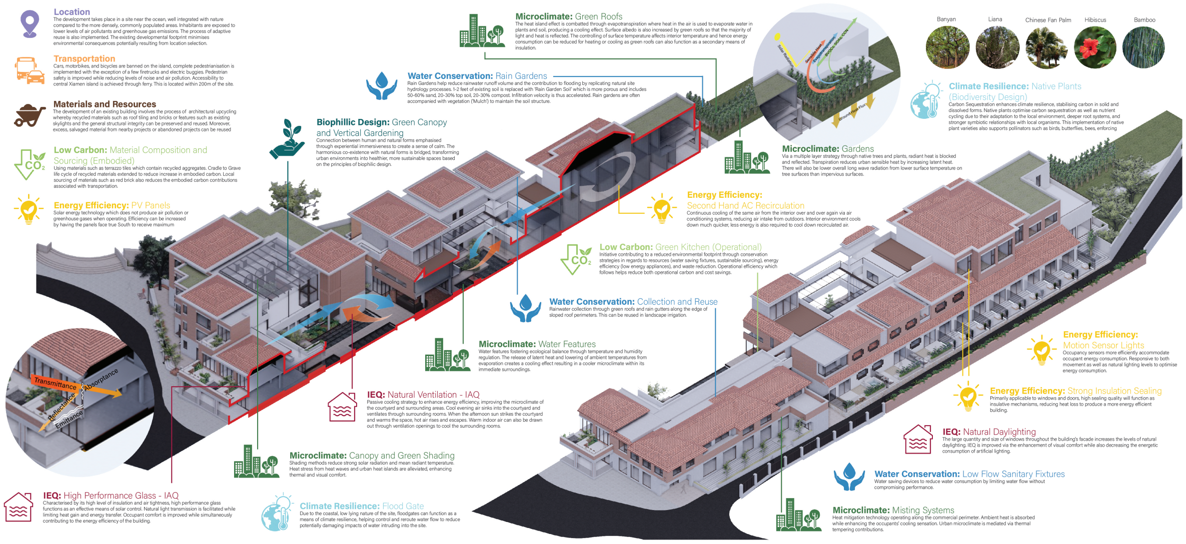
Case Study Title:



Location
The development takes place in a site near the ocean, well integrated with nature compared to the more densely, commonly populated areas. Inhabitants are exposed to lower levels of air pollutants and greenhouse gas emissions. The process of adaptive reuse is also implemented. The existing developmental footprint minimises environmental consequences potentially resulting from location selection.

Transportation
Cars, motorbikes, and bicycles are banned on the island, complete pedestrianisation is implemented with the exception of a few firetrucks and electric buggies. Pedestrian safety is improved while reducing levels of noise and air pollution. Accessibility to central Xiamen island is achieved through ferry. This is located within 200m of the site.

Materials and Resources
The development of an existing building involves the process of architectural upcycling whereby recycled materials such as roof tiling and bricks or features such as existing skylights and the general structural integrity can be preserved and reused. Moreover, excess, salvaged material from nearby projects or abandoned projects can be reused

Low Carbon: Material Composition and Sourcing (Embodied)
Using materials such as terrazzo tiles which contain recycled aggregates. Cradle to Grave life cycle of recycled materials extended to reduce increase in embodied carbon. Local sourcing of materials such as red brick also reduces the embodied carbon contributions associated with transportation.

Energy Efficiency: PV Panels
Solar energy technology which does not produce air pollution or greenhouse gases when operating. Efficiency can be increased by having the panels face true South to receive maximum

Microclimate: Green Roofs
The heat island effect is combatted through evapotranspiration where heat in the air is used to evaporate water in plants and soil, producing a cooling effect. Surface albedo is also increased by green roofs so that the majority of light and heat is reflected. The controlling of surface temperature affects interior temperature and hence energy consumption can be reduced for heating or cooling as green roofs can also function as a secondary means of insulation.

Water Conservation: Rain Gardens
Rain Gardens help reduce rainwater runoff volume and the contribution to flooding by replicating natural site hydrology processes. 1-2 feet of existing soil is replaced with 'Rain Garden Soil' which is more porous and includes 50-60% sand, 20-30% top soil, 20-30% compost. Infiltration velocity is thus accelerated. Rain gardens are often accompanied with vegetation ('Mulch') to maintain the soil structure.

Biophillic Design: Green Canopy and Vertical Gardening
Connection between human and natural forms emphasised through experiential immersiveness to create a sense of calm. The harmonious co-existence with natural forms is bridged, transforming urban environments into healthier, more sustainable spaces based on the principles of biophilic design.

Climate Resilience: Native Plants (Biodiversity Design)
Carbon Sequestration enhances climate resilience, stabilising carbon in solid and dissolved forms. Native plants optimise carbon sequestration as well as nutrient cycling due to their adaptation to the local environment, deeper root systems, and stronger symbiotic relationships with local organisms. This implementation of native plant varieties also supports pollinators such as birds, butterflies, bees, enforcing

Microclimate: Gardens
Via a multiple layer strategy through native trees and plants, radiant heat is blocked and reflected. Transpiration reduces urban sensible heat by increasing latent heat. There will also be lower overall long wave radiation from lower surface temperature on tree surfaces than impervious surfaces.

Energy Efficiency: Second Hand AC Recirculation
Continuous cooling of the same air from the interior over and over again via air conditioning systems, reducing air intake from outdoors. Interior environment cools down much quicker, less energy is also required to cool down recirculated air.

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Initiative contributing to a reduced environmental footprint through conservation strategies in regards to resources (water saving fixtures, sustainable sourcing), energy efficiency (low energy appliances), and waste reduction. Operational efficiency which follows helps reduce both operational carbon and cost savings.

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Rainwater collection through green roofs and rain gutters along the edge of sloped roof perimeters. This can be reused in landscape irrigation.

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Water features fostering ecological balance through temperature and humidity regulation. The release of latent heat and lowering of ambient temperatures from evaporation creates a cooling effect resulting in a cooler microclimate within its immediate surroundings.

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Occupancy sensors more efficiently accommodate occupant energy consumption. Responsive to both movement as well as natural lighting levels to optimise energy consumption.

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Passive cooling strategy to enhance energy efficiency, improving the microclimate of the courtyard and surrounding areas. Cool evening air sinks into the courtyard and ventilates through surrounding rooms. When the afternoon sun strikes the courtyard and warms the space, hot air rises and escapes. Warm indoor air can also be drawn out through ventilation openings to cool the surrounding rooms.

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Primarily applicable to windows and doors, high sealing quality will function as insulative mechanisms, reducing heat loss to produce a more energy efficient building.

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The large quantity and size of windows throughout the building's facade increases the levels of natural daylighting. IEQ is improved via the enhancement of visual comfort while also decreasing the energetic consumption of artificial lighting.

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Shading methods reduce strong solar radiation and mean radiant temperature. Heat stress from heat waves and urban heat islands are alleviated, enhancing thermal and visual comfort.

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Water saving devices to reduce water consumption by limiting water flow without compromising performance.

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Characterised by its high level of insulation and air tightness, high performance glass functions as an effective means of solar control. Natural light transmission is facilitated while limiting heat gain and energy transfer. Occupant comfort is improved while simultaneously contributing to the energy efficiency of the building.

Climate Resilience: Flood Gate
Due to the coastal, low lying nature of the site, floodgates can function as a means of climate resilience, helping control and reroute water flow to reduce potentially damaging impacts of water intruding into the site.

Microclimate: Misting Systems
Heat mitigation technology operating along the commercial perimeter. Ambient heat is absorbed while enhancing the occupants' cooling sensation. Urban microclimate is mediated via thermal tempering contributions.

Project Name	La vie Of Dix pieces Hotel Resort, Kulangsu Island
Location	Kulangsu Island, Xiamen, Fujian, China
Climate Zone	Hot Summer and Warm Winter
Latitude/Longitude	24.4798° N, 118.0894° E [1]
Building Type	Hotel
Floor Area [sqm]	4183.00 m^2
Building Height [m]	12.2 m
Number of Storeys	3 stories
Completion Year	2025 (Projected)
Project Team	**Hotel:** La vie Of Dix pièces (LOD) **Developer:** Fangjian Xingshe (Xiamen) Tourism Technology Development Co., Ltd. **Designer:** Laliving and Opr Design | LOD

*mock-up experiments and other research-based experiments could be included as case study, aside from actual building construction projects if similar information could be provided.

1. Project Description

Project Overview

1. Project Background

This project is a hotel and cultural exchange center located on the campus of Fuzhou University's Xiamen Academy of Arts and Design, situated on the pedestrian-only Kulangsu Island. As a UNESCO World Heritage site, the context demands a design that balances modern sustainability with heritage sensitivity. The project is designed to achieve near-zero energy building certification, establishing a new benchmark for sustainable development in the region's hot and humid climate. It integrates advanced energy strategies with a deep respect for the local environment and low-carbon ethos of its unique island setting.

2. Passive Cooling Intervention

The design prioritizes a robust passive cooling strategy to combat Xiamen's hot, humid climate. The project design leverages natural ventilation as a primary means of cooling and improving indoor air quality. To mitigate significant solar heat gain, the building incorporates substantial shading, double glazed insulated windows, deep façade recesses, covered walkway and strategic landscaping including pool to create microclimate environment. These passive interventions work in concert to drastically reduce the building's cooling load before high-efficiency active systems are engaged, forming the foundational layer of its energy-saving performance.

3. Project Achievements

The project serves as a model for sustainable building design in a hot and humid climate. The design integrates passive cooling strategies with high-efficiency active systems and renewable energy generation to minimize energy consumption while ensuring a high level of indoor comfort. The building's comprehensive energy-saving measures are projected to result in an overall energy saving rate of 81.90% compared to a baseline building, with a renewable energy utilization rate of 71.75%.

The project successfully met the design standards for a near-zero energy building. All sustainable design performance metrics were validated through simulation and calculation during the design phase.

2. Climate & Site Context

Basic Climate Conditions

Temperature	Annual Average	22.50 °C
	Annual Range	1.60 °C (min) - 36.60 °C (max)
Relative Humiditiy	Annual Average	77%
	Annual Range	69% (October/November) - 86% (June)
Annual Degree-Days (ASHRAE Standard 169-2020)		HDD 18°C: 556 CDD 10°C: 3,636

Climate Analysis

Xiamen’s humid subtropical climate is defined by long, hot, humid summers and short, mild winters, driving a design focused on heat mitigation and passive cooling. High annual temperatures and intense solar radiation necessitate robust shading and a high-performance building envelope to minimize heat gain. The significant cooling degree days (CDD10°C: 3,636) underscore a primary demand for cooling. Prevailing southeast winds in summer and monsoon patterns offer a key opportunity for cross-ventilation to alleviate humidity and reduce mechanical cooling loads. High annual relative humidity (77%) further emphasizes the need for effective moisture management and ventilation strategies. The design therefore prioritizes passive measures—strategic solar orientation, deep overhangs, and enhanced natural airflow—to improve comfort and drastically lower energy consumption in this demanding hot-humid environment.

Site Analysis

The project is located on a university campus with rich landscape resources. The building's orientation and form were optimized to take advantage of the prevailing summer winds for natural ventilation. Site simulations confirmed that the building's layout avoids the creation of wind vortexes, ensuring effective airflow. The design also maximizes natural daylighting while controlling for solar heat gain.

Fig. 2.1 Aerial View

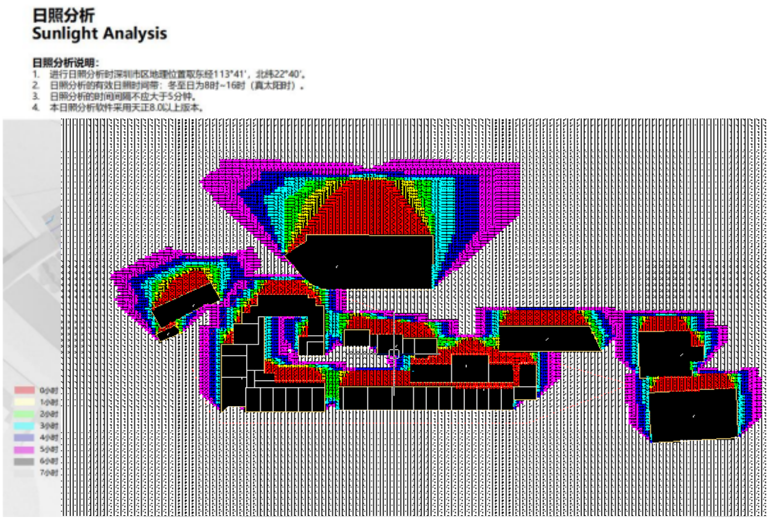
3. Passive Cooling Design Details

Passive Cooling Strategies (please tick implemented passive cooling strategies)

☑ Building Orientation & Form (site orientation, building shape, etc.)
☑ Envelope Design (insulation, air-tightness, shading, window system, thermal mass, etc.)
☑ Natural Ventilation (cross ventilation, stack ventilation, night ventilation, etc.)
☑ Evaporative Cooling (direct/indirect evaporative cooling, etc.)
☐ Ground Cooling (geothermal, ground-coupled systems, basement/underground space,etc.)
☐ Radiative Cooling (cool roof, night sky radiation, radiant barriers, reflective surfaces, etc.)
☑ Nature-based Solutions (green roof/wall, tree shading, etc.)
☑ Others (human behavior, clothing, semi-passive (fans, etc.))

Description (please describe one strategy per box – you can add more boxes below if needed)

- **Building Orientation & Form:** The building is oriented to capture prevailing summer breezes, and its form is designed to promote cross-ventilation.



日照分析
Sunlight Analysis

日照分析说明：
1. 进行日照分析时深圳市区地理位置取东经113°41′，北纬22°40′。
2. 日照分析的有效日照时间带：冬至日为8时~16时（真太阳时）。
3. 日照分析的时间间隔不应大于5分钟。
4. 本日照分析软件采用天正8.0以上版本。

Fig. 2.2 Sunlight Analysis

- **Envelope Design:** A high-performance building envelope is a key feature. This includes:
  - **Insulation:** The roof is insulated with extruded polystyrene (XPS) boards, and the external walls use vitrified micro-bead mortar insulation.
  - **Windows:** Double-glazed, low-E windows with a U-value of 2.3 W/m²K are used.
  - **Airtightness:** The building is designed to achieve a high level of airtightness (Grade 6).

- **Natural Ventilation:** Operable windows and doors are used throughout the building to facilitate natural ventilation. Simulations show that the design achieves at least 6 air changes per hour in major functional rooms, with indoor air speeds of 0.2-0.7 m/s.

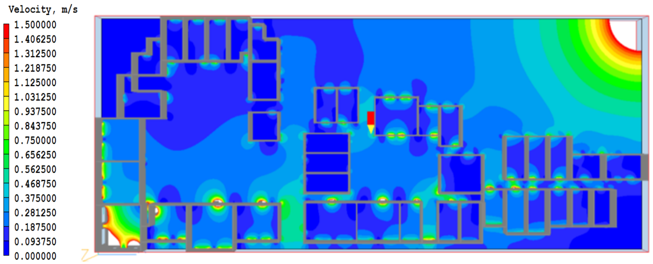


Fig. 2.3 Indoor Air Velocity Contour Plot – First Floor

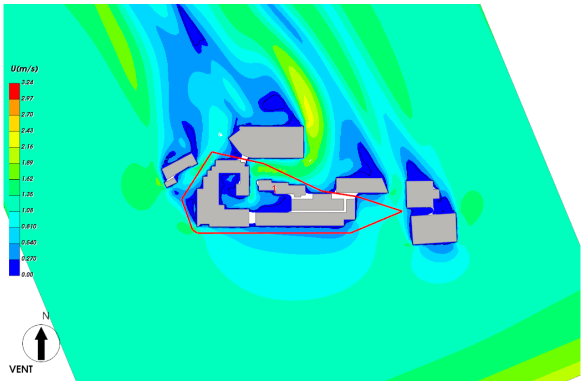


Fig. 2.4 Air Velocity Contour Plot at 1.5m Height – Summer Condition

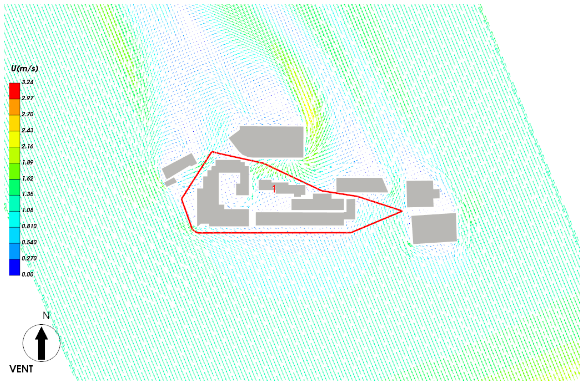


Fig. 2.5 Air Velocity Vector Plot at 1.5m Height – Summer Condition

- **Shading:** Horizontal shading devices are installed over the windows. Additionally, the rooftop photovoltaic (PV) array is integrated into the building's design to provide shading for the roof.

Fig. 2.6 Shading Devices on Elevations

Fig. 2.7 Photovoltaic (PV) Panels on Roof

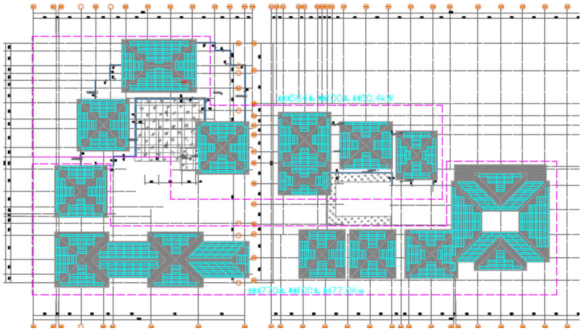


Fig. 2.8 Photovoltaic (PV) Panels Roof Layout Plan

- **Evaporative Cooling:** Strategically placing two water pools in the courtyard induces a powerful evaporative cooling effect, significantly lowering air temperature before it is drawn into corridors and rooms.

- **Nature-based Solutions:** Shading is provided through a nature-based approach that retains existing mature trees for courtyards and roof gardens, complemented by new vegetation around the building perimeter.

- **Human Behavior:** User-centered design, informed by persona studies and guest journey mapping, encourages residents to lower cooling loads through intuitive semi-passive strategies like ceiling fans and direct, simplified BMS controls.

4. Active Components

Active (Hybrid) Cooling Strategies

(please describe one strategy per box – you can add more boxes below if needed)

- **HVAC System:** A multi-split air conditioning system with a high coefficient of performance (APF 5.2) provides cooling when passive strategies are insufficient. The system is coupled with a fresh air system that filters PM2.5 particles.

- **Control Systems:** A Direct Digital Control (DDC) system is used to monitor and control the HVAC system for optimal performance. Smart lighting controls are also used in guest rooms.

- **Renewable Energy:** A 127.4 kWp rooftop photovoltaic system is installed, covering an area of 580 m². The PV system is expected to generate a significant portion of the building's electricity needs. Additionally, an air-source heat pump with a COP of 4.4 is used for hot water.

5. Performance Data

Cooling Energy Use

The building is projected to have a comprehensive energy consumption of 11.87 kWh/m²·a. The overall building energy saving rate is 81.90%, with a building envelope energy saving rate of 35.90%. The renewable energy utilization rate is 71.75%.

Indoor Thermal Comfort

The design maintains a high level of indoor thermal comfort, with summer indoor temperatures not exceeding 26°C and relative humidity not exceeding 60%. Indoor air quality is also a priority, with design values for PM2.5 and CO2 well within the recommended limits. The design also meets stringent standards for indoor noise levels.

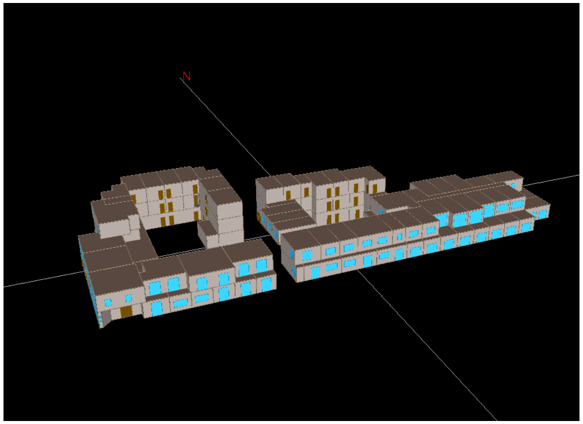


Fig. 4.1 eQUEST Energy Model

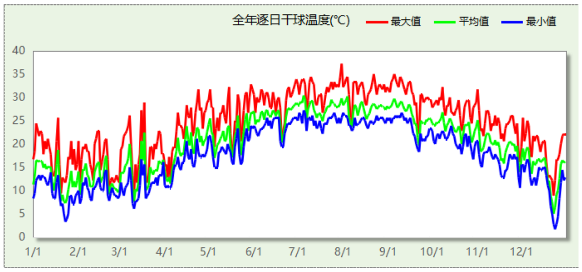


Fig. 4.2 Table of Daily Dry-bulb Temperature

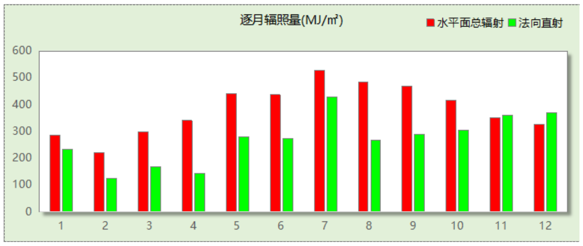


Fig. 4.3 Table of Monthly Solar Irradiance Data

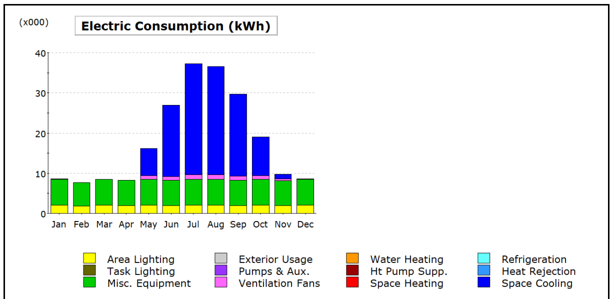


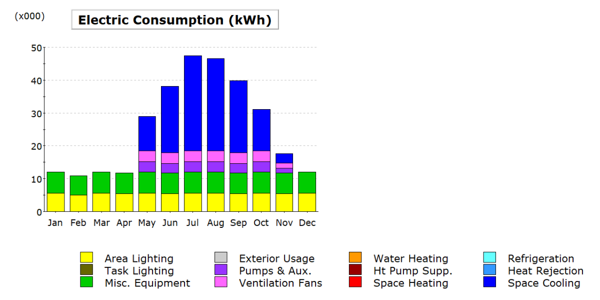
Table of Predicted Monthly Energy Consumption for the Designed Building

Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	0.01	6.87	17.78	27.65	26.91	20.37	9.62	1.18	-	110.39
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	-	-	-	0.00	0.87	0.90	1.14	1.14	1.07	0.86	0.41	-	6.39
Pumps & Aux.	0.09	0.06	0.04	-	-	-	-	-	-	-	-	0.05	0.24
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	6.46	5.84	6.46	6.25	6.46	6.25	6.46	6.46	6.25	6.46	6.25	6.46	76.08
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	2.02	1.82	2.01	1.99	2.01	1.96	2.04	2.01	1.96	2.04	1.90	2.04	23.80
Total	8.57	7.72	8.52	8.25	16.21	26.90	37.29	36.53	29.66	18.98	9.74	8.55	216.90

Summary of Energy Consumption for the Designed Building

Fig. 4.4 Energy Simulation Software Output – Designed Building



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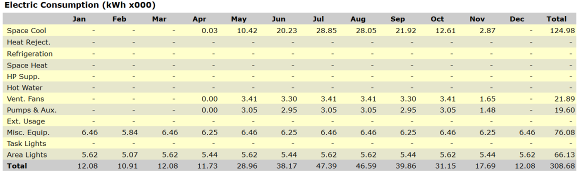

Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	0.03	10.42	20.23	28.85	28.05	21.92	12.61	2.87	-	124.98
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	-	-	-	0.00	3.41	3.30	3.41	3.41	3.30	3.41	1.65	-	21.89
Pumps & Aux.	-	-	-	0.00	3.05	2.95	3.05	3.05	2.95	3.05	1.48	-	19.60
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
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Area Lights	5.62	5.07	5.62	5.44	5.62	5.44	5.62	5.62	5.44	5.62	5.44	5.62	66.13
Total	12.08	10.91	12.08	11.73	28.96	38.17	47.39	46.59	39.86	31.15	17.69	12.08	308.68

Summary of Energy Consumption for the Designed Building

Fig. 4.4 Energy Simulation Software Output – Baseline Building

6. Financial Data

Cost Benefits

The incremental cost for the near-zero energy design was 100% self-funded by the developer. The unit area cost of the building is 3744 RMB/m², compared to a baseline of 3500 RMB/m². The incremental cost is primarily attributed to the passive technology (34.7%) and renewable energy systems (68.6%).

*Please try to extract passive cooling cost and savings; however, if it is difficult, please annotate the premise. (e.g., the calculation includes the cost for both passive heating and cooling, etc.)

7. Passive Cooling Operation

Maintenance Requirement

nil

8. Lesson Learnt / Recommendations

Technical Challenges, Solutions and Achievement

The project demonstrates the feasibility of achieving near-zero energy performance for a hotel in a challenging climate. The successful integration of passive design, high-efficiency active systems, and renewable energy provides a valuable model for future projects. The use of energy simulation software (eQUEST) was crucial for optimizing the design and ensuring that performance targets could be met.

Financial Challenges, Solutions and Achievement

nil

Other Challenges, Solutions and Achievement

nil

9. Free Description

Free Description

Please describe the information that could be useful to readers (e.g. replicability of case studies, tips on design and material specifications, cost information, etc.) [Max 300].

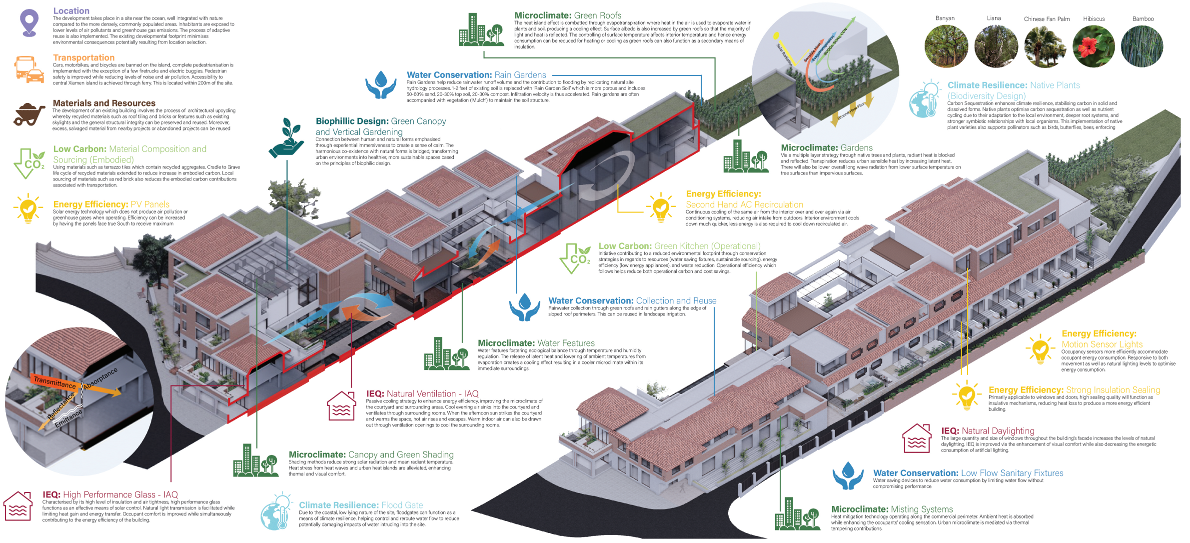
ECO-logical and Sustainable Design

Kulangsu, a pedestrian-only island accessible by an 8-minute ferry from Xiamen, is unique in China as a "traffic-free island," emphasizing low-carbon transportation. As a UNESCO-preserved site, its historic buildings are adaptively reused, balancing heritage conservation with modern development.

The plan focuses on on-site segregation, reuse, and recycling. Concrete, bricks, and stones are crushed for backfilling or landscaping, while metals, glass, tiles, and plastics are recycled. Non-reusable waste is sent to local facilities. Roof tiles and red bricks are preserved or reused on site, and valuable trees are retained. Waste is processed off-site to produce recycled materials like non-fired bricks, promoting resource efficiency and reducing environmental impact.

10. Annex

Supporting documentations



Location
The development takes place in a site near the ocean, well integrated with nature compared to the more densely, commonly populated areas. Inhabitants are exposed to lower levels of air pollutants and greenhouse gas emissions. The process of adaptive reuse is also implemented. The existing developmental footprint minimises environmental consequences potentially resulting from location selection.

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Cars, motorbikes, and bicycles are banned on the island, complete pedestrianisation is implemented with the exception of a few firetrucks and electric buggies. Pedestrian safety is improved while reducing levels of noise and air pollution. Accessibility to central Xiamen island is achieved through ferry. This is located within 200m of the site.

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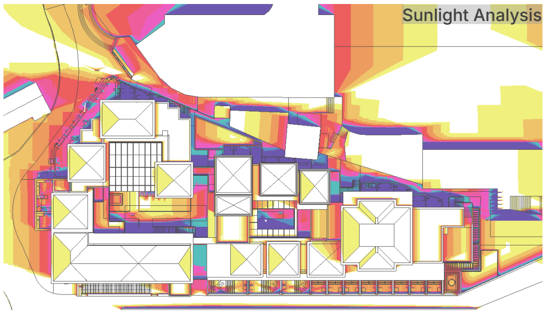
Due to the coastal, low lying nature of the site, floodgates can function as a means of climate resilience, helping control and reroute water flow to reduce potentially damaging impacts of water intruding into the site.

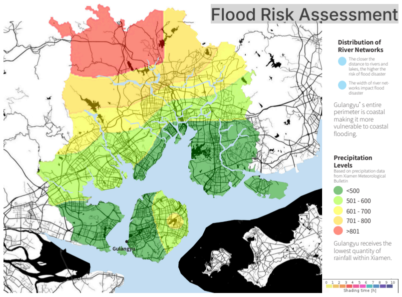
Microclimate: Misting Systems
Heat mitigation technology operating along the commercial perimeter. Ambient heat is absorbed while enhancing the occupants' cooling sensation. Urban microclimate is mediated via thermal tempering contributions.

Kulangsu, a pedestrian-only island, emphasizes low-carbon transportation and sustainability. Its historic buildings are adaptively reused, blending heritage conservation with modern development.

The project recycles materials like concrete and metals, preserves roof tiles and trees, processes non-reusable waste off-site to create recycled materials, reducing environmental impact.

Sustainability Strategy


Sunlight Analysis


Flood Risk Assessment

Distribution of River Networks
- The closer the distance to rivers and lakes, the higher the risk of flood disaster
- The width of river networks impact flood disaster

Gulangyu's entire perimeter is coastal making it more vulnerable to coastal flooding.

Precipitation Levels
Based on precipitation data from Xiamen Meteorological Bulletin
- 🟩 <500
- 🟩 501 - 600
- 🟨 601 - 700
- 🟨 701 - 800
- 🟥 >801

Gulangyu receives the lowest quantity of rainfall within Xiamen.


Windrose Diagram

Embodied Ciphers & Material Rebirth

From rubble to revival, these time-tested bricks, rescued from demolition, are reborn as art, narrating an ecological revolution through their second life.

11. Citation

Citation
Please include here the citations/references/links of your project and/or research. 1] Xiamen, Fujian, China. *LatLong.net*. URL: https://www.latlong.net/place/xiamen-fujian-china-14703.html (Accessed: October 22, 2025).

12. Contact

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