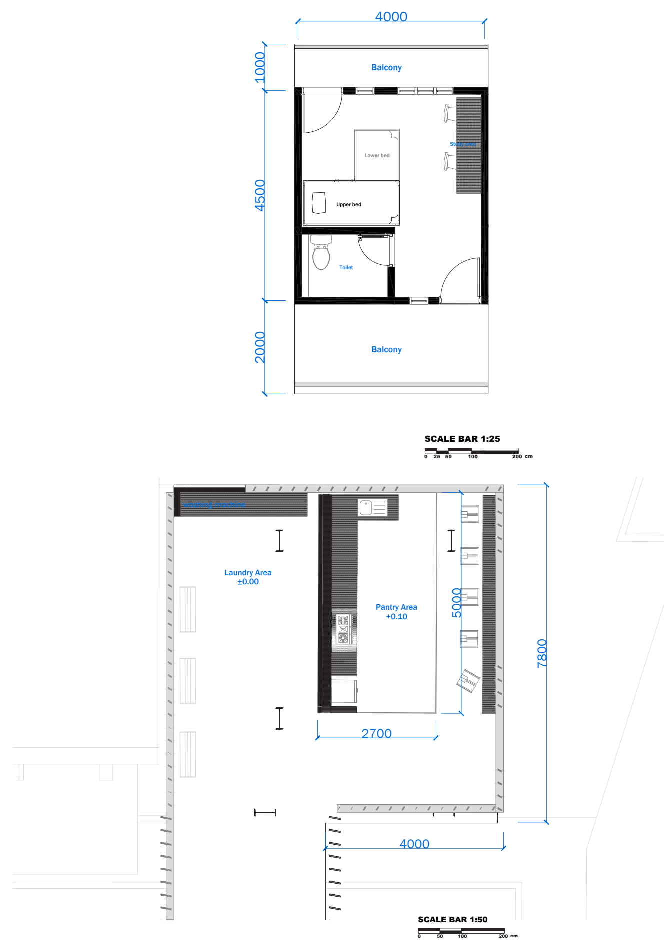
FLOOR PLAN

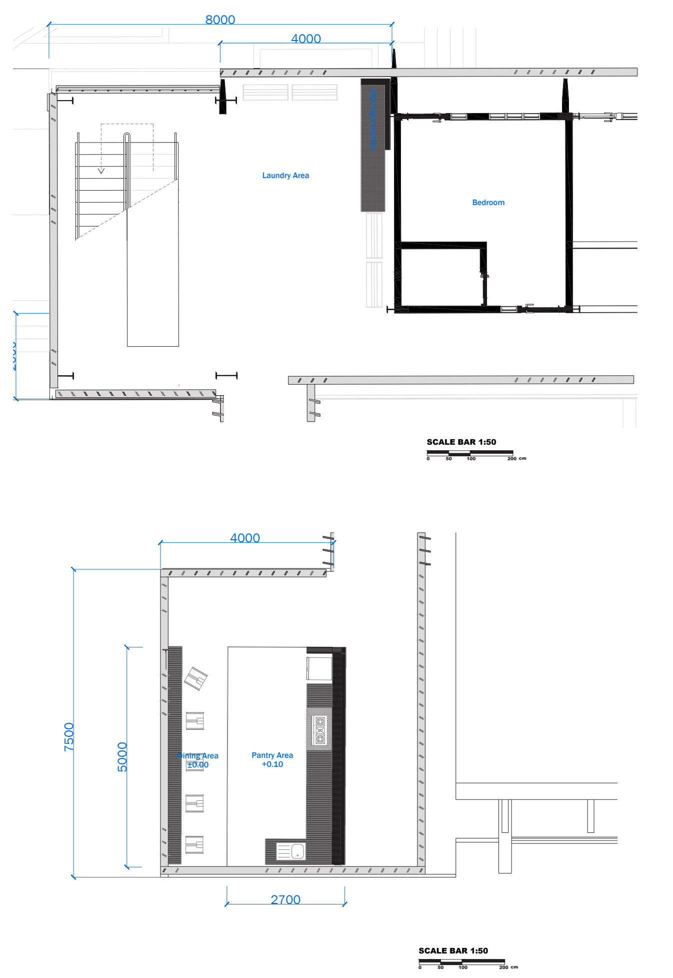


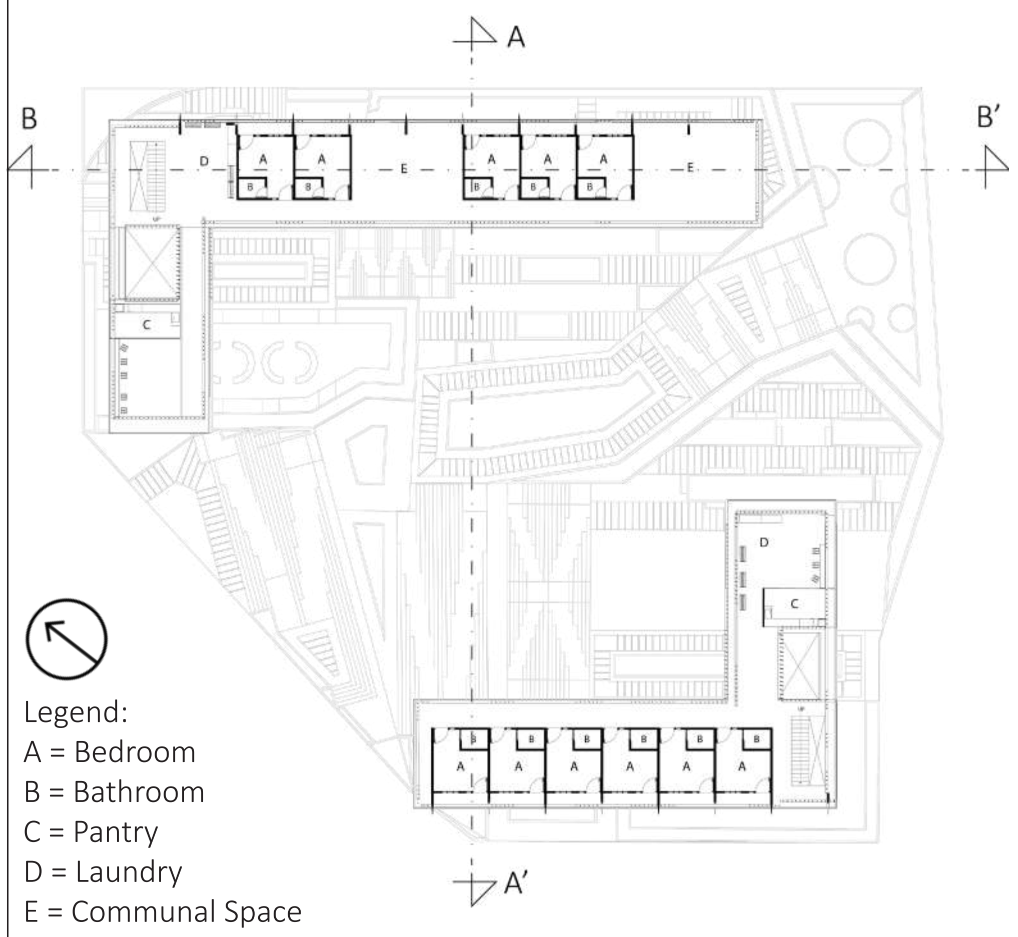
Legend:
A = Bedroom
B = Bathroom
C = Pantry
D = Laundry
E = Communal Space

FIRST FLOOR

INTERIOR LAYOUT

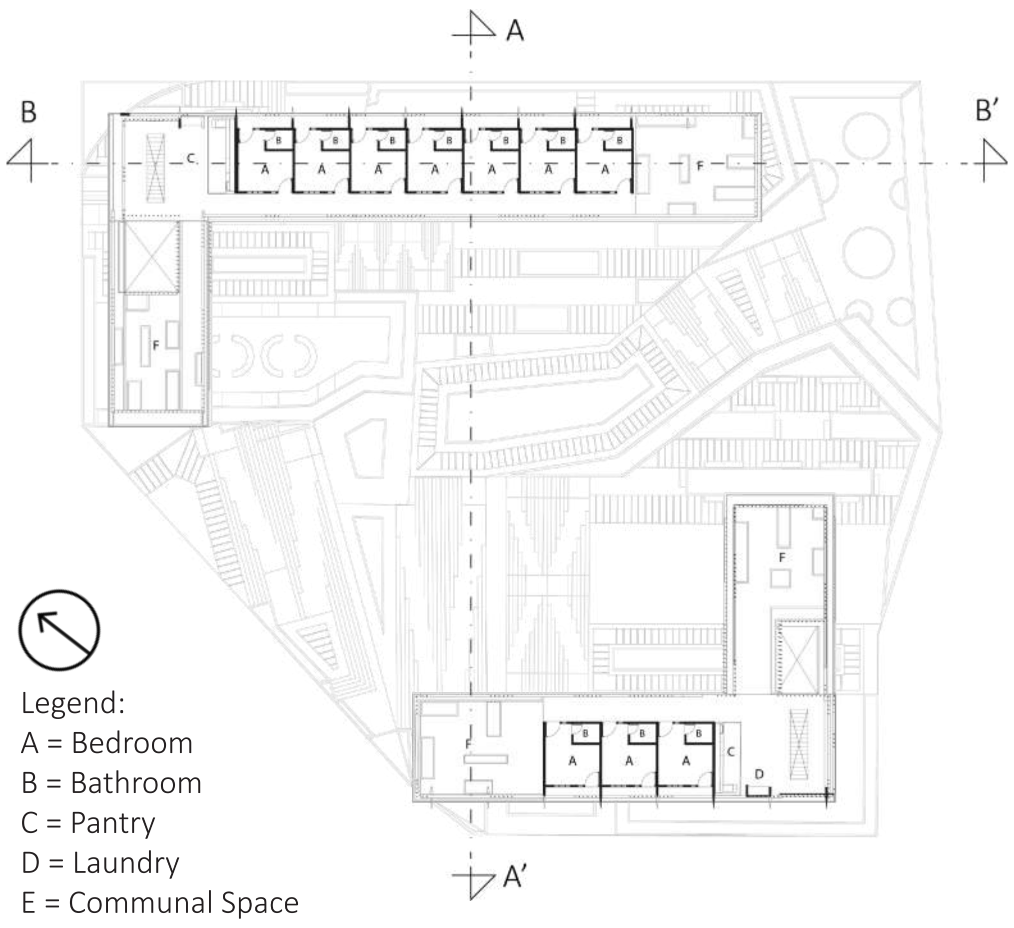






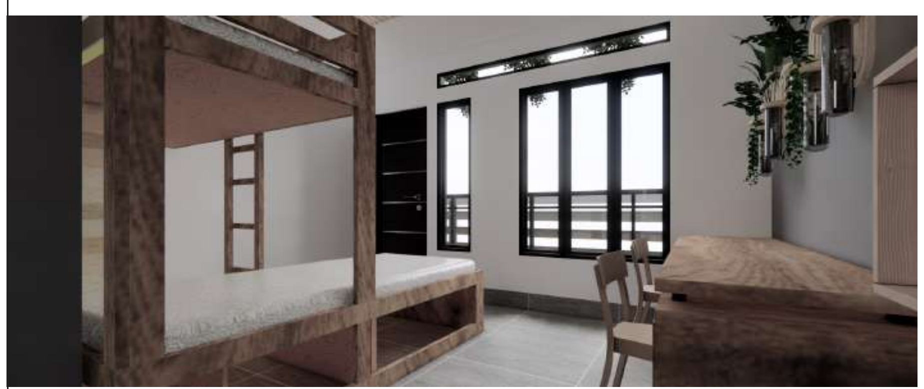
Legend:
A = Bedroom
B = Bathroom
C = Pantry
D = Laundry
E = Communal Space

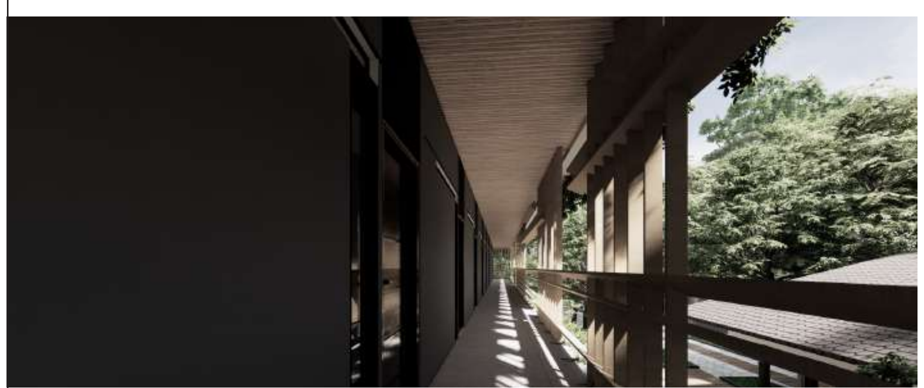
SECOND FLOOR



Legend:
A = Bedroom
B = Bathroom
C = Pantry
D = Laundry
E = Communal Space

THIRD FLOOR





SECTION

SECTION AA'

SECTION BB'

ELEVATION

NORTHWEST

NORTHEAST

SOUTHWEST

SOUTHEAST

ENERGY-SAVING STRATEGY

ENERGY EFFICIENCY MEASURES

Reduced Window to Wall Ratio - WWR of 10.90 (North Building) 6.68% (South Building)
Reduced Window to Wall Ratio (WWR) with a value of 10.90 (North Building) and 6.68% (South Builing) in dormitory buildings refers to a design approach where the proportion of window area to the total exterior wall area of the building is intentionally limited. In the context of dormitory buildings, this means that only about 6.68% of the total wall area is used for windows.

Reflective Paint/Tiles for Roof - Solar Reflectivity (albedo) of 0.7
Reflective paint or tiles for roofs with a Solar Reflectivity (albedo) of 0.7 refers to a roofing material that has been designed to reflect a significant portion of the solar energy that reaches it.

External Shading Devices - Annual Average Shading Factor (AASF) of 0.73
External shading devices with an Annual Average Shading Factor (AASF) of 0.73, when applied to dormitory buildings, are architectural elements strategically positioned on the building's exterior to manage sunlight and heat.

Natural Ventilation
Natural ventilation in dormitory buildings refers to the use of natural airflow to regulate air circulation within the structure.

Ceiling Fans in All Habitable Rooms
Ceiling fans in all habitable rooms in dormitory buildings refer to the installation of ceiling-mounted rotating fans in every living space within the building.

Energy-Saving Light Bulbs - Internal Spaces
Energy-saving light bulbs in internal spaces of dormitory buildings refer to the use of efficient lighting technology to illuminate the indoor areas.

Energy-Saving Light Bulbs - Common Areas and External Spaces
Energy-saving light bulbs in common areas and external spaces of dormitory buildings refer to the utilization of energy-efficient lighting technology to illuminate shared spaces and outdoor areas.

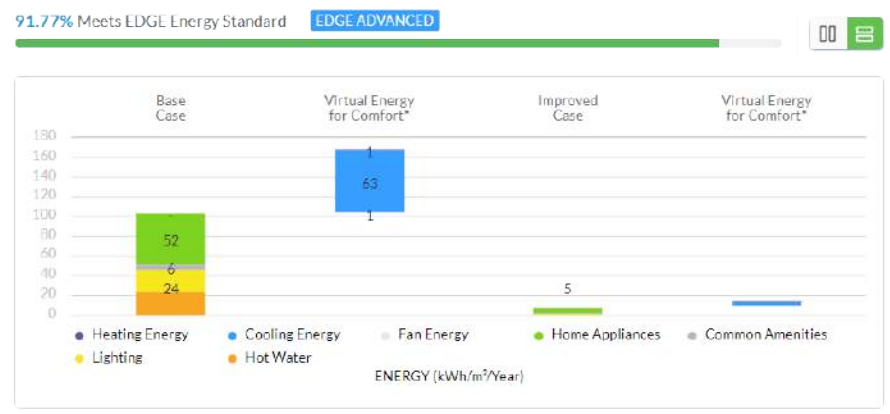
Lighting Controls for Common Areas and Outdoors
Lighting controls for common areas and outdoors in dormitory buildings refer to the implementation of systems that enable the efficient and effective management of lighting in shared indoor spaces and outdoor environments.

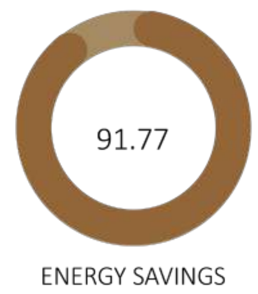
Solar Photovoltaics - 25% of Total Energy Use
Energy-saving light bulbs in internal spaces of dormitory buildings refer to the use of efficient lighting technology to illuminate the indoor areas.

Other Renewable Energy for Electricity Generation
Using other renewable energy sources for electricity generation in dormitory buildings involves adopting alternative methods to produce power while reducing the reliance on conventional fossil fuels.

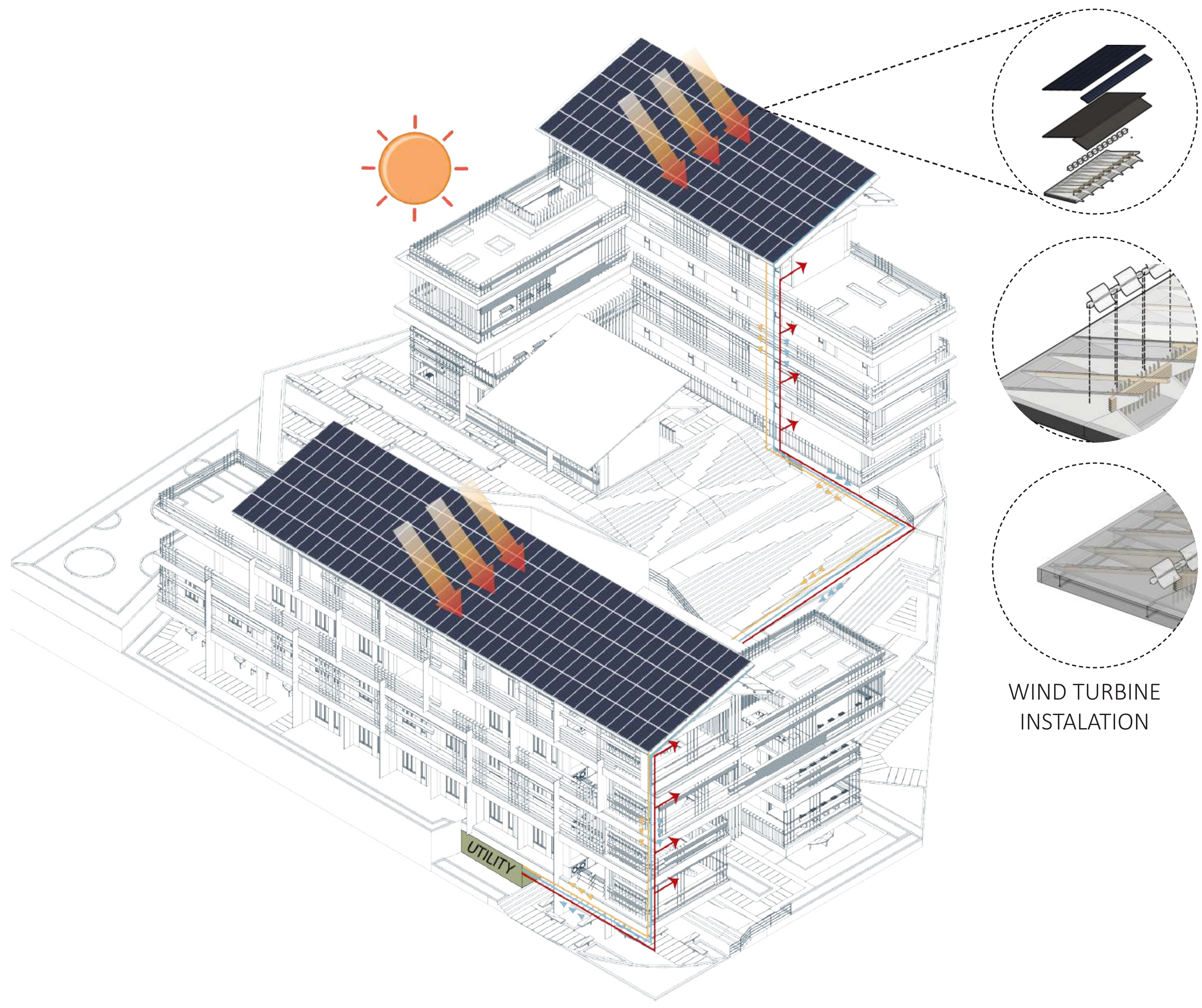
Offsite Renewable Energy Procurement - Equal to 100% of Total Operational CO2
Offsite renewable energy procurement equal to 100% of total operational CO2 in dormitory buildings refers to the practice of sourcing renewable energy from external providers to offset the carbon dioxide emissions associated with the building's operations.

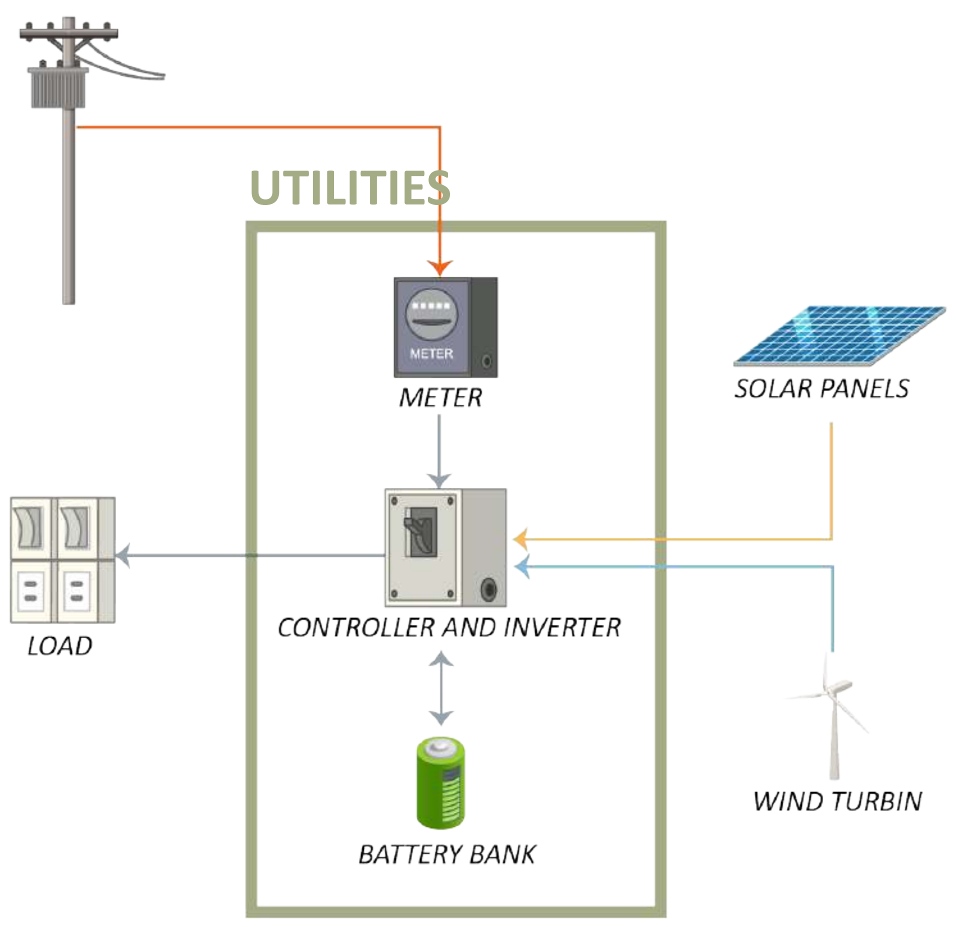
Carbon Offset - 100% of Total CO_2
Carbon offsetting equal to 100% of total CO_2 in dormitory buildings refers to the practice of compensating for all carbon dioxide emissions produced by the building's operations by investing in projects or activities that reduce or capture an equivalent amount of carbon elsewhere.





The implementation of hybrid solar panels in dormitories involves the utilization of solar panel technology interconnected with other energy sources, namely the electrical grid, wind power, to optimize energy usage and provide a stable power supply. In the context of dormitories, this can mean generating and utilizing solar energy for daily needs while maintaining energy reserves when necessary. The primary benefits of this implementation include cost savings, sustainability, and energy independence.





Based on the calculations performed, the power generated from the solar panel installation on the North Building is 55.2 kWp, approximately 1.7 kWp per unit (total of 31 units). This can lead to energy savings of up to 85 percent. Similarly, for the South Building, the solar panel installation generates power of 35.4 kWp, around 1.7 kWp per unit (total of 21 units). This can result in energy savings of up to 90 percent.

WATER-SAVING STRATEGY

WATER EFFICIENCY MEASURES

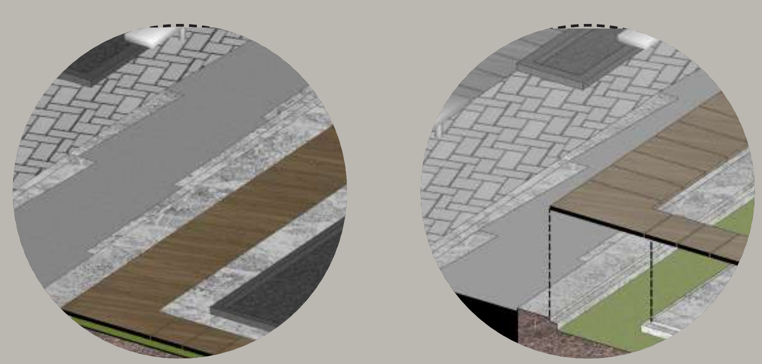
Low-Flow Showerheads - 7 L/min
Low-flow showerheads operate on the principle of restricting water flow to reduce water consumption while still providing a satisfactory shower experience. The "7 L/min" specification refers to a flow rate of 7 liters per minute, indicating the amount of water that flows out of the showerhead every minute.

Low-Flow Faucets for Kitchen Sinks - 5 L/min
Low-flow faucets for kitchen sinks operate based on the principle of reducing the amount of water flowing through the faucet while maintaining functionality for various tasks such as washing dishes and filling containers. The "5 L/min" specification indicates a flow rate of 5 liters per minute, which represents the volume of water flowing out of the faucet in one minute.

Low-Flow Faucets in All Bathrooms - 5 L/min
Low-flow faucets in all bathrooms work based on the principle of reducing the water flow rate to conserve water while still providing functional water delivery for various bathroom tasks. The "5 L/min" specification indicates a flow rate of 5 liters per minute, indicating the volume of water flowing out of the faucet in one minute.

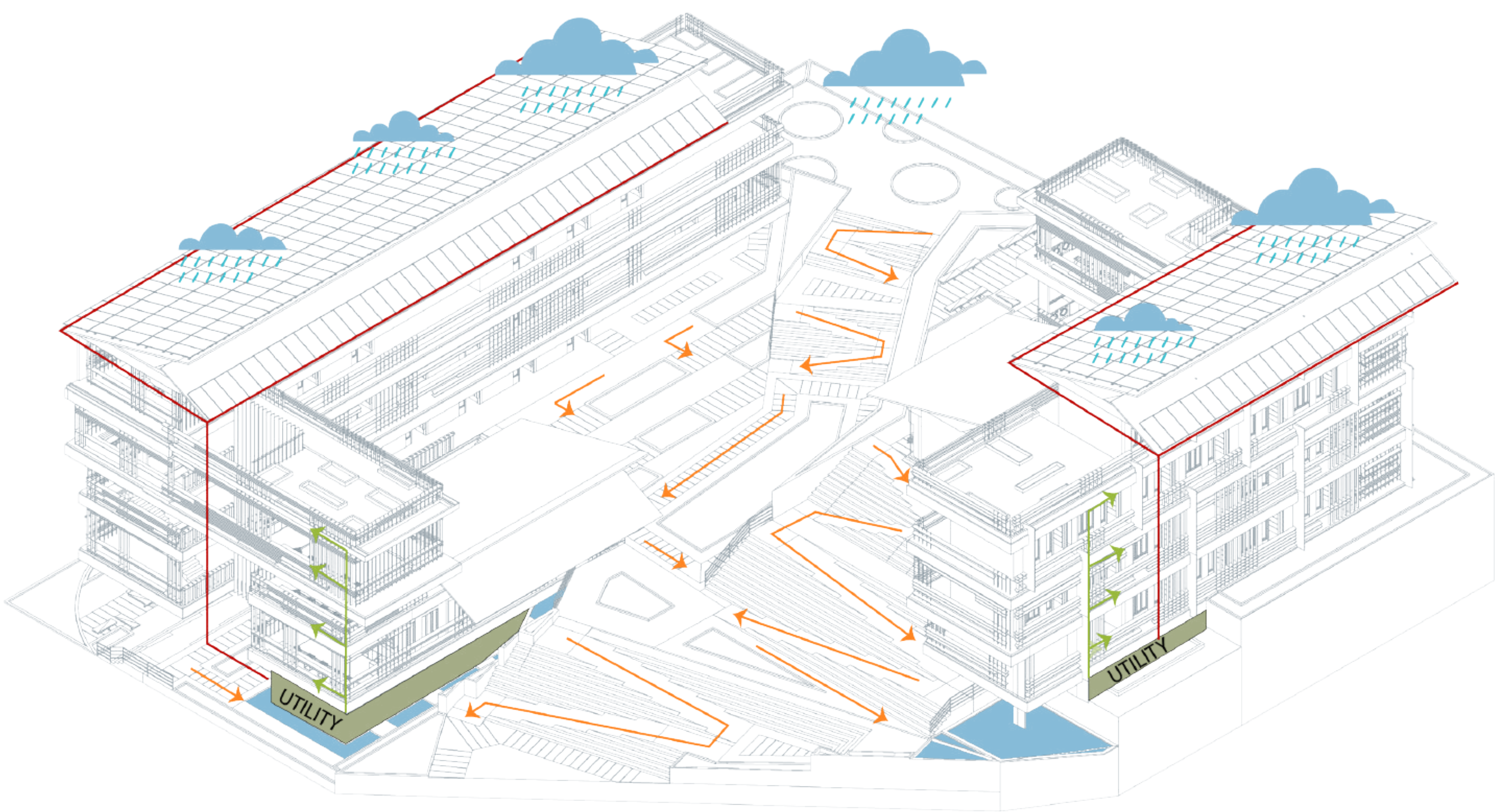
Dual Flush for Water Closets in All Bathrooms - 4 L/first flush and 3 L/second flush
Dual flush systems for water closets (toilets) work based on providing users with two options for flushing, each designed for different types of waste and corresponding water volumes. The specified "4 L/first flush and 3 L/second flush" indicates that the system offers a first flush option using 4 liters of water and a second flush option using 3 liters of water.

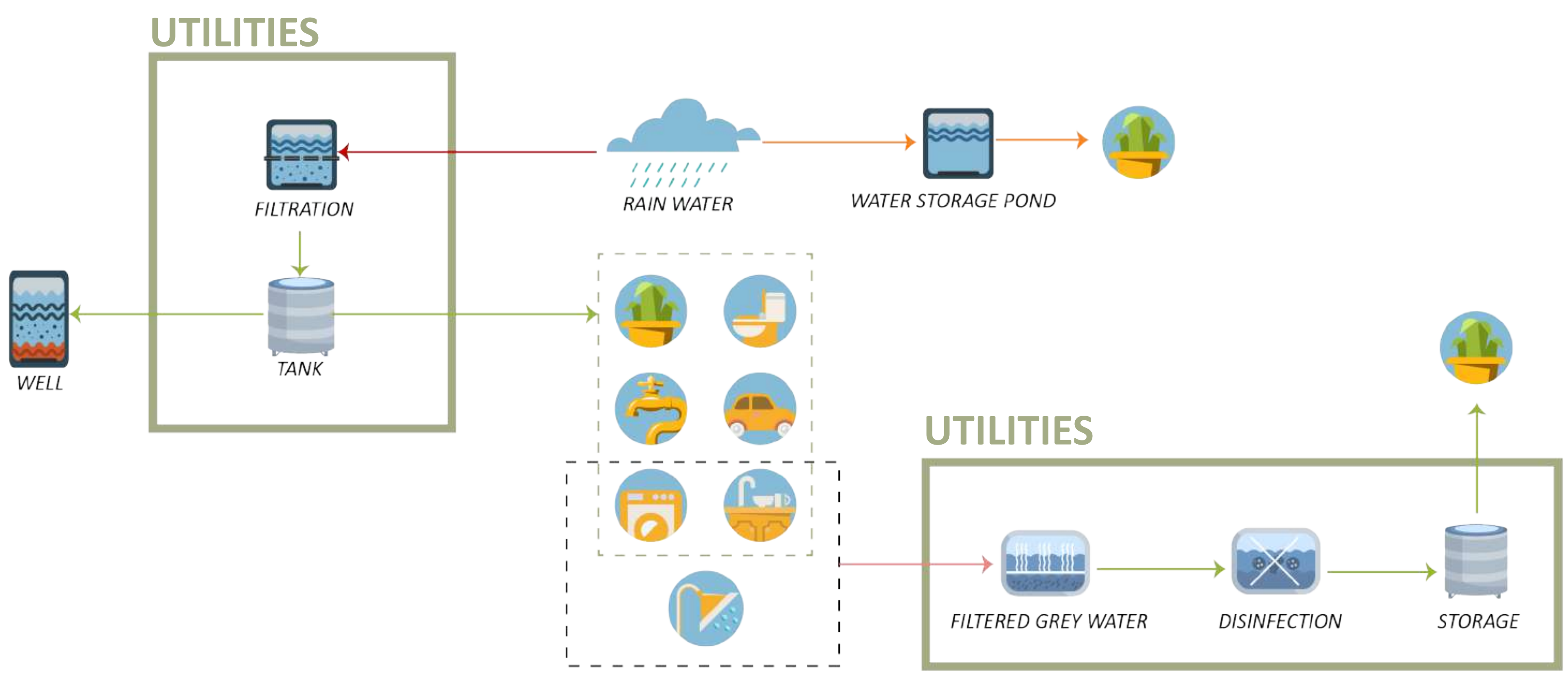
Rainwater Harvesting System - 50% of Roof Area Used for Rainwater Collection
A Rainwater Harvesting System utilizing 50% of a building's roof area efficiently collects and stores rainwater for non-potable uses, reducing water consumption, lowering costs, and promoting sustainability.



Infiltration areas enable rapid water absorption into the ground, reducing stagnant water on paved surfaces that could potentially flow into the surrounding environment. This is achieved by lowering the floor level by about 15 to 20 cm in specific paved sections. These lowered sections are left unpaved and instead planted with grass. Wooden boards, specially treated for heat and rain resistance, are placed over these areas with a spacing of 2.5 cm between each board.

For water treatment, this dormitory utilizes a rainwater harvesting system and recycles grey water from used water. The rainwater harvesting is divided into two methods: through the roof and contour of the landscape. For the roof method, water is directed to a utility tank, then filtered and used by the dormitory occupants. For the method involving the landscape contour, water is channeled through existing ramps and collected in a pond located at the lowest point. Subsequently, water from the pond is utilized for irrigating the vegetation within the dormitory. Additionally, there are also absorption systems in place in several areas to prevent water overflow into the surroundings and instead allow direct infiltration into the ground. Grey water is stored separately, then treated and processed to be reused for irrigating the vegetation present in the dormitory.





LESS EMBODIED ENERGY IN MATERIAL STRATEGY

MATERIALS EFFICIENCY MEASURES

Floor Slabs: Composite In-Situ Concrete and Steel Deck (Permanent Shuttering)
A composite in-situ concrete and steel deck with a thickness of 100 mm refers to a structural system used in construction that combines both concrete and steel elements.

Roof Construction: Clay Roofing Tiles on Timber Rafters
The application of clay roofing tiles on timber rafters with a proportion of 100 in a dormitory involves using clay tiles as roofing material supported by timber rafters.

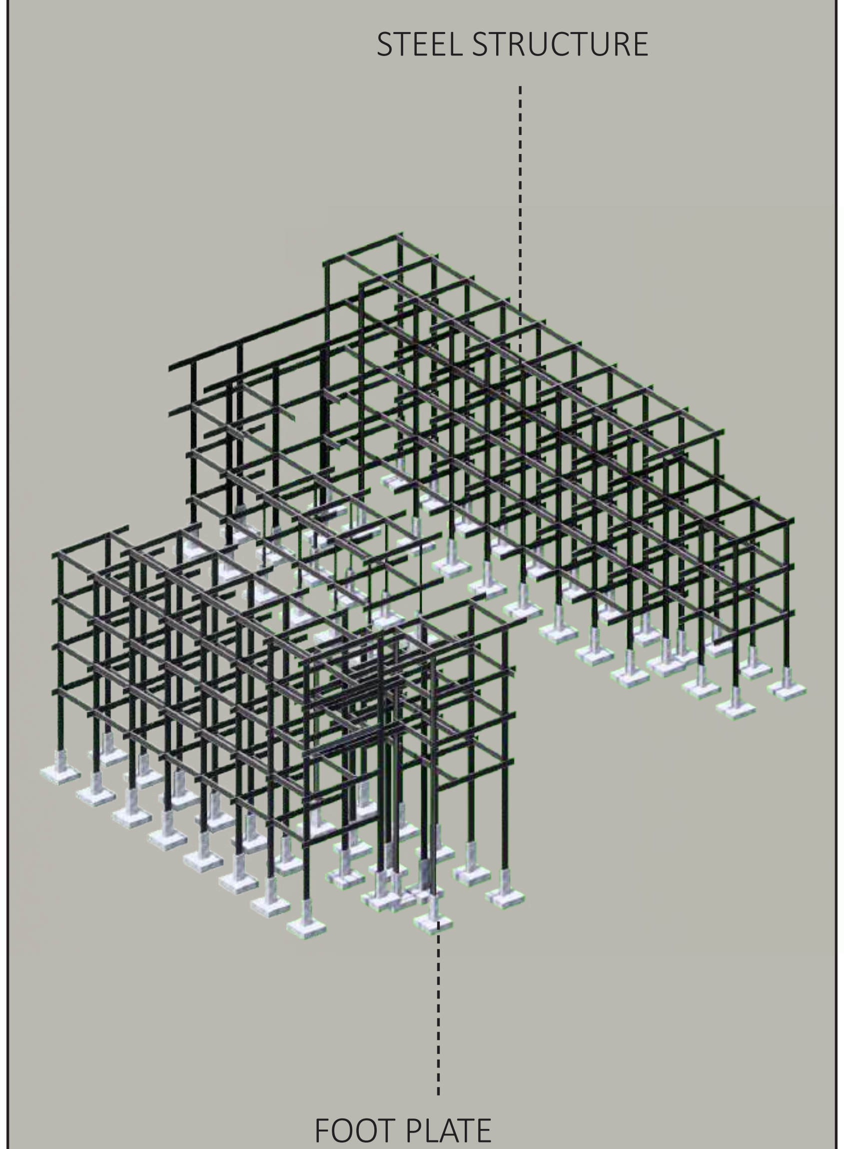
External Walls: Cellular Light Weight Concrete Blocks
The application of cellular lightweight concrete (CLC) blocks for external walls with a proportion of 100 in a dormitory involves using these lightweight and insulating blocks as the primary construction material for the outer walls of the building.

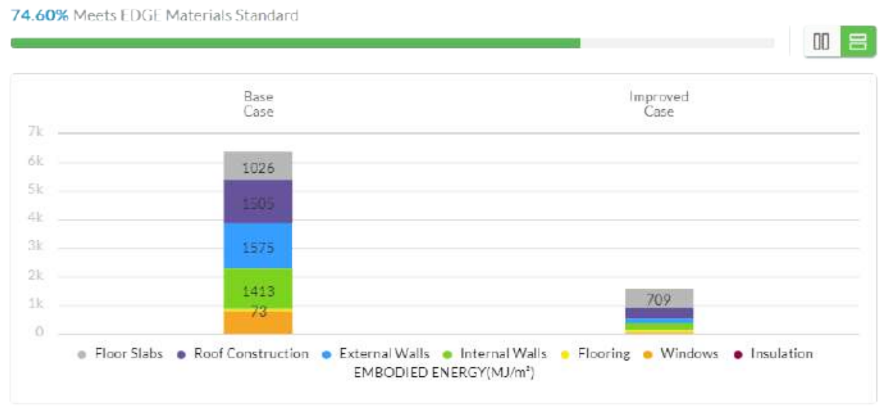
Internal Walls: Cellular Light Weight Concrete Blocks
The application of cellular lightweight concrete (CLC) blocks for internal walls with a proportion of 100 in a dormitory involves using these lightweight and insulating blocks as the primary construction material for the interior partition walls of the building.

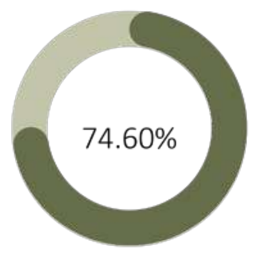
Flooring: Ceramic Tiles
The implementation of ceramic tile flooring in the dormitory involves the use of durable and aesthetically pleasing ceramic tiles throughout the living spaces. These tiles offer a polished and clean appearance that complements the overall ambiance of the dormitory.

Window Frames: Timber
Utilizing timber window frames with a proportion of 100 in a dormitory involves exclusively using wooden materials for crafting window frames throughout the building.

STRUCTURAL ISOMETRIC







LESS EMBODIED ENERGY IN MATERIALS

This building employs various environmentally friendly materials that are energy-efficient and have low carbon emissions. Furthermore, for the building's structure, reusable materials are used, allowing the structure to be repurposed for future constructions upon dismantling. All of these measures are taken to ensure efficient energy and material savings, as well as effective post-use waste management.

CONCLUSION

The building is a dormitory intended for UNS students. The building is designed with a biophilic and contoured approach as a response to the site, this also makes the building look beautiful and fresh which can be useful as a medium for student relaxation because of boredom from doing lecture assignments and increasing productivity. It can also be seen that the building has many communal areas as a means of student interaction which encourages student discussion and socialization processes. This comfortable atmosphere is expected to improve the quality of life of students who live in it.

The building is designed to have several detailed energy, water and material efficiency features such as external shading, rain water harvesting, solar pv, natural ventilation and Recycled Gray Water. From the application of these features, based on the results of calculations in the Edge 2.15 application, it is found that buildings produce carbon emissions of 26.11 tons of CO2/year. In order to achieve zero carbon, vegetation is added as an absorber of building carbon emissions. the results of calculating the ability to apply based on the type of vegetation and the amount of vegetation planted, the overall vegetation can absorb carbon emissions of 52.9 tons of CO2/year. From this, carbon emissions from buildings will be absorbed perfectly so as to achieve zero carbon and vegetation is able to contribute more oxygen to the site or around the site.

The application of green architecture in buildings makes this building have complex features. efforts to minimize energy use and utilize renewable energy are very important in building design. For both buildings, this building managed to achieve energy efficiency of 91.77%, water efficiency of 82.82%, and material efficiency of 74.60%. In this energy efficiency effort, the company spent Rp 95.8 million for one room unit with a total of 52 room units. So that it can make a return on investment without calculating the rent from students for 23.4 years.