



**TAYLOR'S
UNIVERSITY**
Wisdom • Integrity • Excellence

PASSIVE GREEN BUILDING CASE STUDIES

ARC61804 Green Strategies for Building Design
Ms Teh Beng Siang - G3

Izza Alisya Harlizan 0370717 | Alyssa Qistina 0370580 | Charlene Ferreira 0370374
Luqman Ul-Haqeem 0348151 | Akrish Bhandari 0372728 | Tariq 0344358

Table of Contents

1.0	INTRODUCTION				
	1.1	Project Overview			
	1.2	Objectives & Learning Outcome			
	1.3	Methodology			
	1.4	Overview of Selected Case Studies			
	1.5	Drawings of Guha Bambu, Indonesia			
	1.6	Drawings of Green Solution House 2.0			
2.0	PASSIVE DESIGN STRATEGY ANALYSIS				
	2.1	Site Planning			
		2.1.1 Guha Bambu			
		2.1.2 Green Solution House 2.0			
	2.2	Daylighting			
		2.2.1 Guha Bambu			
		2.2.2 Green Solution House 2.0			
	2.3	Facade Design			
		2.3.1 Guha Bambu			
		2.3.2 Green Solution House 2.0			
	2.4	Natural Ventilation			
		2.4.1 Guha Bambu			
		2.4.2 Green Solution House 2.0			
	2.5	Strategic Landscaping			
		2.5.1 Guha Bambu			
		2.5.2 Green Solution House 2.0			
3	3.0	COMPARATIVE EVALUATION			
		3.1	Summary of all Passive Strategies		19
		3.2	Impact on Spatial Quality & User Experience		20
		3.3	Lessons Learned & Key Takeaways		21
4					
5					
6					
	4.0	CONCLUSION			22
8		4.1	Overall Findings		
10	5.0	REFERENCES			23
12					
14					
16					

1.0 Introduction

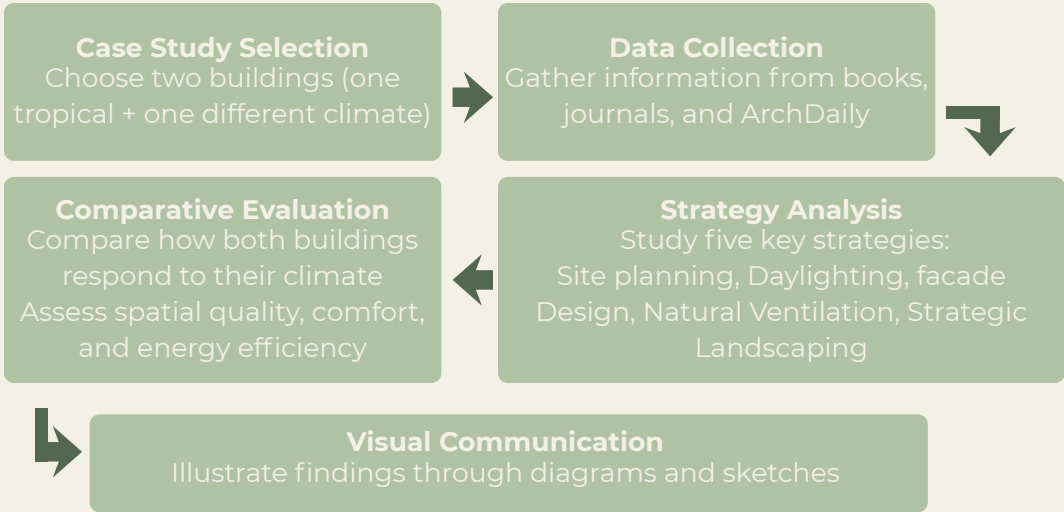
1.1 Project Overview

This project explores how passive design strategies are applied in real buildings from different climatic regions. By analyzing two selected case studies, one from a tropical climate and another from a contrasting region, the study examines how site planning, daylighting, façade design, natural ventilation, and strategic landscaping enhance environmental performance and spatial comfort. The comparison highlights how each design responds to its context and climate, promoting sustainable and climate-responsive architecture.

1.2 Objectives & Learning Outcomes

Objectives	Learning Outcomes
 To critically appraise the application of passive green design strategies in different climatic contexts  To analyze the theories and principles of passive design and their role in achieving energy efficiency  To compare how site planning, daylighting, façade design, natural ventilation, and strategic landscaping influence spatial quality and user comfort  To develop an understanding of climate-responsive architectural solutions that promote sustainability	Describe Understand passive design principles and green technologies Analyze Examine how strategies respond to climate and culture Analyze Evaluate their effects on spatial quality and user experience Communicate Present findings through text, diagrams, and visuals 

1.3 Methodology



1.4 Overview of Selected Case Studies



Guha Bambu, Indonesia



Tropical Climate

Completed 2020

Multi-purpose complex housing a library, dental clinic, private residence, and architecture studio

Blends traditional craftsmanship (bamboo, wood) with modern structure (steel, glass, concrete); embraces lush vegetation and natural elements

Locally sourced bamboo, steel frame, wood, and glass



Green Solution House 2.0, Denmark

Temperate Climate



Completed 2021

Conference and hotel facility promoting sustainable design

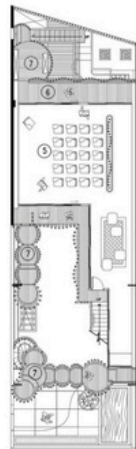
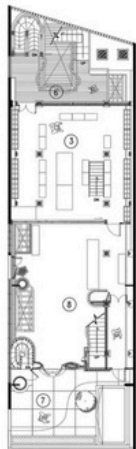
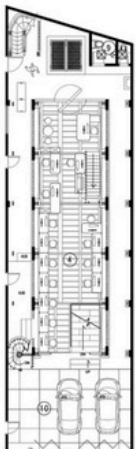
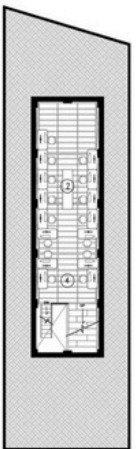
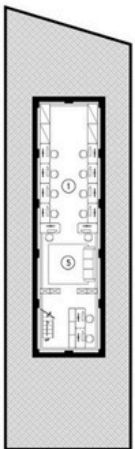
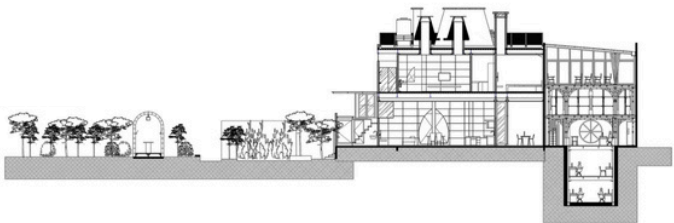
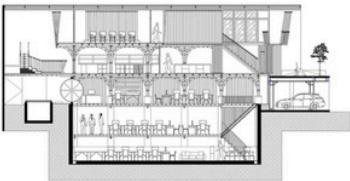
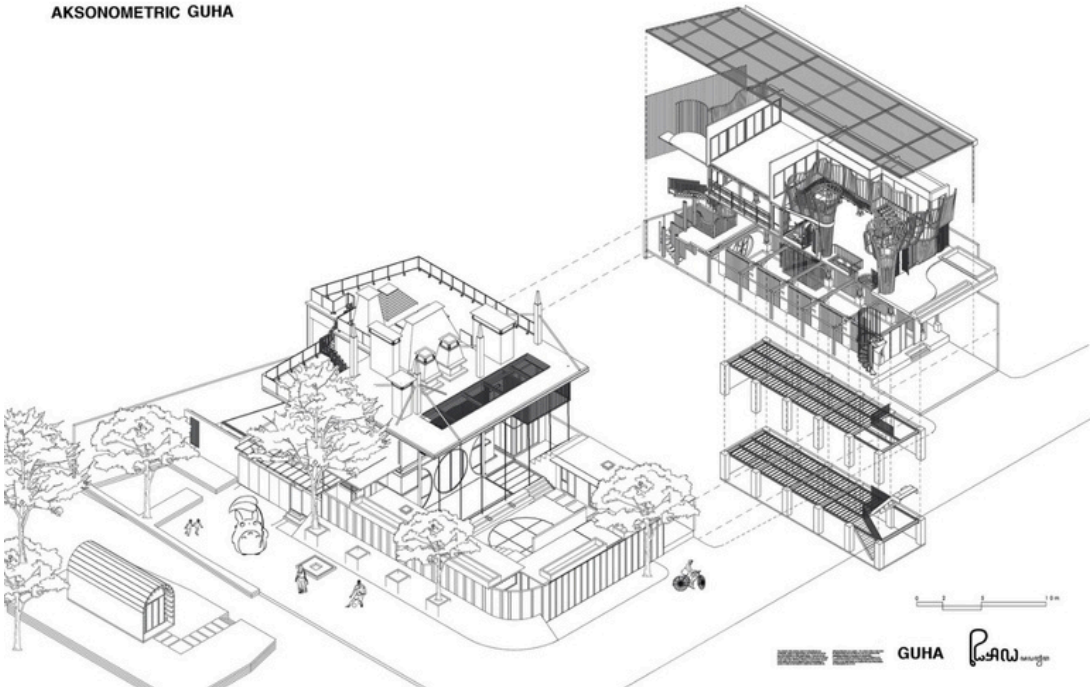
Demonstration of circular sustainability — “cradle-to-cradle” design; integrates renewable energy, recycling, and adaptable systems

Biodegradable and recyclable materials (timber, glass, aluminum, and composite materials)

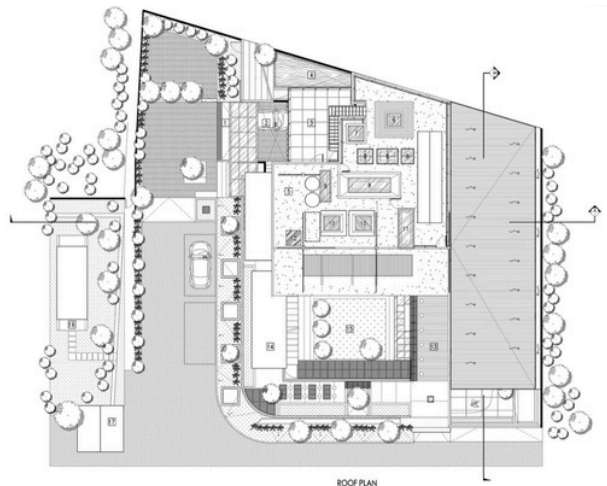


1.5 Drawings of Guha Bambu, Indonesia

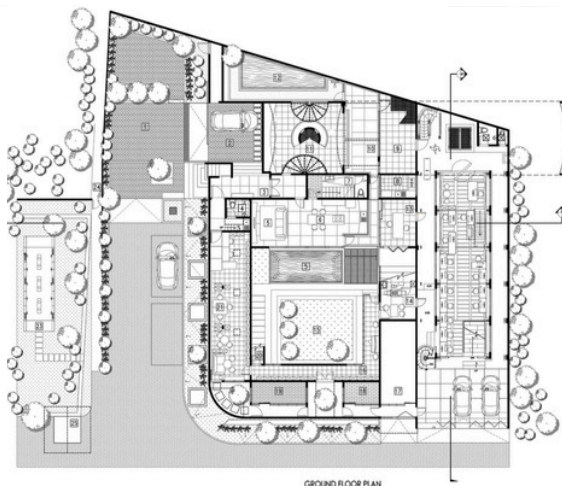
AKSONOMETRIC GUHA



- LEGEND
- 1. Design Studio
 - 2. Technical Studio
 - 3. Material Library
 - 4. Administration Office
 - 5. Classroom
 - 6. Corridor
 - 7. Terrace
 - 8. Discussion Hall
 - 9. Toilet
 - 10. Garage



- LEGEND
- 1. Entrance
 - 2. Carport
 - 3. Drying Area
 - 4. Swimming Pool
 - 5. Terrace
 - 6. Corridor
 - 7. Family Room
 - 8. Master Bedroom
 - 9. Master Bedroom
 - 10. Corridor
 - 11. Corridor
 - 12. Corridor
 - 13. Corridor
 - 14. Corridor
 - 15. Corridor
 - 16. Corridor
 - 17. Corridor
 - 18. Corridor
 - 19. Corridor
 - 20. Corridor
 - 21. Corridor
 - 22. Corridor
 - 23. Corridor
 - 24. Corridor
 - 25. Corridor
 - 26. Corridor
 - 27. Corridor
 - 28. Corridor
 - 29. Corridor
 - 30. Corridor
 - 31. Corridor
 - 32. Corridor
 - 33. Corridor
 - 34. Corridor
 - 35. Corridor
 - 36. Corridor
 - 37. Corridor
 - 38. Corridor
 - 39. Corridor
 - 40. Corridor
 - 41. Corridor
 - 42. Corridor
 - 43. Corridor
 - 44. Corridor
 - 45. Corridor
 - 46. Corridor
 - 47. Corridor
 - 48. Corridor
 - 49. Corridor
 - 50. Corridor
 - 51. Corridor
 - 52. Corridor
 - 53. Corridor
 - 54. Corridor
 - 55. Corridor
 - 56. Corridor
 - 57. Corridor
 - 58. Corridor
 - 59. Corridor
 - 60. Corridor
 - 61. Corridor
 - 62. Corridor
 - 63. Corridor
 - 64. Corridor
 - 65. Corridor
 - 66. Corridor
 - 67. Corridor
 - 68. Corridor
 - 69. Corridor
 - 70. Corridor
 - 71. Corridor
 - 72. Corridor
 - 73. Corridor
 - 74. Corridor
 - 75. Corridor
 - 76. Corridor
 - 77. Corridor
 - 78. Corridor
 - 79. Corridor
 - 80. Corridor
 - 81. Corridor
 - 82. Corridor
 - 83. Corridor
 - 84. Corridor
 - 85. Corridor
 - 86. Corridor
 - 87. Corridor
 - 88. Corridor
 - 89. Corridor
 - 90. Corridor
 - 91. Corridor
 - 92. Corridor
 - 93. Corridor
 - 94. Corridor
 - 95. Corridor
 - 96. Corridor
 - 97. Corridor
 - 98. Corridor
 - 99. Corridor
 - 100. Corridor



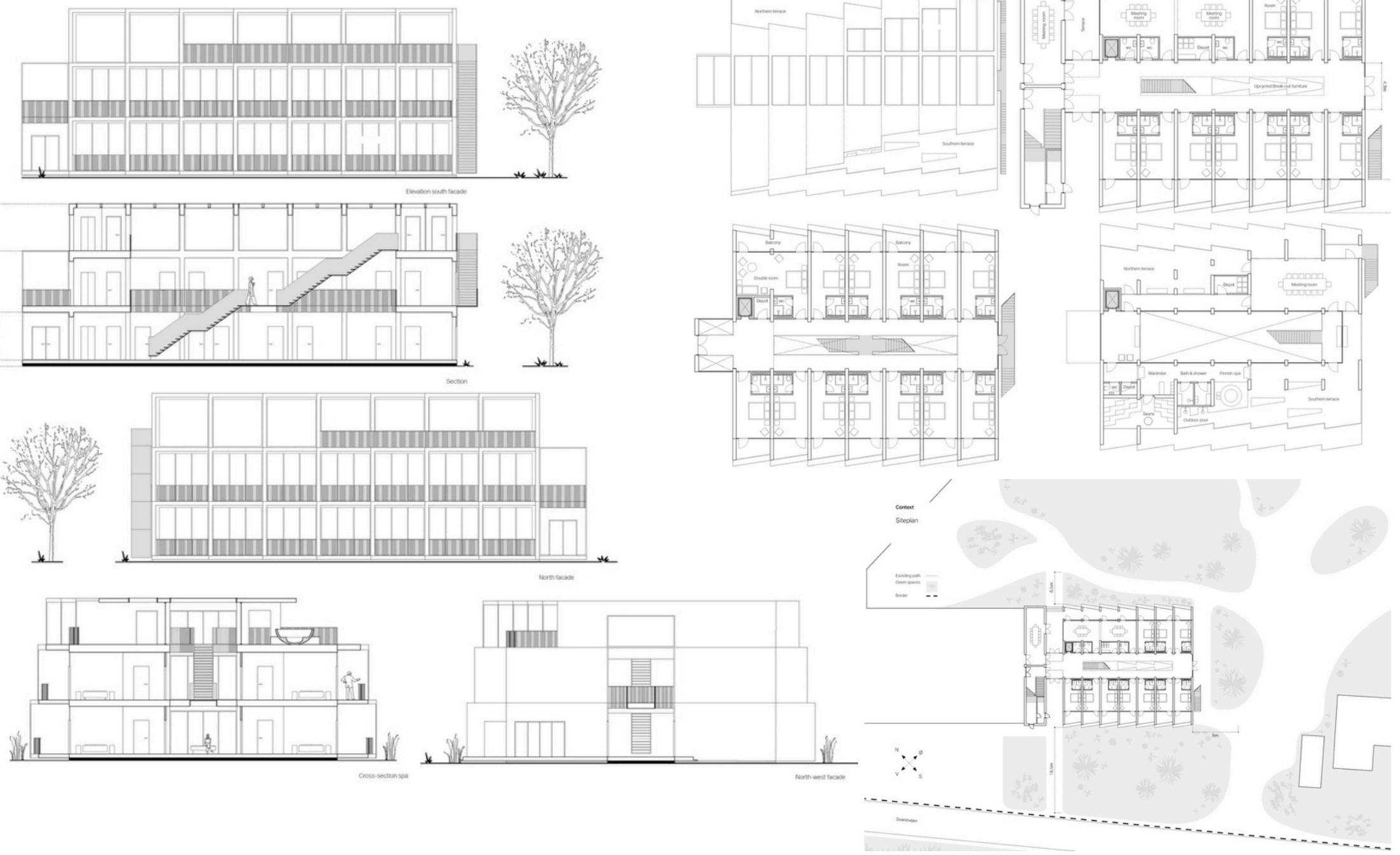
- LEGEND
- 1. Carport
 - 2. Carport
 - 3. Carport
 - 4. Carport
 - 5. Carport
 - 6. Carport
 - 7. Carport
 - 8. Carport
 - 9. Carport
 - 10. Carport
 - 11. Carport
 - 12. Carport
 - 13. Carport
 - 14. Carport
 - 15. Carport
 - 16. Carport
 - 17. Carport
 - 18. Carport
 - 19. Carport
 - 20. Carport
 - 21. Carport
 - 22. Carport
 - 23. Carport
 - 24. Carport
 - 25. Carport
 - 26. Carport
 - 27. Carport
 - 28. Carport
 - 29. Carport
 - 30. Carport
 - 31. Carport
 - 32. Carport
 - 33. Carport
 - 34. Carport
 - 35. Carport
 - 36. Carport
 - 37. Carport
 - 38. Carport
 - 39. Carport
 - 40. Carport
 - 41. Carport
 - 42. Carport
 - 43. Carport
 - 44. Carport
 - 45. Carport
 - 46. Carport
 - 47. Carport
 - 48. Carport
 - 49. Carport
 - 50. Carport
 - 51. Carport
 - 52. Carport
 - 53. Carport
 - 54. Carport
 - 55. Carport
 - 56. Carport
 - 57. Carport
 - 58. Carport
 - 59. Carport
 - 60. Carport
 - 61. Carport
 - 62. Carport
 - 63. Carport
 - 64. Carport
 - 65. Carport
 - 66. Carport
 - 67. Carport
 - 68. Carport
 - 69. Carport
 - 70. Carport
 - 71. Carport
 - 72. Carport
 - 73. Carport
 - 74. Carport
 - 75. Carport
 - 76. Carport
 - 77. Carport
 - 78. Carport
 - 79. Carport
 - 80. Carport
 - 81. Carport
 - 82. Carport
 - 83. Carport
 - 84. Carport
 - 85. Carport
 - 86. Carport
 - 87. Carport
 - 88. Carport
 - 89. Carport
 - 90. Carport
 - 91. Carport
 - 92. Carport
 - 93. Carport
 - 94. Carport
 - 95. Carport
 - 96. Carport
 - 97. Carport
 - 98. Carport
 - 99. Carport
 - 100. Carport



MEZANINE FLOOR PLAN



1.6 Drawings of Green Solution House 2.0, Denmark





2.0 PASSIVE DESIGN STRATEGIES

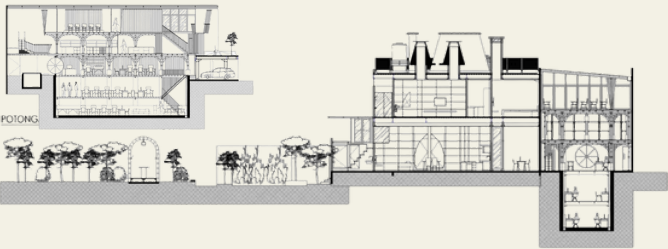
2.1 Site Planning

Overall Concept

Guha Bambu’s site planning emphasizes low-impact development, ecological sensitivity, and harmonious integration with nature. Rather than reshaping the land, the architecture adapts to it—embracing the terrain, climate, and existing ecosystem to create a self-sustaining and contextually rooted environment



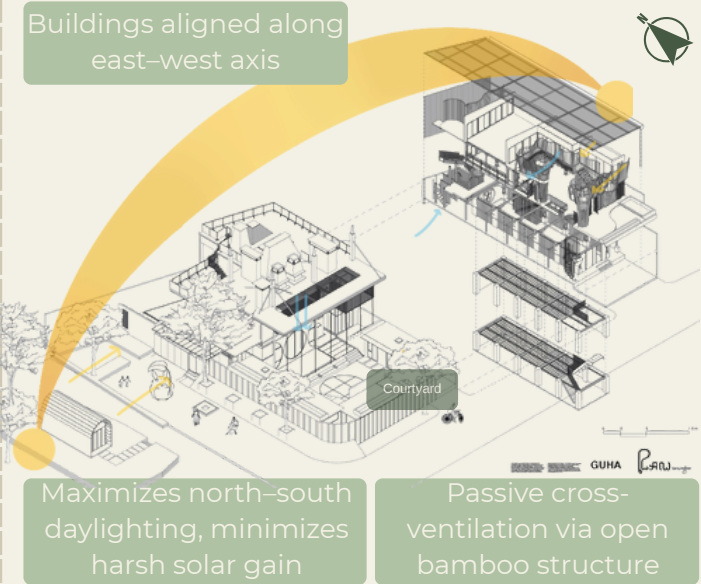
Grading Considerations



RAW limited grading to 10–40 feet beyond built areas, preserving drainage and preventing erosion

Grading Factor	Application	Environmental Benefit
Topography	Natural slope maintained	Reduces erosion and visual impact
Excavation Depth	Limited to building footprint	Protects soil layers and root systems
Foundation System	Shallow pad foundations for bamboo structures	Minimizes soil disturbance
Drainage Preservation	Existing channels kept intact	Maintains natural water flow and infiltration

Site & Building Layout



SITE PLANNING

Site Selection & Context Sensitivity

- Located in Taman Villa Meruya, Guha Bambu blends with the suburban context, aligning with the principle of reusing developed sites over greenfields.

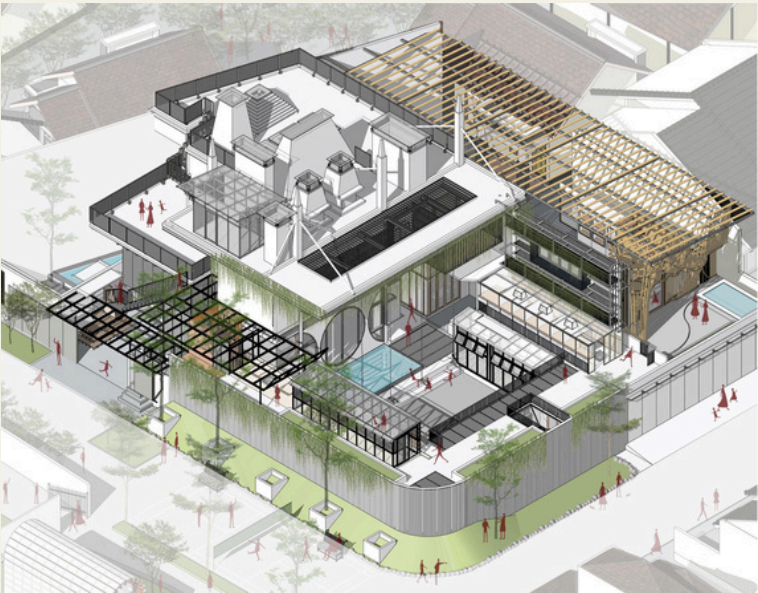
Building Orientation (Solar Access & Ventilation)

- RAW oriented the bamboo structures along the east-west axis, following sustainable site planning principles to:
- Maximize north-south exposure for natural daylighting.
- Minimize east-west solar gain, reducing overheating.
- Enhance passive cross-ventilation through the open bamboo façades.

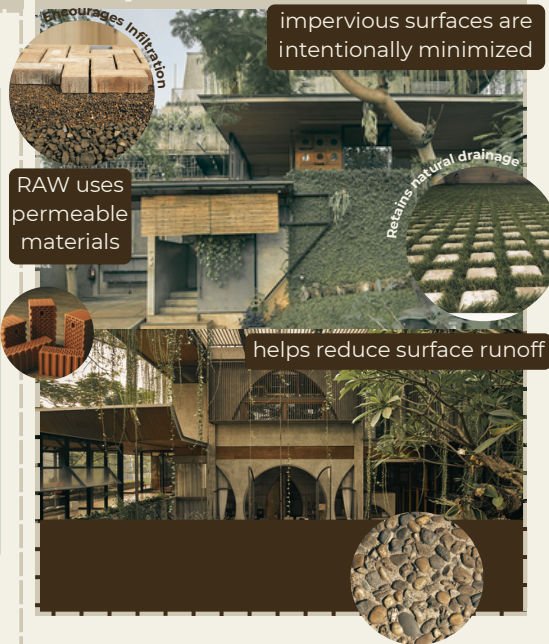


Landscape Integration & Native Planting

- The site preserves existing vegetation and enhances the landscape with additional native tropical plantings integrated throughout the compound.

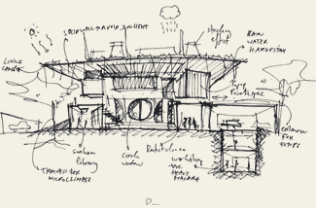


Impervious Surfaces



Stormwater & Water Management

- The Guha Bambu site incorporates rainwater collection and ground infiltration systems, reducing surface runoff and supporting a low-impact development approach.



Human Comfort & Cultural Context

- Guha Bambu was conceived as a “micro-village,” designed to harmonize with the landscape and its inhabitants. The layout promotes easy circulation and encourages outdoor living.

2.1 Site Planning

GREEN SOLUTIONS HOUSE W.0

Overall Concept

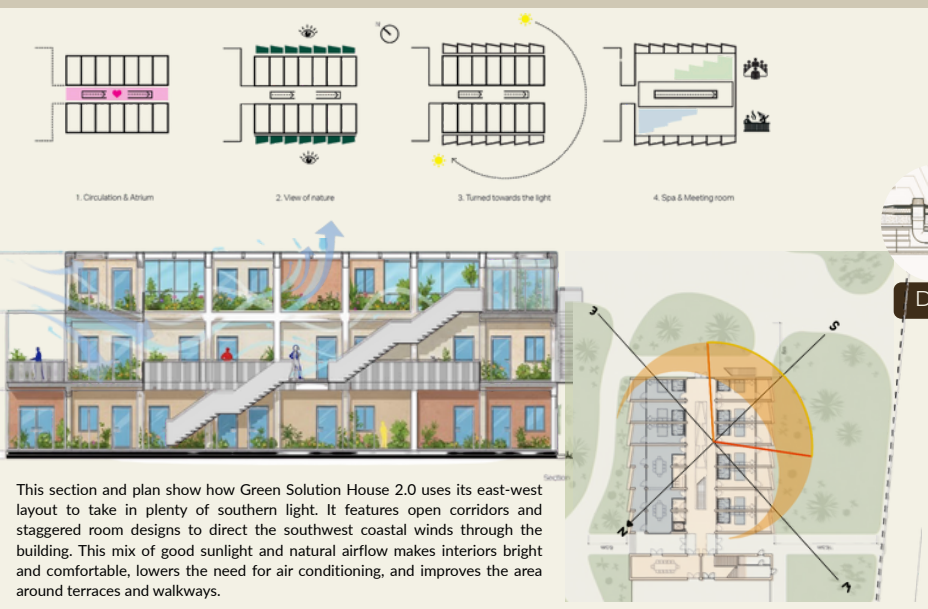
Green Solution House 2.0 will be a Bornholm-based regenerative coastal development.

This technique promotes little land disturbance, good integration with existing vegetation, and passive use of daylight, coastal winds, and thermal mass.

The architecture integrates into the nature to create a climate-responsive hotel and conference town.



Site & Building Layout

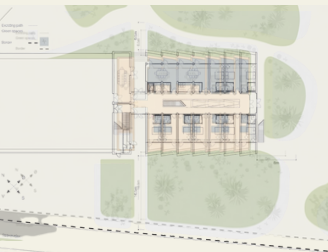


This section and plan show how Green Solution House 2.0 uses its east-west layout to take in plenty of southern light. It features open corridors and staggered room designs to direct the southwest coastal winds through the building. This mix of good sunlight and natural airflow makes interiors bright and comfortable, lowers the need for air conditioning, and improves the area around terraces and walkways.

SITE PLANNING

Building Orientation (Solar Access & Ventilation)

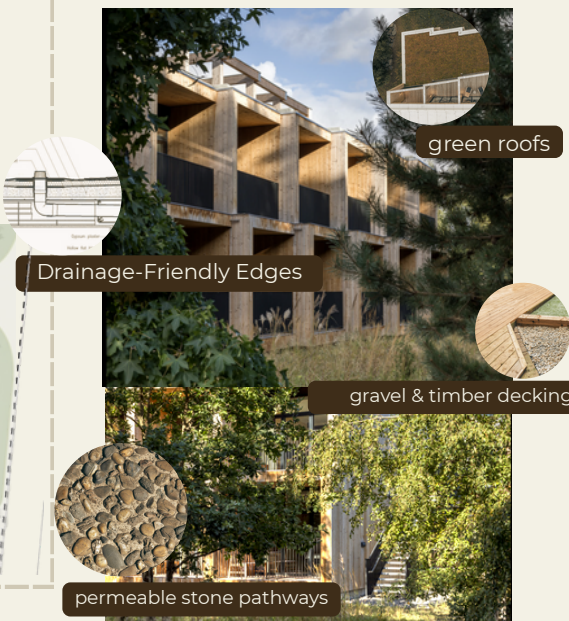
- East-west alignment for optimal southern daylight
- South façades absorb winter sun; north gets diffuse light
- Reduced east/west glazing to avoid glare and heat gain
- SW coastal winds drive natural cross-ventilation
- Courtyards + vertical cores enhance airflow and stack effect



Landscape Integration & Native Planting

- Preserves Bornholm's existing coastal vegetation belts to protect biodiversity and stabilize soil.
- Uses native species (sea buckthorn, juniper, birch, dune grasses) for low-maintenance, climate-adapted planting.
- Integrates bioswales + rain gardens directly into the site's natural drainage paths.

Impervious Surfaces



Stormwater & Water Management

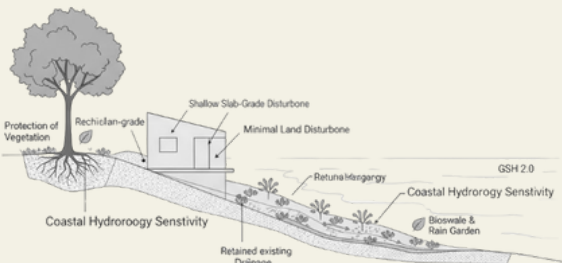
- Stormwater is slowed, filtered, and absorbed through a fully integrated system of bioswales, rain gardens, permeable surfaces, and green roofs that follow the site's natural drainage paths, protecting Bornholm's coastal hydrology while supporting a regenerative water cycle.



Human Comfort & Cultural Context

- Human comfort is enhanced through sheltered outdoor spaces, soft microclimates created by vegetation buffers, daylight-rich interiors, and a layout that reflects Bornholm's calm coastal character, while culturally the design embraces local materials, low-rise forms, and a community-oriented spatial rhythm.

Grading Considerations



Grading Factor

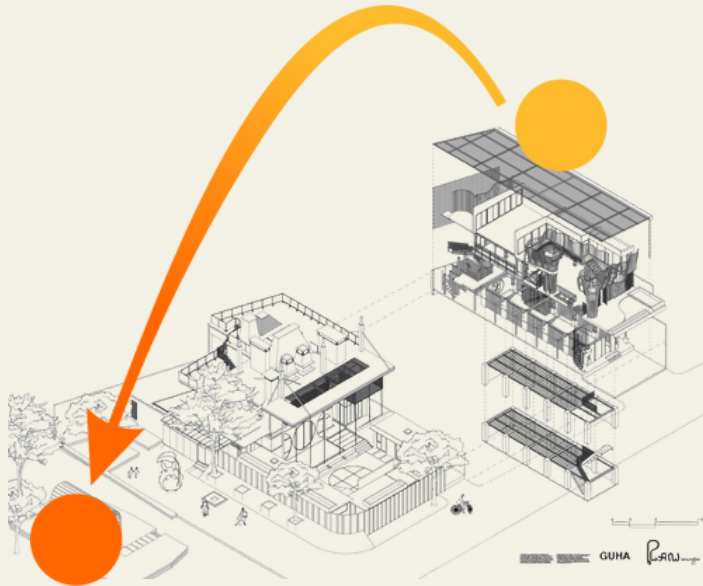
Application

Environmental Benefit

Minimal Land Disturbance	Grading is restricted to the immediate building footprint.	reduces visual impact and potential for erosion.
Preservation of Natural Drainage	Existing surface water routes are retained	Allows stormwater to flow naturally and prevents erosion
Shallow Foundations	Uses shallow slab foundations and lightweight timber modules.	Minimizes excavation depth
Coastal Hydrology Sensitivity	Mild slopes are only lightly reshaped.	coastal runoff patterns remain intact

Overall Concept

By giving North-South openings priority for indirect light and shading the West façade with solid walls, louvres and vegetation to keep out the intense afternoon sun and heat, the building employs bioclimatic passive design. Maximum natural light penetration and cross-ventilation are ensured by an open, adaptable interior design with lots of windows and skylights.



SUMMER

During summer is when the day has the longest amount of daylight (approximately 12 hours and 29 min). During this time the sun is at the northern most tilt.

ALL YEAR

The sun stays at a high position all year long including winter months. This means the sun's rays are intense and overhead for most of the day.

Passive Green Building Impact

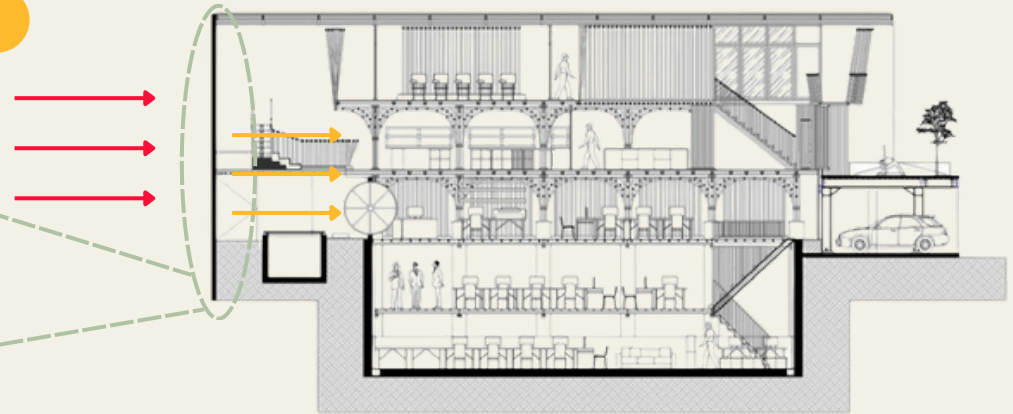
Aligns windows to the north and south to allow indirect sunlight to enter while blocking harsh sunlight on the west.

Uses shading devices to block harsh sunlight during peak hours.

These daylighting strategies reduce daytime reliance on artificial lighting

Vertical Louvres for Solar Shading

Vertical bamboo and steel louvres are incorporated into the facade. Before direct sunlight enters the interior, these serve as a screen to diffuse and filter it, reducing heat gain and glare while letting light in.



Integration of Greenery and Vines

Lush vegetation, tumbling vines, and luxuriant shrubs adorn the building's facades, especially the western elevation. By blocking direct sunlight and producing a living, natural screen, this vegetation helps to cool the surrounding microclimate through evapotranspiration.



Skylights and windows

The flexible layout allows natural light and airflow through doors, windows, and skylights.

POTONGAN A - A'

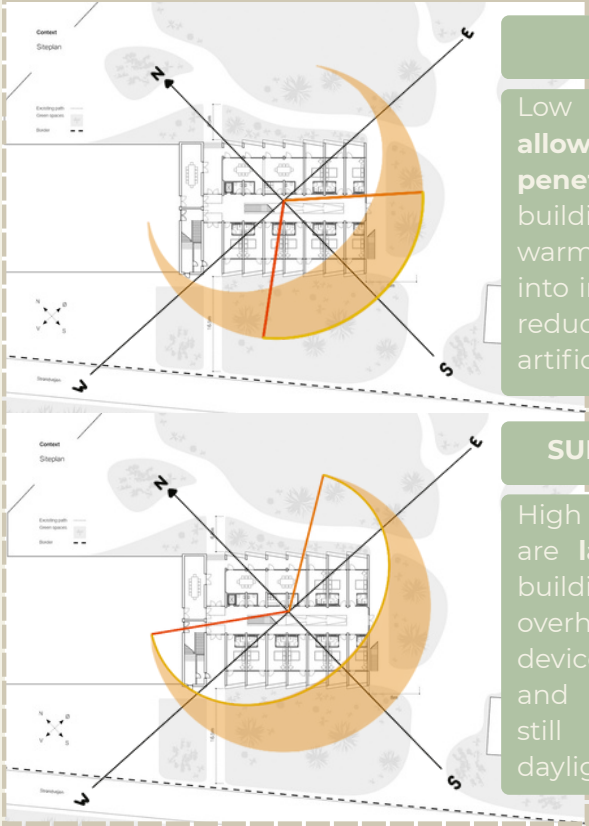


Spaces are arranged with the sun's path to maximize daylight.

Overall Concept

The building’s daylighting strategy focuses on **maximising high-quality diffuse daylight** while minimising glare, responding to Bornholm’s strong seasonal variations. Its multi-wing, serrated layout and courtyard/atrium geometry bring natural light deep into the interior, while room orientation and loggias optimise southern exposures and woodland views. This reduces reliance on artificial lighting, enhances comfort in winter, and efficiently captures summer daylight.

Site/Building Design for Daylight



WINTER

Low winter sun angles **allow sunlight to penetrate deep** into the building, bringing warmth and natural light into interior spaces while reducing the need for artificial lighting

SUMMER SUN PATH

High summer sun angles are **largely blocked** by building orientation, overhangs, and shading devices, preventing glare and overheating while still allowing diffuse daylight

Passive Green Building Impact

Aligns orientation, windows, and skylights with seasonal sun paths
Maximizes useful daylight year-round

Reduces energy use for lighting and HVAC
Enhances occupant comfort and connection to nature

extended shading before the big windows blocks direct sunlight so only diffused west evening light enters

Windows & Skylights



Glazed façades & large windows

The façades include south and woodland-facing exposures, which allow daylight to penetrate into the rooms

Generous skylights & roof-monitor glazing

Skylights and well-oriented glazing provide abundant daylight, reduce artificial lighting, and connect interiors to the outdoors

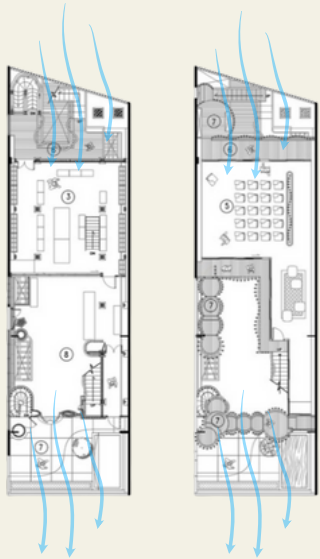


extended shading before the big windows blocks direct sunlight so only diffused east morning light enters

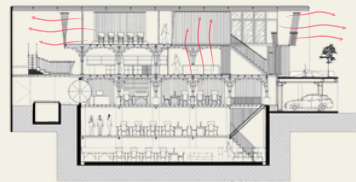
2.3 Facade Design

Guha Bambu

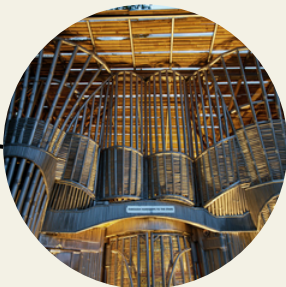
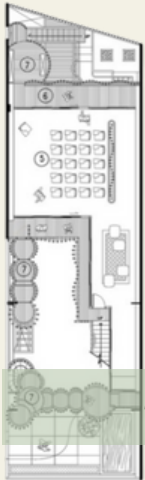
Climate-Responsive Orientation and Facade Design



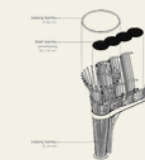
Strategically placed openings on the north and south facades enable cross ventilation by utilizing natural wind patterns in the tropical climate. This creates a stack effect that minimizes mechanical cooling dependence, ensuring continuous airflow, thermal comfort, and better air quality.



Vertical bamboo and steel louvres filter and diffuse sunlight, minimizing glare and controlling solar heat gain while maintaining visual openness. These elements balance light and shade, enhancing comfort, reducing energy consumption, and emphasizing the project's integration of natural materials with sustainable, climate-responsive design principles.



03
Guha Bambu



Use of Local and Natural Materials

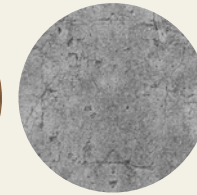
The building prominently features **bamboo, wood, and stone**, which have **low embodied energy** and are **locally available, reducing transportation impact**. Bamboo acts as both a structural and aesthetic element, showcasing **renewable material** use and traditional Indonesian craftsmanship.



Bamboo

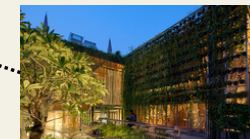
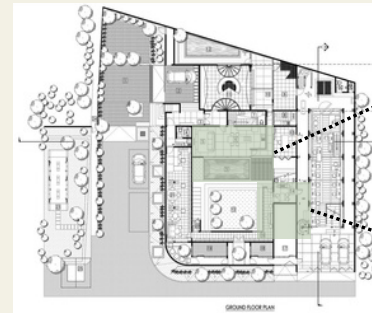


Wood



Stone

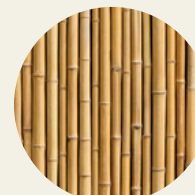
Integration with Nature



By absorbing heat, offering shade, and reducing surface temperatures, the complex's lush vegetation organically cools the microclimate. It improves air quality, promotes biodiversity, and strengthens the project's climate-responsive architecture

Hybrid Structural Efficiency

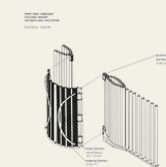
A hybrid structural system that maximises sustainability and efficiency is produced by combining steel trusses with bamboo. Steel offers the strength and stability required for multi-story structure, while bamboo adds lightness, flexibility, and a renewable quality. By reducing the need for bulky, high-carbon materials like concrete, this synergy lowers the building's total embodied energy.



Bamboo



Steel



02
Guha Bambu

2.3 Facade Design

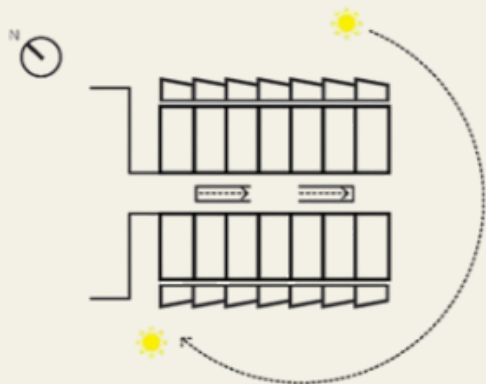
Green Solution House 2.0

Optimized Orientation and Serrated Facade Form

- The angled, serrated facade provides self-shading, reducing direct solar gain on windows and exterior walls. This geometric design ensures that each hotel room receives daylight and natural views while limiting overheating a passive control of solar exposure.

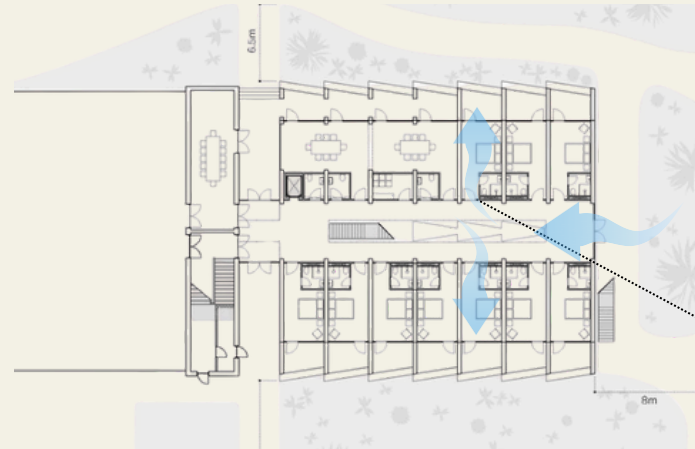


Daylighting and Visual Comfort



- Carefully oriented glazing and generous skylights allow ample natural daylight into interior spaces, minimizing reliance on artificial lighting during the day. The facade's rhythmic recesses and balconies prevent glare while maintaining a bright, pleasant interior environment.

Natural Ventilation Integration

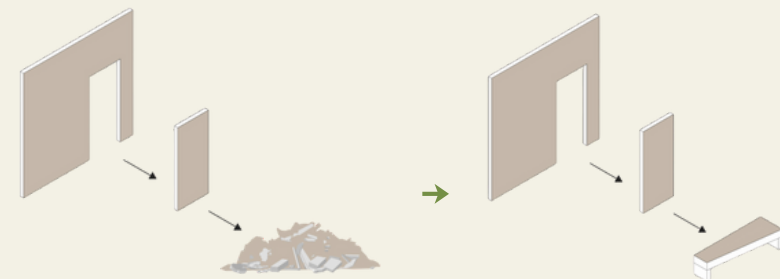


- Bespoke ventilation grills are cut directly into the CLT facade panels, allowing controlled airflow through the building without mechanical systems. This promotes cross ventilation, improving indoor air quality and reducing the need for air-conditioning.



Prefabrication and Material Efficiency

- The prefabricated CLT panels ensure airtightness and precision, minimizing heat loss and construction waste. Offcuts from the facade's manufacture were upcycled into furniture, supporting a circular material strategy and reducing embodied carbon.



BEFORE

NOW

Climate Context

- Hot-humid tropical climate → high temperature + high humidity.
- Main needs: heat dissipation, cross-ventilation, reduced reliance on mechanical cooling.
- Bamboo structures work well due to lightweight, breathable materials.



How Ventilation Works :

- Permeable bamboo wall system allows continuous airflow.
- Elevated floor enables cooling from underneath.
- High-pitched roof enables hot air to rise and escape (stack effect).
- Large openable façades and shutters allow full cross-ventilation.
- Central void/atrium enhances upward airflow through chimney effect.



Performance Outcomes

- Indoor temperature reduced by 3–5°C vs closed-wall concrete buildings
- ACH (Air Changes per Hour) naturally exceeds typical tropical comfort standard (≥ 10 ACH)
- No mechanical AC required in most daytime conditions
- CO₂ levels stay low due to continuous airflow
- Reduces energy demand + operational carbon footprint

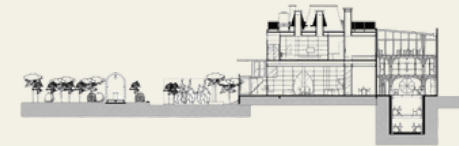


NATURAL VENTILATION



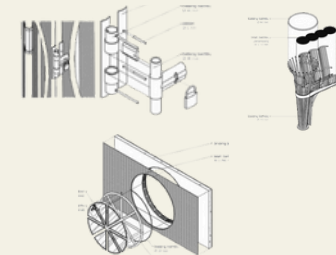
Flexible / Open Plan & Multiple Entrances

- Rooms have at least two entrances (often facing north-south) to facilitate airflow



Louvers, Vertical Screens & Bamboo Slats

- The facades use bamboo and steel vertical louvers/screens to allow air to pass through, while controlling sunlight, glare, and privacy



Greenery as Thermal Buffer



- Abundant vertical and surrounding vegetation pre-cools incoming air and minimizes radiant heat from surrounding surfaces.

Climate Context

- *Cool-temperate maritime climate – mild summers, cold winters.*
- *Strategy focuses on mixed-mode ventilation: natural ventilation when climate allows, mechanical backup in extreme seasons.*
- *Design prioritizes healthy indoor air, low energy demand, and circular principles.*



How Ventilation Works :

- *Automated operable windows controlled by sensors (CO₂, temp, humidity).*
- *Central atrium acts as ventilation chimney for passive air exhaust.*
- *Night purge ventilation cools thermal mass overnight.*
- *Cross-ventilation through aligned openings across rooms.*
- *Breathable façade and timber structure help regulate internal climate.*



Performance Outcome

- *Maintains healthy indoor CO₂ levels (< 800 ppm) without mechanical ventilation*
- *Temperature stable through passive air exchange + thermal mass buffering*
- *Saves ~70% ventilation energy compared to conventional mechanical-only system*
- *Meets Active House + DGNB Platinum performance requirements*
- *Supports WELL-standard indoor comfort without AC dependency*



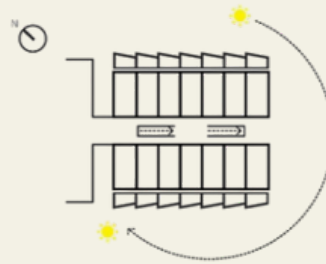
NATURAL VENTILATION

Strategic Orientation & Glazing

- Windows and glazing are oriented to optimize airflow, daylight, and thermal comfort.

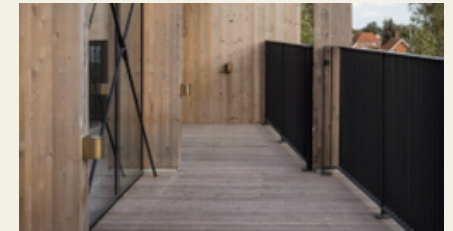
Skylights & Roof Openings

- Skylights and roof openings enable warm air to escape, creating a natural stack ventilation effect.



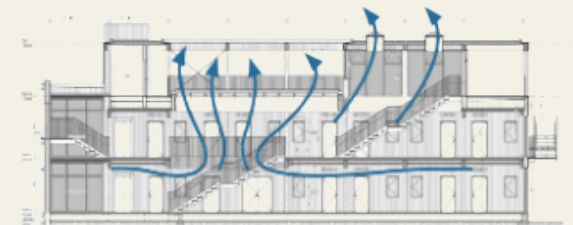
Ventilation Grills Cut into CLT Panels

- Integrated ventilation grills in CLT panels enable natural airflow without full mechanical reliance.



Passive Ventilation to Minimize Mechanical Use

- Building systems prioritize natural ventilation, minimizing dependence on mechanical cooling.



2.5 Strategic Landscape

Guha Bambu

Main Landscape Strategies

- Dense native vegetation for natural shading + cooling
- Water features for evaporative cooling
- Permeable ground surfaces (no heat-absorbing paving)
- Courtyard + open layout to promote wind flow
- Raised structure to protect soil + vegetation



Sustainability Outcomes

- Indoor-outdoor blur: verandas, open platforms, and bamboo screens.
- Sensory landscape: sound of water, filtered light, natural ventilation.
- Pathways follow organic site flow, not grid planning.



Landscape Experience

- Restores soil + biodiversity
- Eliminates need for paved heat-island surfaces
- Enhances passive ventilation + thermal comfort
- Reduces irrigation through native planting



STRATEGIC LANDSCAPE

Orientation & Ventilation

- Open façades to north and south; closed or minimized openings toward the west to reduce heat gain



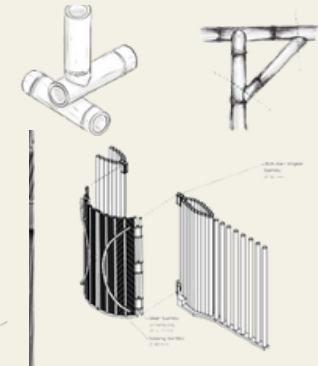
Abundant Greenery to Blur Boundaries



- The project uses lush vegetation, so that the building feels like it's been there for a long time, enveloped by nature.

Local Craftsmanship & Materials

- supports a landscape of local identity, craft, and connection to place.



Vegetation as Climate Control



- helps with shading, cooling, and mitigating the tropical heat.

2.5 Strategic Landscape

Green Solution House 2.0

Main Landscape Strategies

- Green roofs for insulation + stormwater control
- Rain gardens + bioswales for on-site water management
- Native + edible planting for biodiversity
- Outdoor wellness spaces connected to interior
- Circular material reuse in landscape (e.g. crushed brick, compost)



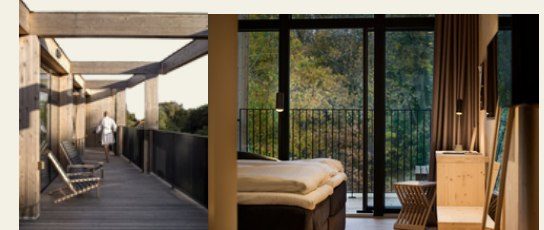
Sustainability Outcomes

- Climate-adaptive planting palette
- Stormwater fully processed on site
- Enhances WELL-standard health goals
- Reduces building heating/cooling loads through green layer insulation



Landscape Experience

- Continuous path system connecting indoor spaces to nature.
- Atrium opens directly to outdoor landscape, dissolving threshold.
- Seasonal landscape expression (winter bark, spring bloom, summer foliage).



STRATEGIC LANDSCAPE

Climate Adaptation & Comfort

- Planting and orientation provide natural shading and wind buffering; terraces allow seasonal light control.

Experiential Connection

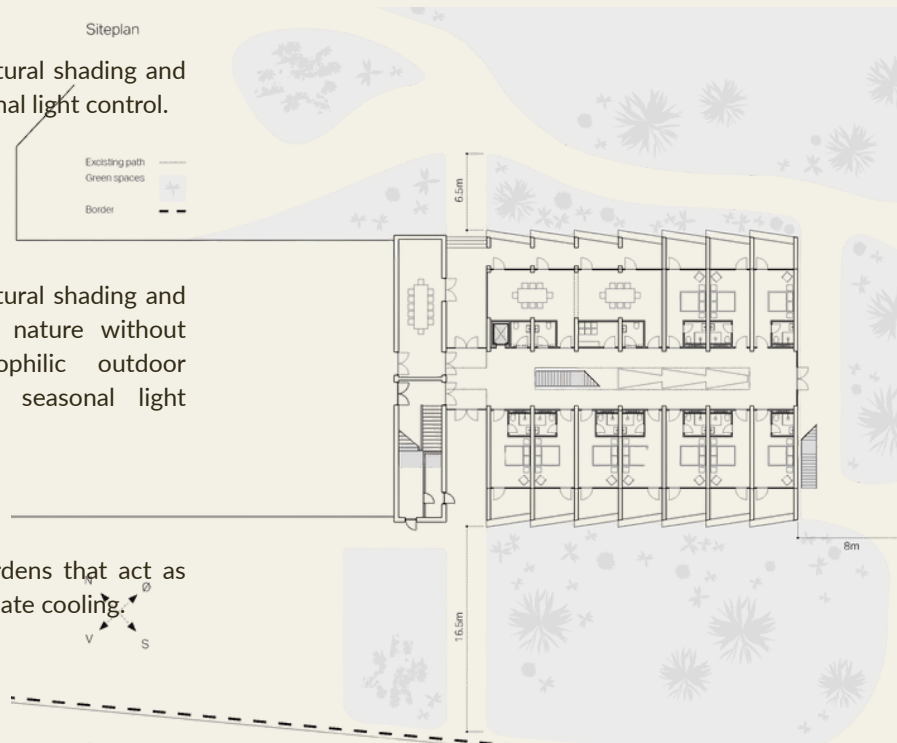
- Planting and orientation provide natural shading and wind buffering; terraces open to nature without barriers, creating a calm, biophilic outdoor experience.

Permeable & Low-Impact Surfaces

- Roof runoff is filtered into rain gardens that act as habitat zones and improve microclimate cooling.

Siteplan

Existing path
Green spaces
Border

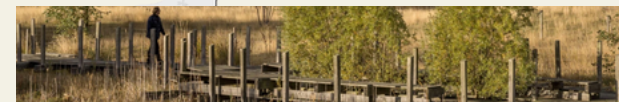


Integration with Natural Vegetation

- Semi-wild landscape continues Bornholm's native meadow. Native grasses and shrubs reduce irrigation needs and blend the building into its natural context.

Permeable & Low-Impact Surfaces

- Reused timber and gravel paths enable rainwater infiltration and reduce heat island effects.



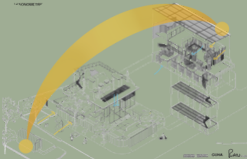
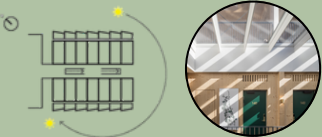
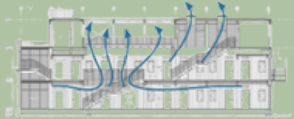
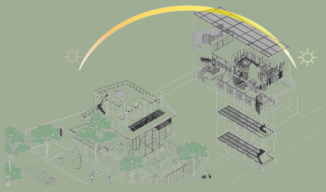


3.0 COMPARATIVE EVALUATION

3.1 Summary of All Passive Strategies

	 Guha Bambu, Indonesia	 Green Solution House 2.0, Denmark
Site Planning	• Buildings aligned along east–west axis for north–south daylight and cross-ventilation. • Minimal grading; permeable surfaces for drainage. • Rainwater harvesting + infiltration system. • Dense vegetation reduces heat and improves comfort.	• East–west alignment for optimal southern daylight. • Preserves coastal vegetation + integrates bioswales and rain gardens. • Minimal land disturbance, shallow foundations. • Uses courtyards and orientation to capture daylight + wind.
Day Lighting	• North–south openings for indirect light. • Vertical bamboo & steel louvres filter sunlight. • Vegetation screens reduce glare and heat. • Maximizes daylight while limiting west sun exposure.	• Serrated multi-wing layout + courtyard bring diffuse light inside. • Glazed façades + skylights provide abundant daylight. • Overhangs & orientation control glare and heat. • Winter sun warms interiors; summer sun shaded.
Facade Design	• Bamboo + steel louvres allow airflow and shade. • Hybrid structure (steel + bamboo) reduces embodied carbon. • Vegetated façades cool microclimate naturally.	• Serrated CLT façade provides self-shading. • Prefabricated panels reduce waste and heat loss. • Ventilation grills integrated into façade for natural airflow.
Natural Ventilation	• Open façades and high-pitched roofs for stack effect. • Permeable bamboo walls + elevated floors enhance cooling. • No mechanical AC needed, temperature drops 3–5 °C naturally.	• Ventilation grills in CLT panels for passive airflow. • Atrium acts as ventilation chimney. • Automated windows + night purge cooling reduce mechanical use (~70% energy saved).
Strategic Landscaping	• Dense native planting + water features for cooling. • Permeable surfaces + courtyards promote wind flow. • Blends building with tropical greenery, enhancing sensory experience.	• Green roofs + rain gardens manage stormwater. • Native & edible plants for biodiversity. • Landscaping moderates temperature + creates outdoor wellness areas.
Overall Passive Impact	• Low-energy, climate-responsive design using natural materials and airflow. • Creates immersive indoor-outdoor experience suited to tropical climate.	• Regenerative coastal design maximizing diffuse daylight + natural ventilation. • Energy-efficient, low-carbon building aligned with DGNB & Active House standards.

3.2 Impact on Spatial Quality & User Experience

	Guha Bambu, Indonesia	Green Solution House 2.0, Denmark
Site Planning	Open, village-like spaces promote outdoor living and community interaction.  Users experience a seamless transition between indoor and outdoor spaces.	Courtyards and terraces create calm, connected spaces with nature.  Low-rise form and site integration promote comfort and accessibility
Day-lighting	Filtered sunlight through bamboo screens gives a warm, tranquil glow. 	Soft, diffuse daylight enhances visual comfort and mood 
Façade Design	Natural materials and shading layers create texture and rhythm. 	Serrated timber façade balances daylight, privacy, and views. 
Natural Ventilation	 Breezy interiors and open plans create sensory freshness.	Gentle airflow through atrium ensures clean, quiet comfort. 
Strategic Landscaping	Lush vegetation and water features cool and engage the senses. 	 Native plants and green roofs connect users to the landscape.
Overall Experience	Immersive, lively, and sensory tropical environment.	Calm, bright, and restorative atmosphere enhancing wellbeing.

3.2 Lessons Learned & Key Takeaways

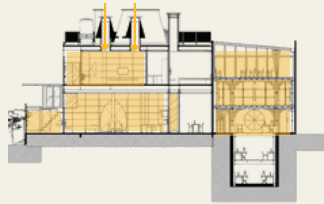


Guha Bambu, Indonesia

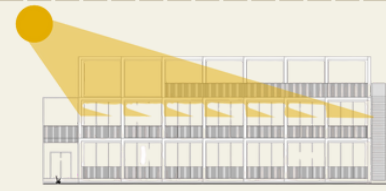


Green Solution House 2.0, Denmark

CLIMATE



Each building responds directly to its climate .Guha Bambu uses shading, vegetation, and open façades to deal with tropical heat,

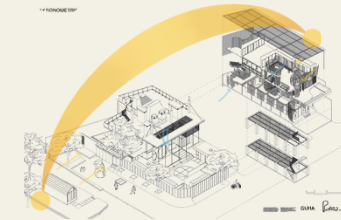


while Green Solution House 2.0 uses insulation, controlled ventilation, and east-west alignment to work with low winter sun and cool coastal winds

SITE



Guha Bambu follows the natural terrain with minimal grading, preserving existing slopes and drainage. Its layout allows wind, light, and vegetation to move through the structure, creating a low-impact relationship with the landscape.



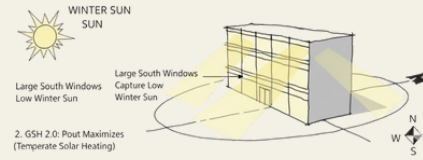
Reuses existing hotel site, east-west orientation, bioswales + permeable surfaces.

ORIENTATION



1. Guha Bambu: Avoiding Heat (Tropical Context)

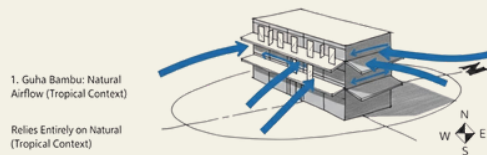
Guha Bambu orients spaces to reduce west heat and maximize shade with usage of overhangs too.



2. GSH 2.0: Post Maximizes (Temperate Solar Heating)

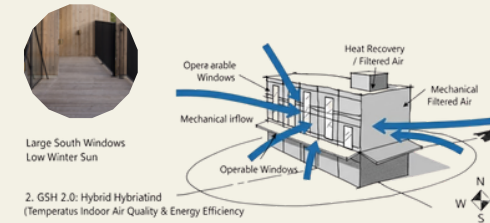
GSH 2.0 aligns east-west to gain optimal sunlight and maintain winter warmth with lesser shade.

Ventilation



1. Guha Bambu: Natural Airflow (Tropical Context)

Guha Bambu depends heavily on natural cross-ventilation, open façades, and porous bamboo screens



2. GSH 2.0: Hybrid Hybratind (Temperatus Indoor Air Quality & Energy Efficiency)

GSH 2.0 uses controlled airflow, stack effect skylights, and integrated ventilation grills in CLT panels

MATERIALITY



Guha Bambu uses local bamboo, wood, and craftsmanship to blend with Indonesian culture

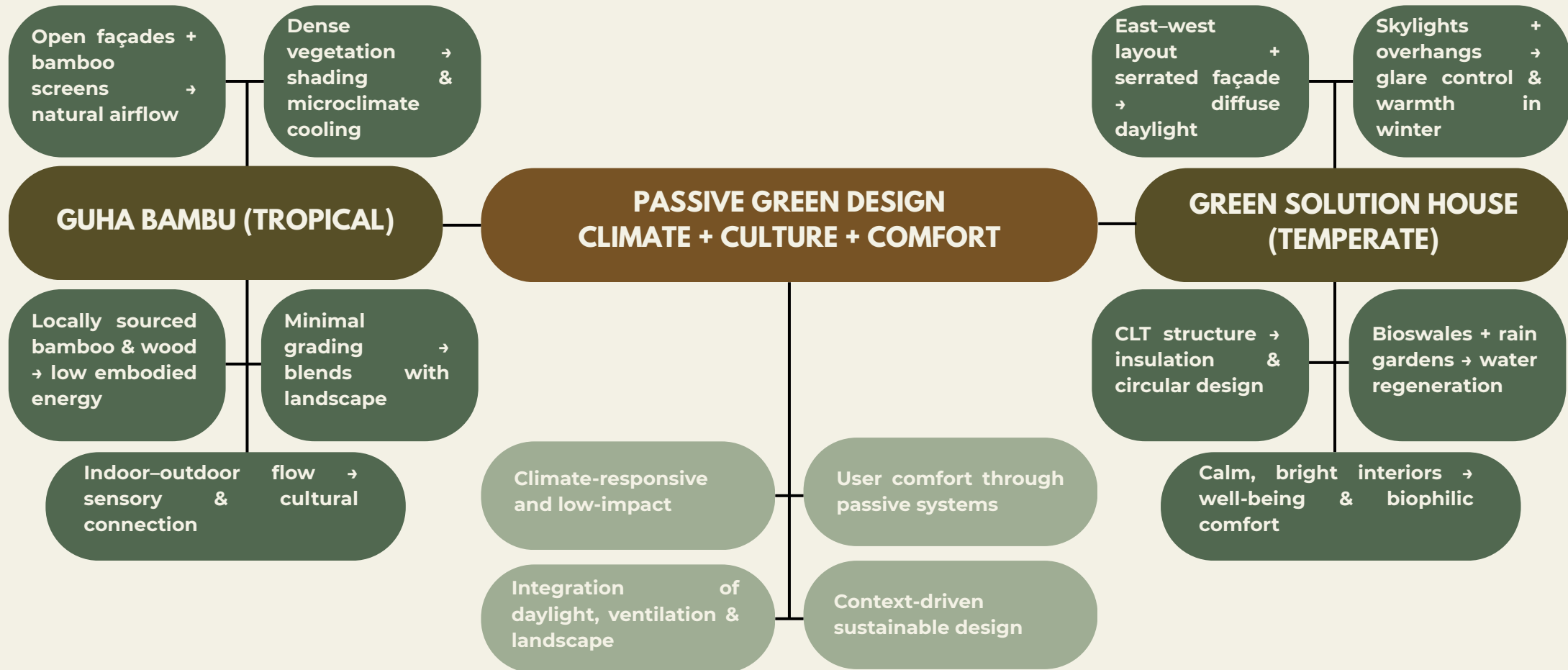


GSH 2.0 uses engineered timber and CLT for thermal performance and low carbon impact

CONCLUSION

In summary, Guha Bambu and Green Solution House 2.0 demonstrate that successful sustainable architecture relies on a thoughtful response to climate, landscape, and cultural context. Each project employs various passive strategies, cooling and shading in tropical areas, daylighting and insulation in temperate regions. While focusing on minimal land disturbance, ecological integration, and improved user comfort. They show that sustainable design works best when it is connected to its location and integrated into the project from the start.

4.0 CONCLUSION



Both Guha Bambu and Green Solution House 2.0 showcase how passive design strategies can adapt to different climates and cultures to achieve sustainable comfort. Guha Bambu responds to Indonesia's tropical climate through natural ventilation, shading, and vegetation that promote cooling and harmony with nature, while Green Solution House 2.0 in Denmark emphasizes daylight optimization, insulation, and circular material use for energy efficiency. Despite their contrasting climates, both buildings share a common goal, creating climate-responsive, low-impact, and user-centered spaces that blend sustainability with human comfort



REFERENCES

- Guha Bambu | Realrich Architecture Workshop RAW Architecture - | Archello. (n.d.). Archello. <https://archello.com/project/guha-bambu>
- Griffiths, A., & Griffiths, A. (2022, February 3). RAW Architecture uses bamboo to build Guha studio extension in Jakarta. Dezeen. <https://www.dezeen.com/2021/10/12/raw-architecture-bamboo-guha-studio-extension-jakarta/>
- Abdel, H. (2024, October 23). Guha / Realrich Architecture Workshop. ArchDaily. <https://www.archdaily.com/937019/guha-raw-architecture>
- Jd. (2021, March 26). Guha by Realrich Architecture Workshop. Home Stratosphere. <https://www.homestratosphere.com/guha-by-realrich-architecture-workshop/>
- Newman, A. (2025, June 21). Green Solution House 2.0 by 3XN and GXN: Denmark's first full timber hotel sets a new sustainability benchmark. Sustainable Design Story. <https://uni.xyz/journal/green-solution-house-20-by-3xn-and-gxn-d>
- Silva, V. (2024, July 3). Green Solution House / 3XN. ArchDaily. <https://www.archdaily.com/945892/green-solution-house-3xn>
- Green Solution House | Ongreening. (n.d.). <https://ongreening.com/en/Projects/green-solution-house-1209>
- Green Solution House – Active House. (n.d.). <https://www.activehouse.info/cases/green-solution-house/>
- DAYLIGHT IN THE GREEN SOLUTION HOUSE. (2017, February 24). <https://buildforlife.velux.com/en/knowledge/articles/2017/february/daylight-in-the-green-solution-house>
- Green solution house 2.0 | 3XN. (n.d.). <https://3xn.com/project/green-solution-house>
- GXN Innovation. (n.d.). <https://gxn.3xn.com/project/green-solution-house>