



Rising from the [Coal] Ashes:
Envisioning a Circular Post-Coal Community in Muara Enim

Mentors:

Mo Smit

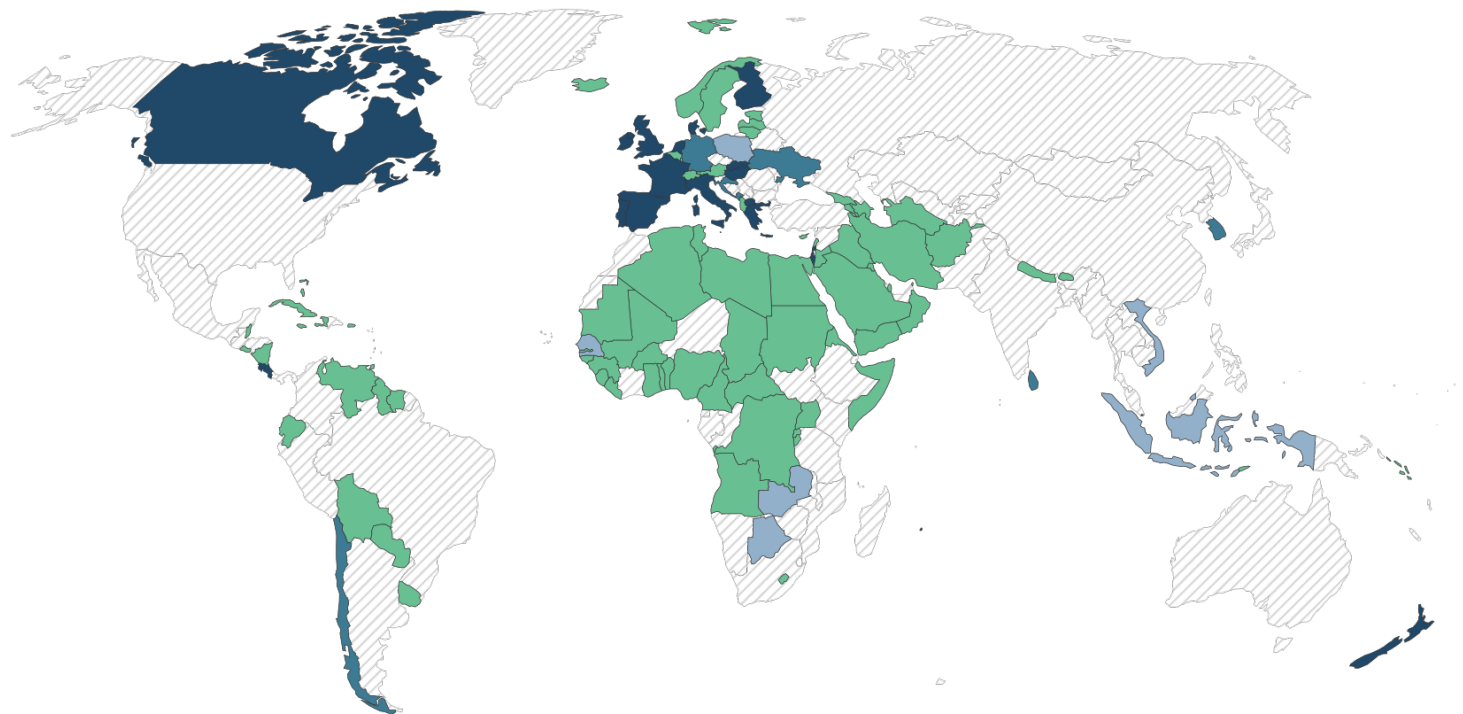
Arie Bergsma

Jos de Krieger



BACKGROUND.

BACKGROUND

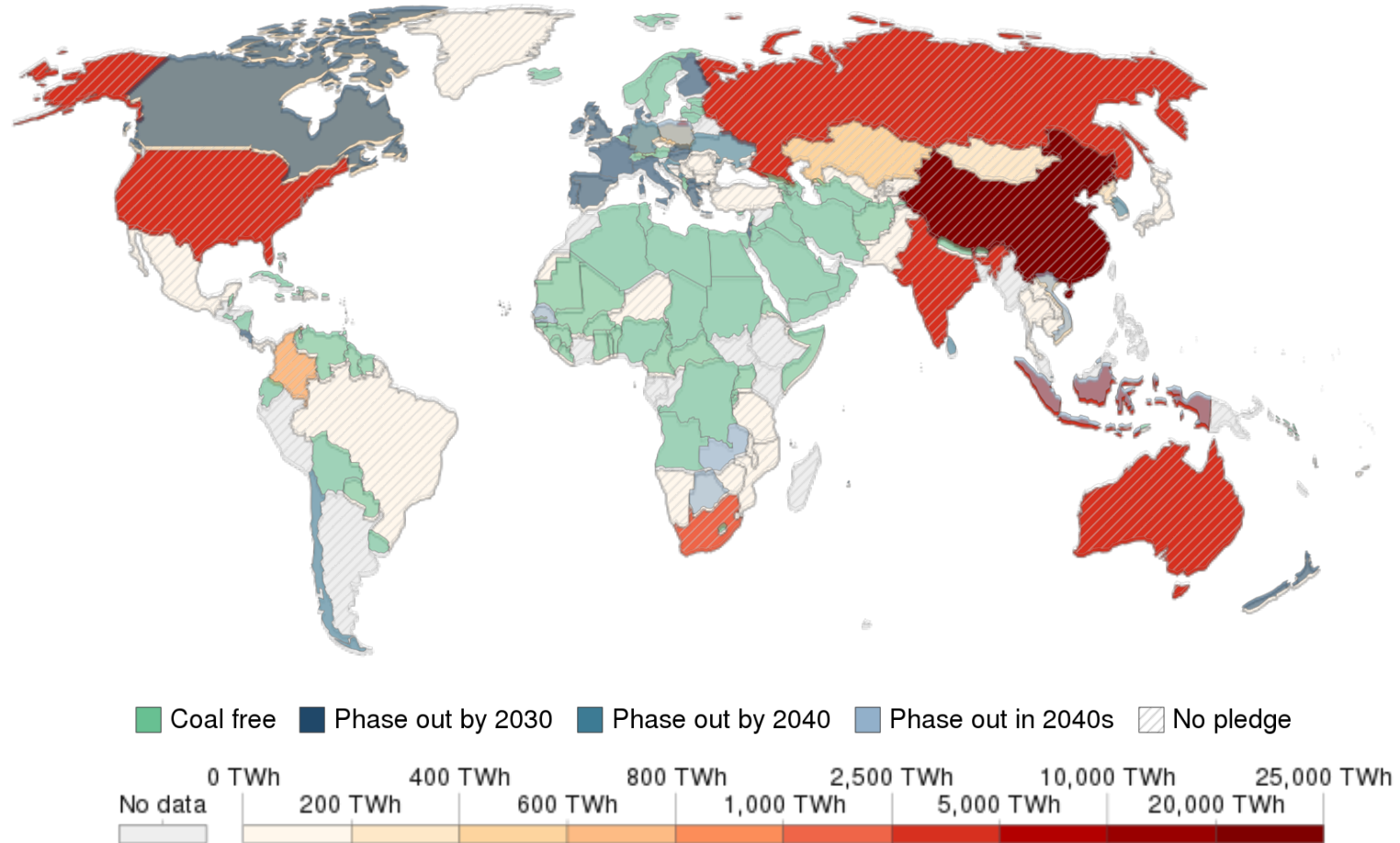


■ Coal free ■ Phase out by 2030 ■ Phase out by 2040 ■ Phase out in 2040s ▨ No pledge

Source: Powering Past Coal Alliance; Ember Climate; Beyond Coal EU; Bloomberg Coal Countdown and other sources

Note: Where a concrete phase out date is not defined, we have allocated the final year of the target decade. For example, "Phase out in the 2040s" is given a target date of 2049.

BACKGROUND

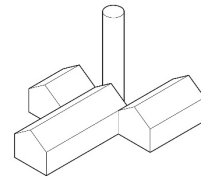


*“A main challenge local authorities in many regions face is to **increase public awareness** for the need of phasing out fossil fuels and to **convince citizens** to actively engage in the transition”*

*Driving Change: How to implement a successful regional just transition First hand recommendations from coal+ regions in transition .
-European Commission, 2023*

BACKGROUND

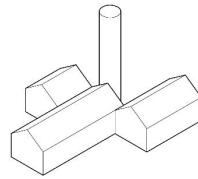
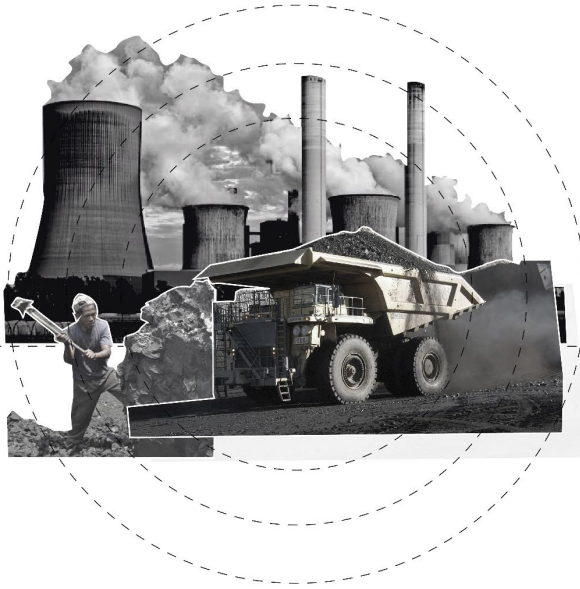
Technology



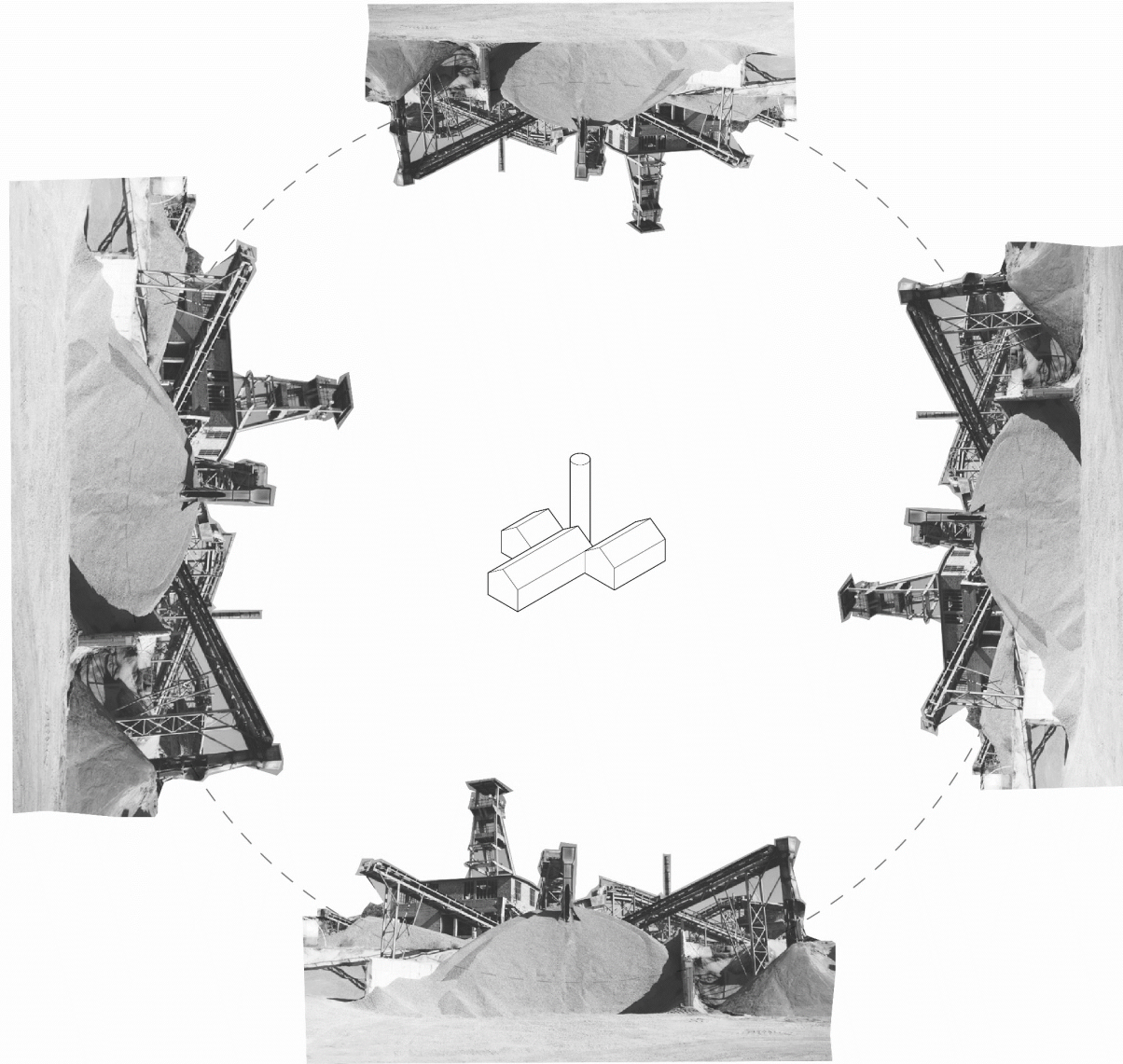
Social

Economy

BACKGROUND



BACKGROUND



BACKGROUND



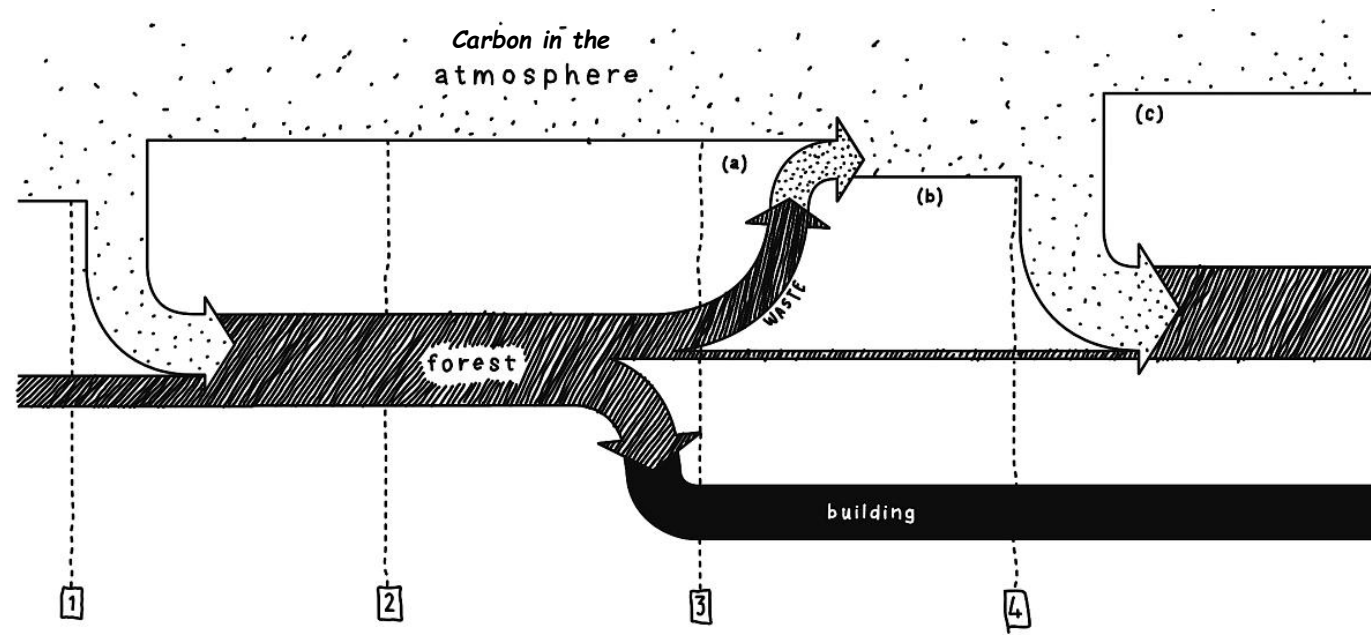
*“Architects are experts in **Veiling all the acts of extraction** that makes a building possible.”*

*Mark Wigley - Returning the Gift: Running Architecture in Reverse
Non-Extractive Architecture Vol. 1 (2021)*

BACKGROUND



BACKGROUND



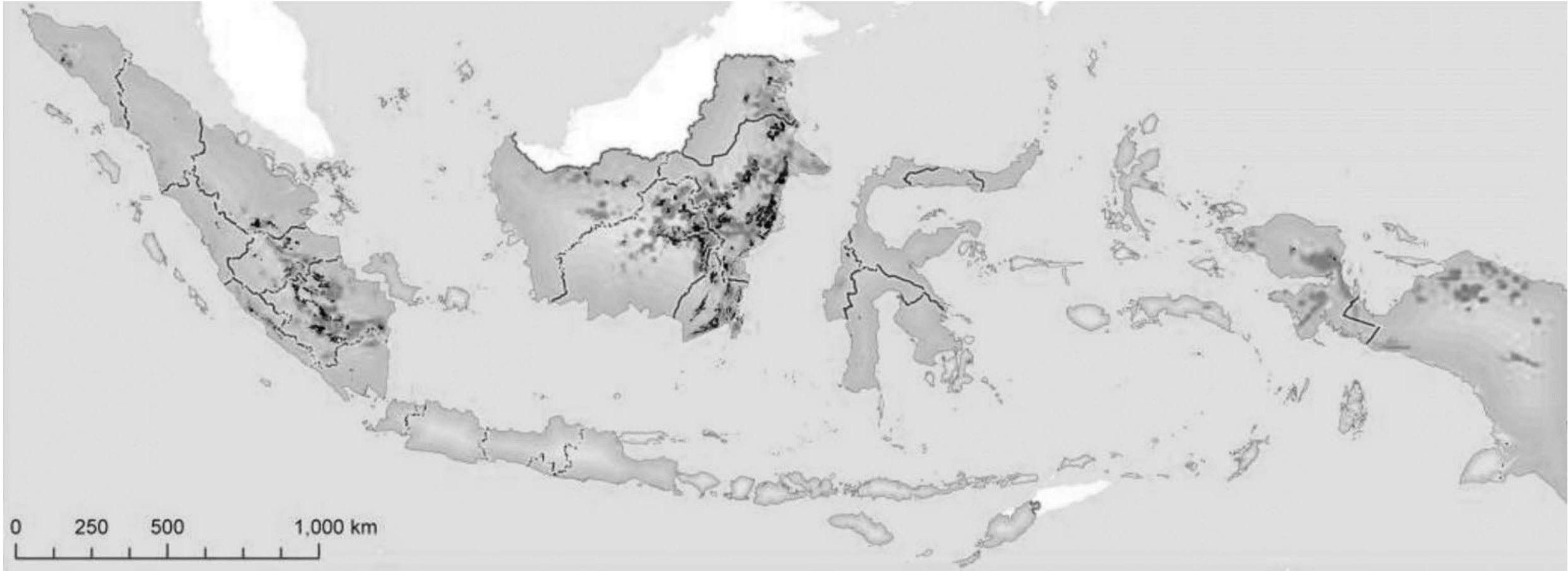
Luke Jones - Carbon Tectonic
Non-Extractive Architecture Vol. 1 (2021)



CONTEXT.

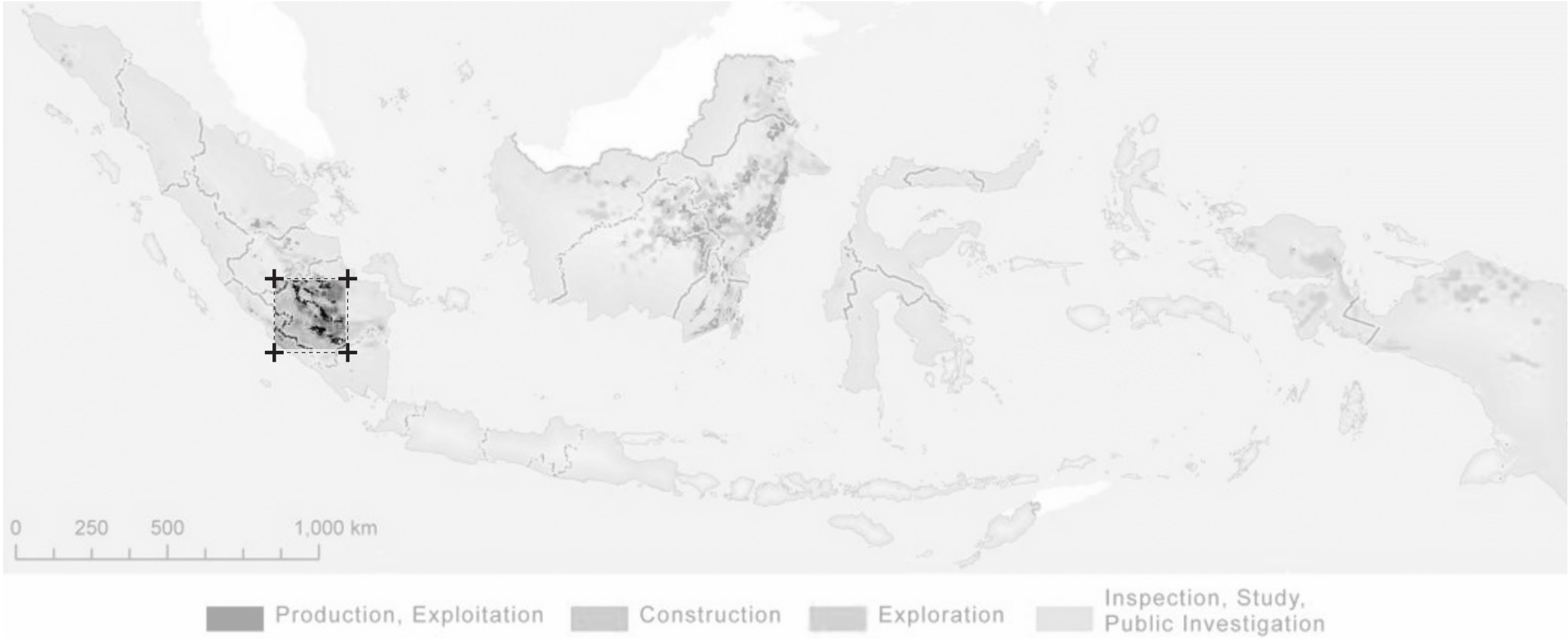
CONTEXT

Coal Activity Map in Indonesia



CONTEXT

Coal Activity Map in Indonesia

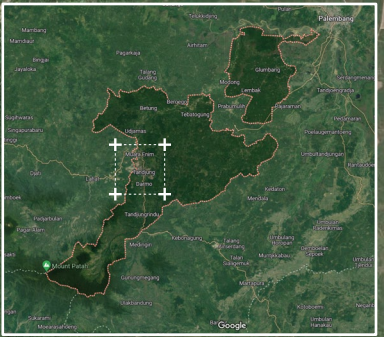


CONTEXT

Coal Mining area in Muara Enim

1984 - 2024







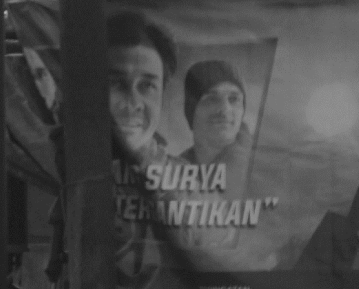


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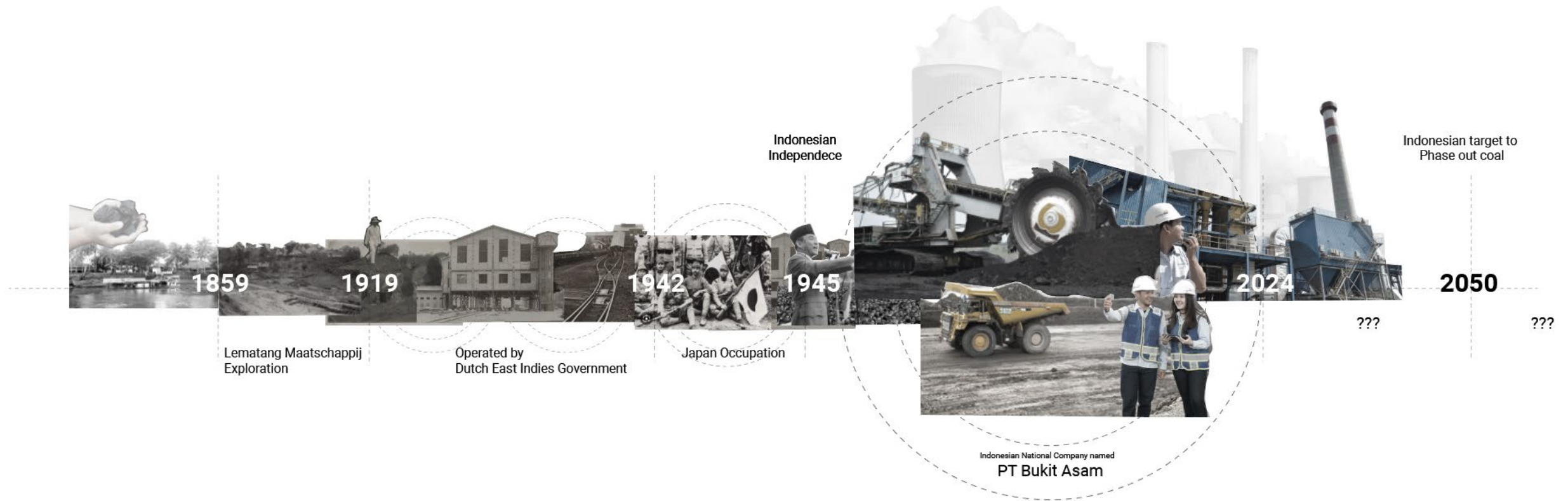


BG 8744 DAR



CONTEXT

Muara Enim Coal History



CONTEXT

Changes in Urban fabric & Building Culture



Modified Traditional Buildings

Traditional Buildings

Modern Buildings

CONTEXT

Muara Enim Future Planning



Tourism



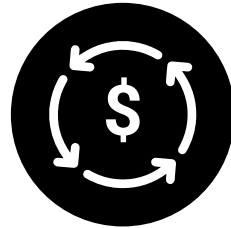
Agriculture

PROJECT OVERVIEW

Problem Statements



Environmental Damages During and After Coal Mining Activity



Need for Alternative Economy and Energy Generator



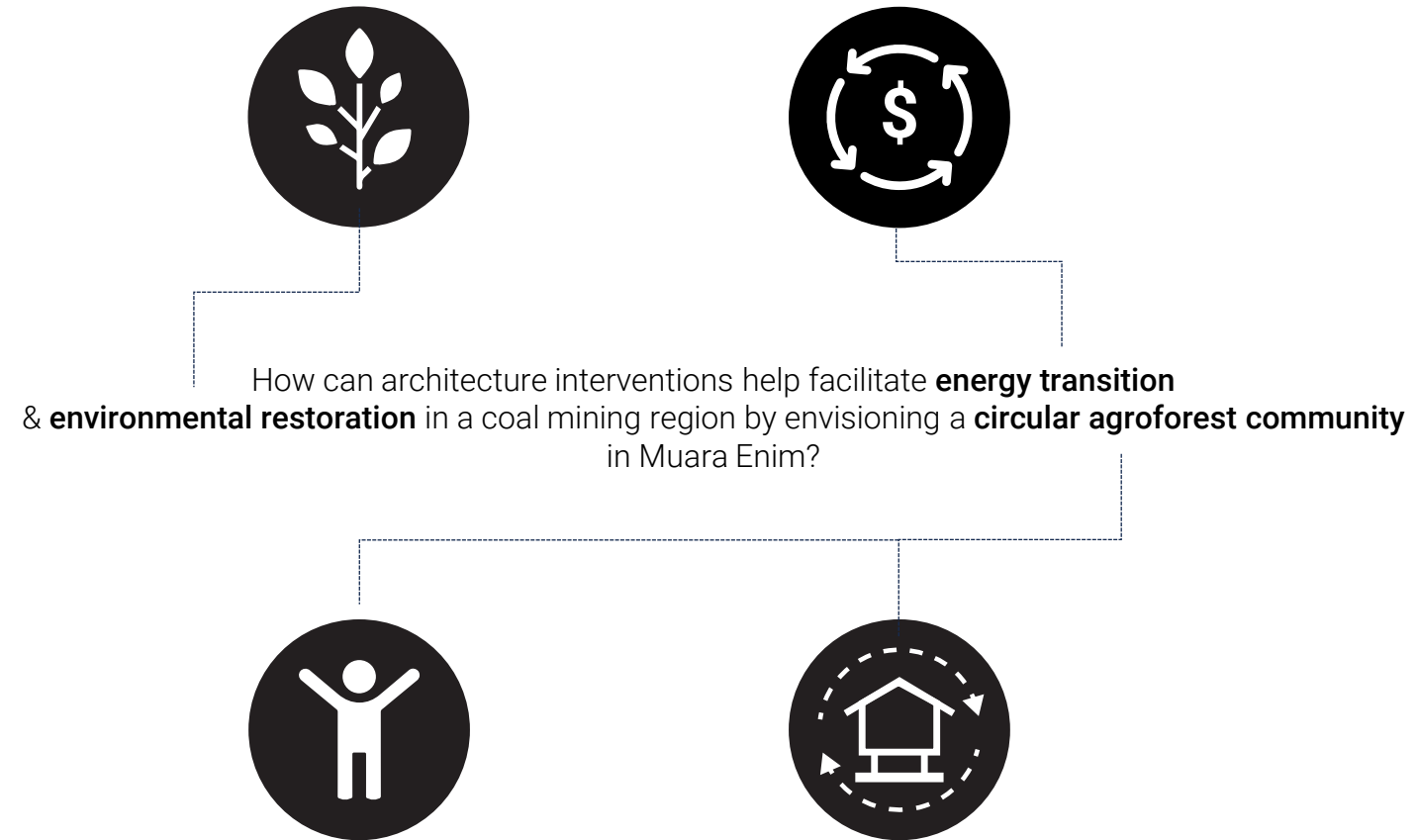
Lack of Public Participation in the transition strategy



Loss of Architectural Identity & Building Culture

PROJECT OVERVIEW

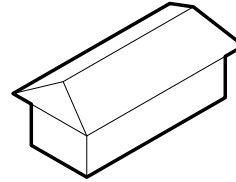
Design Question



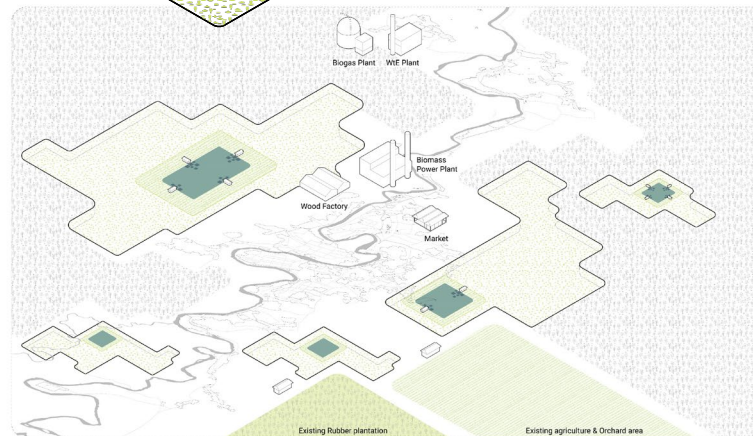
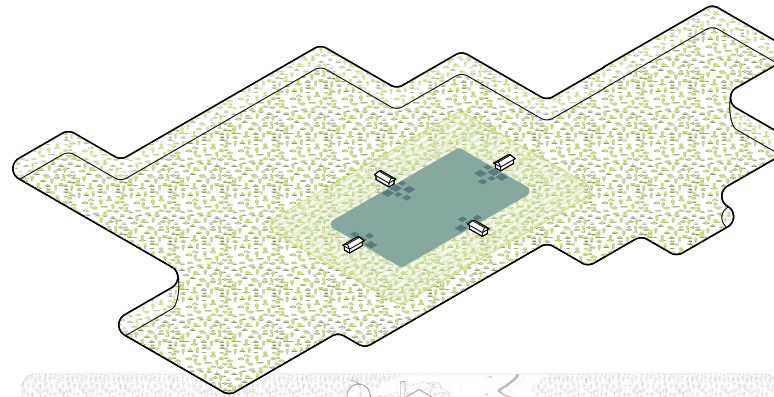
PROJECT OVERVIEW

Design Question

How can the coal mining area be transformed into a productive landscape while enhancing biodiversity?



How to design a building that demonstrates the culture of a post-coal era?



How to develop a spatial strategy that addresses the current and future problems of the coal mining village related to alternative economy and energy generator using agroforest practice ?

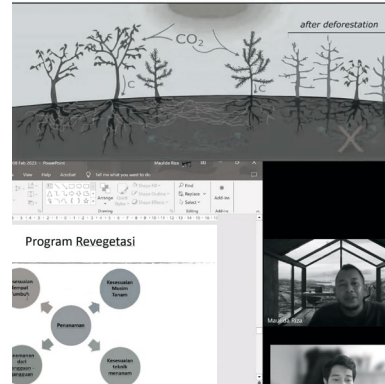
RESEARCH

Methods



Building

Literature
Interview & Study case
Research by design.
(Sketch & Model making)



Landscape

Literature
Site Visit
Interview & Study case

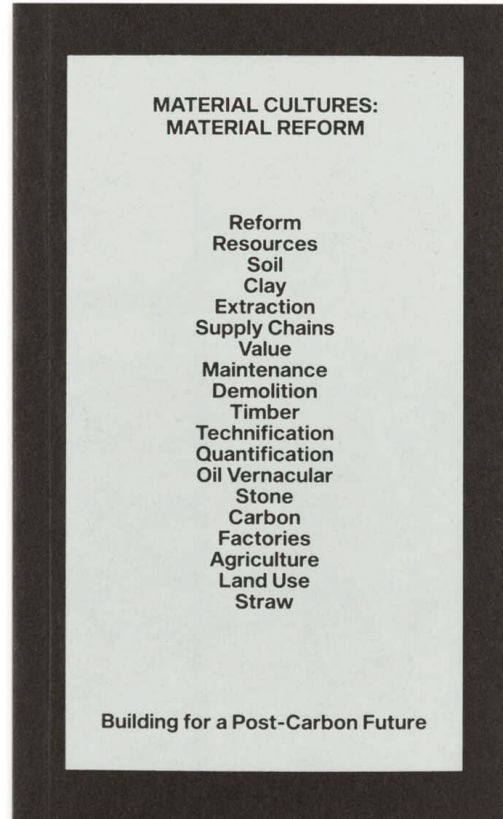


Regional

Literature
Site Visit
Interview
Material Flow Analysis

RESEARCH

Urban Metabolism



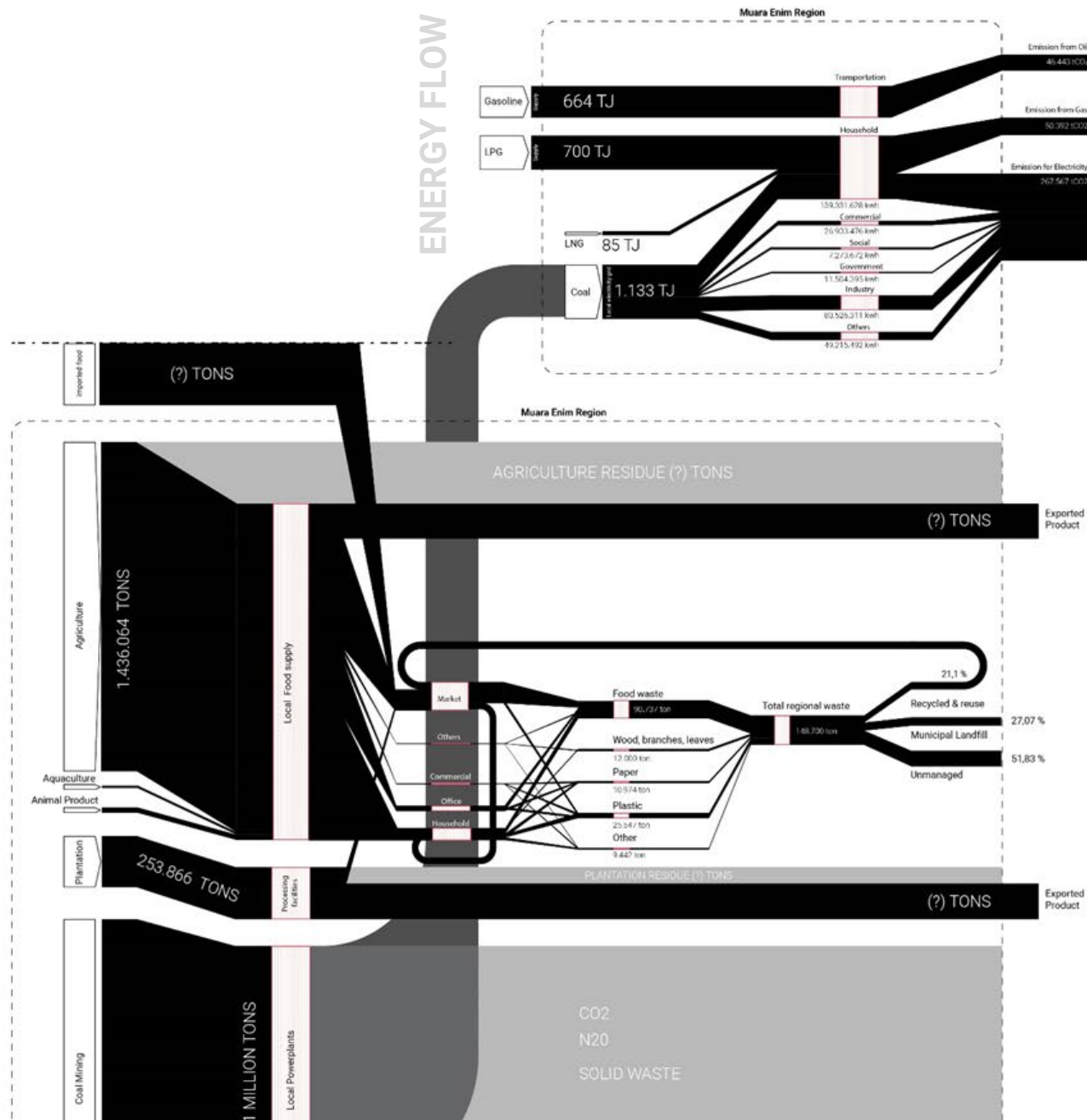
*Approaches to construction that move away from reliance on extractive practices will have to **start with the limits of the land** in which they are situated... It will also require work to **restructure regional economies and the policy and administrative structures** that sustain them.*

Cultures, Material; Dall, Amica. Material Reform: Building for a Post-Carbon Future (pp. 37-38). MACK.

RESEARCH

Urban Metabolism : Existing

MATERIAL FLOW



RESEARCH

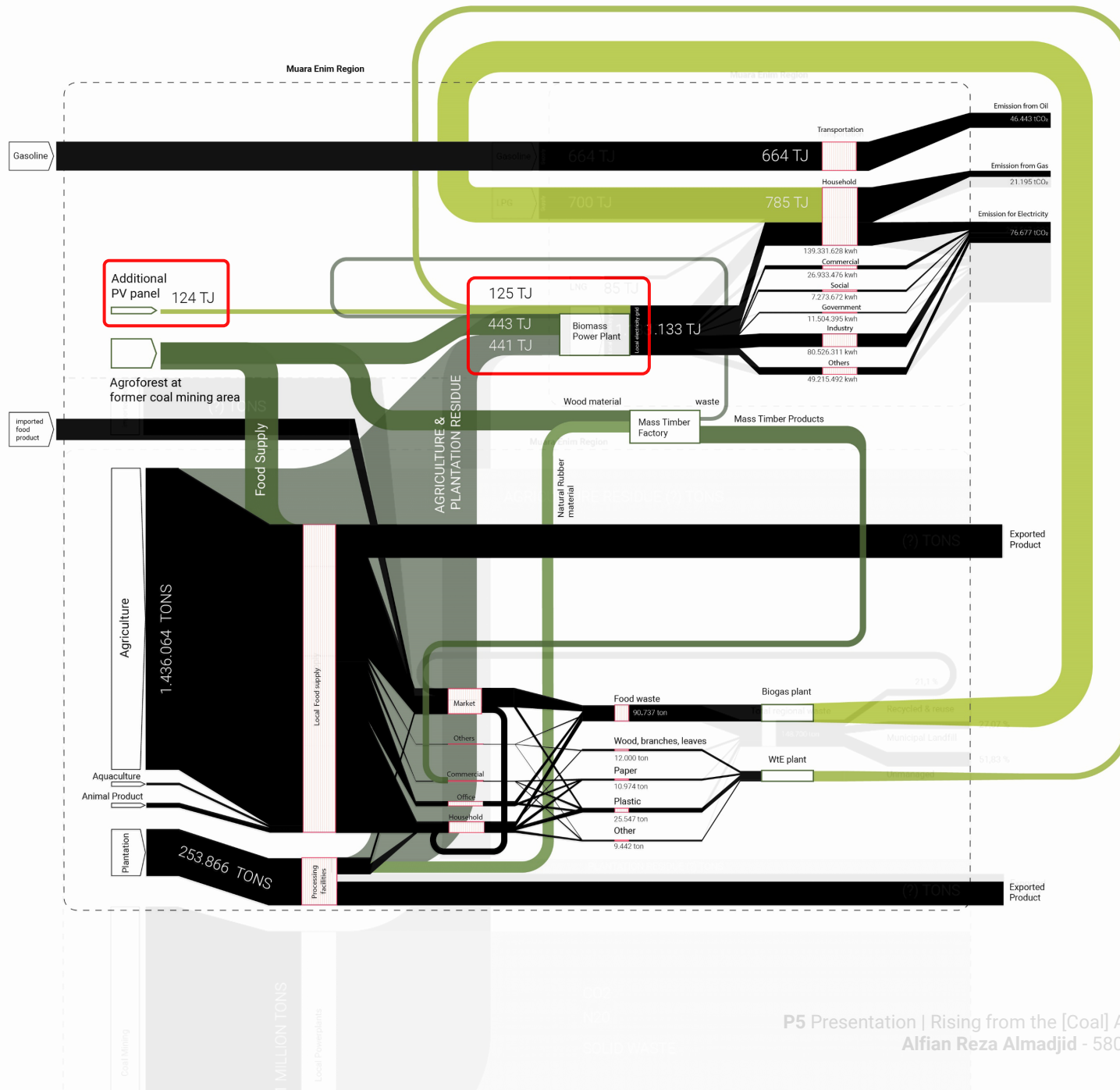
Urban Metabolism : Intervention



Biomass Powerplant



Solar PV



RESEARCH

Urban Metabolism : Intervention



Forest



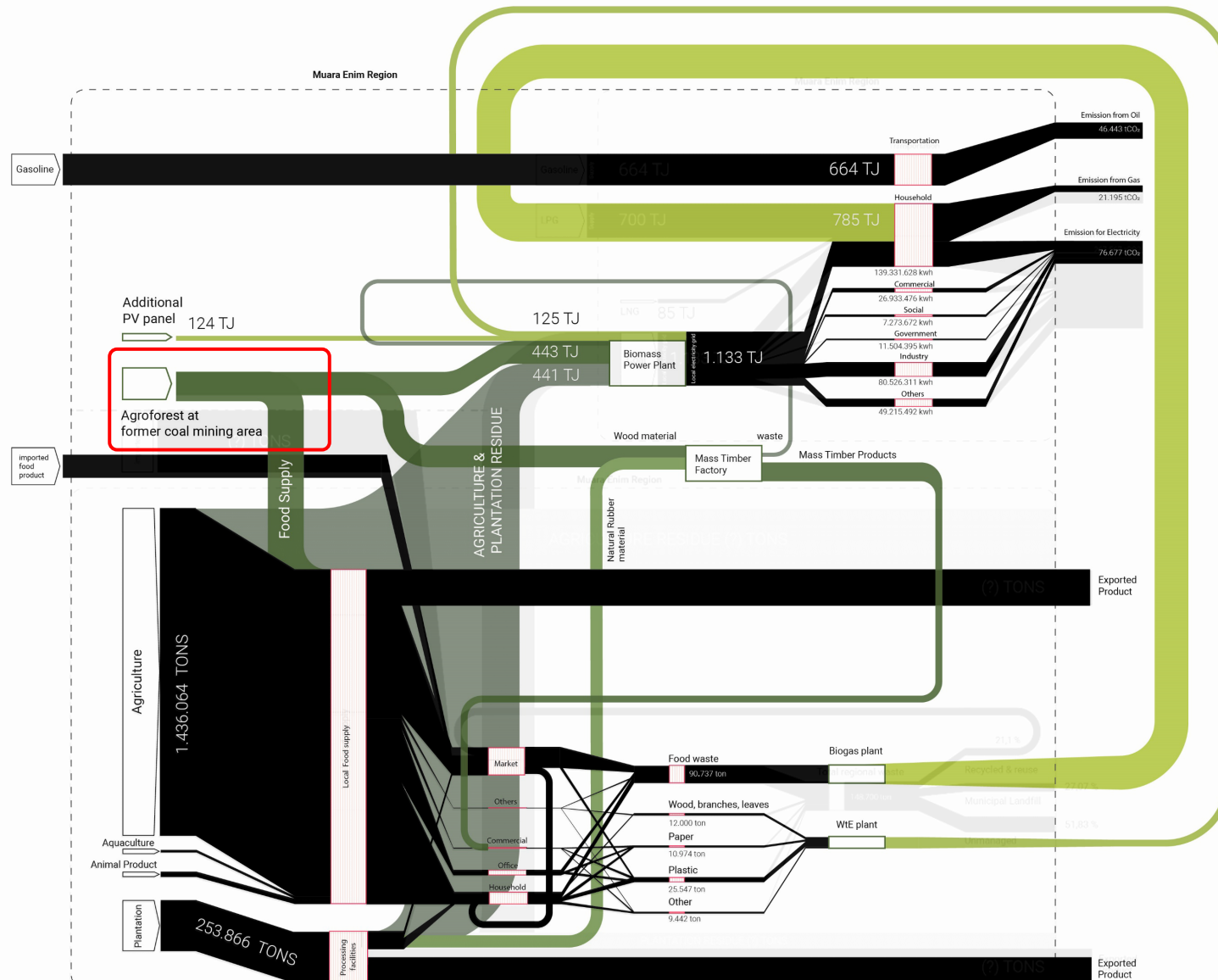
Agriculture



Fish farming



Reclaimed coal mining area



RESEARCH

Urban Metabolism : Intervention



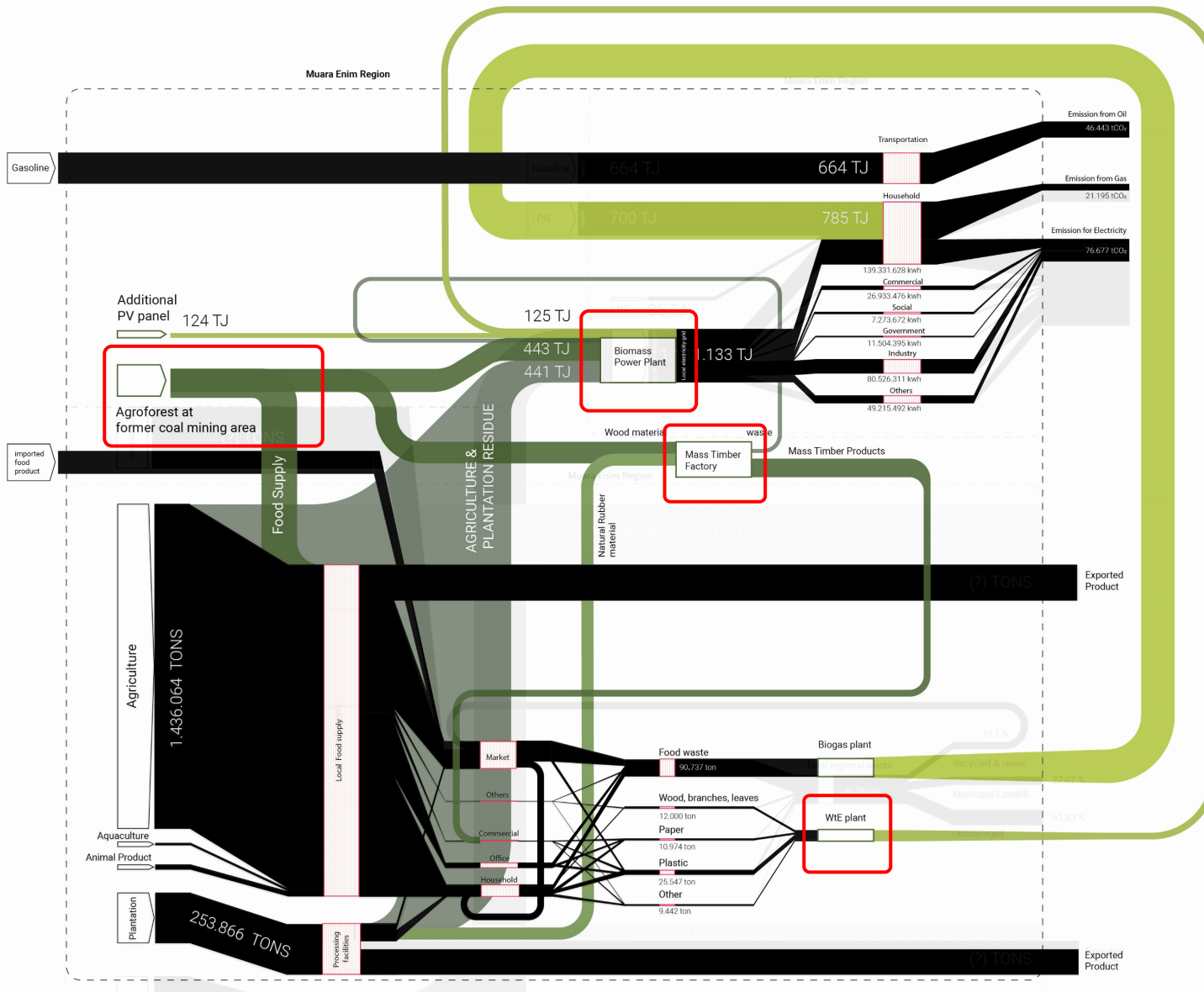
Coal Power Plants



Buildings and Warehouses



Transport tower & Conveyor system



RESEARCH

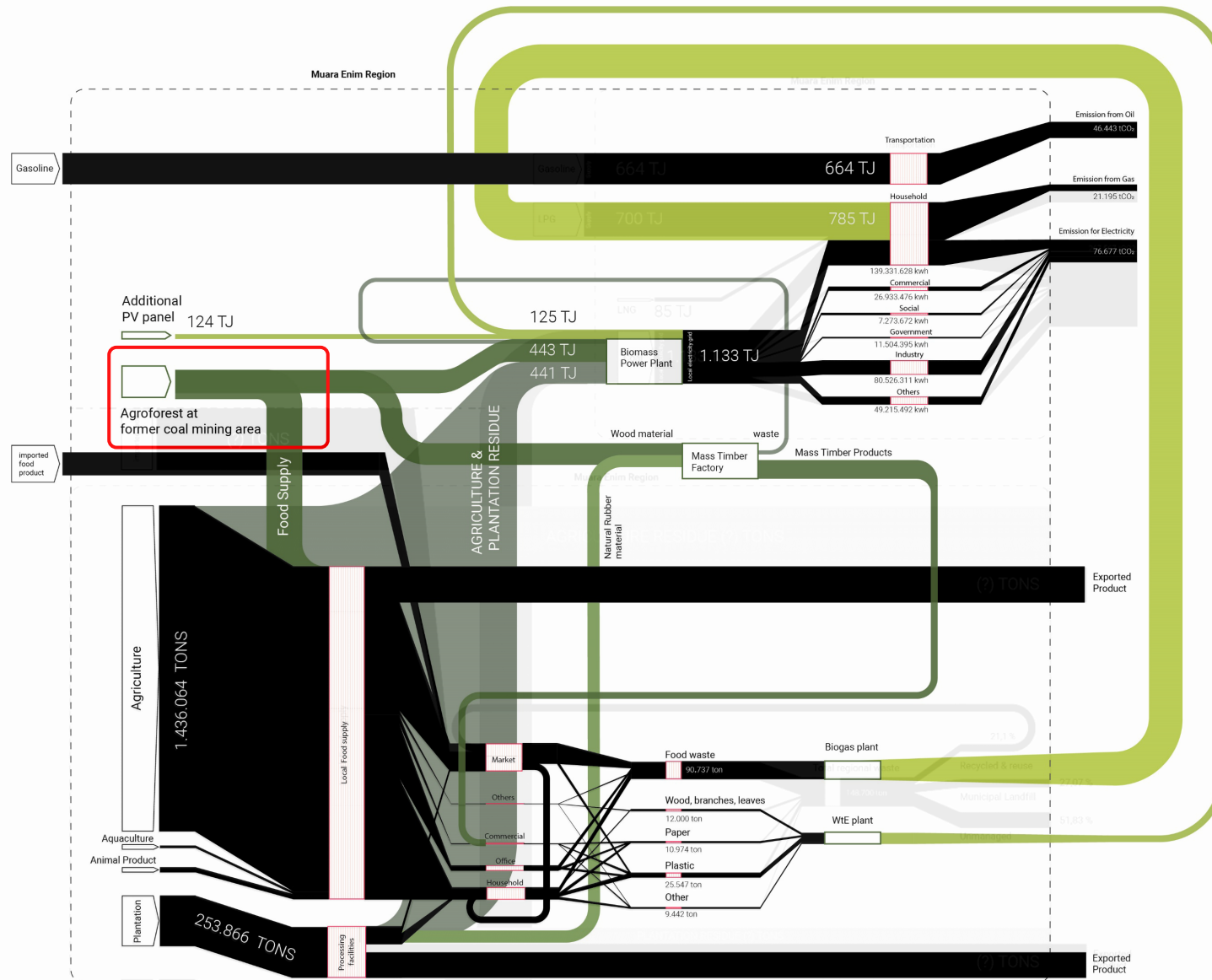
Urban Metabolism : Intervention



Overburden

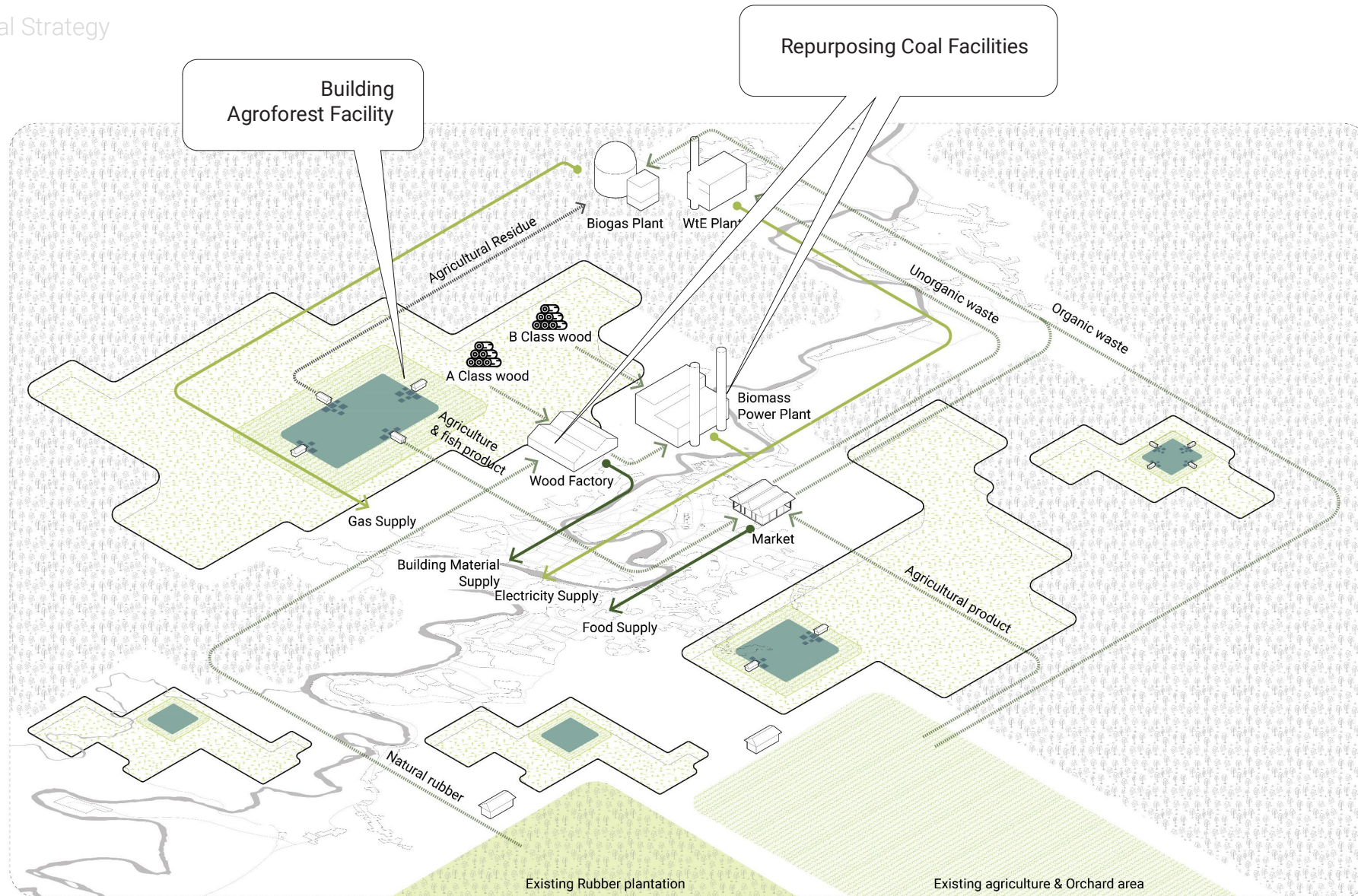


Coal Ashes



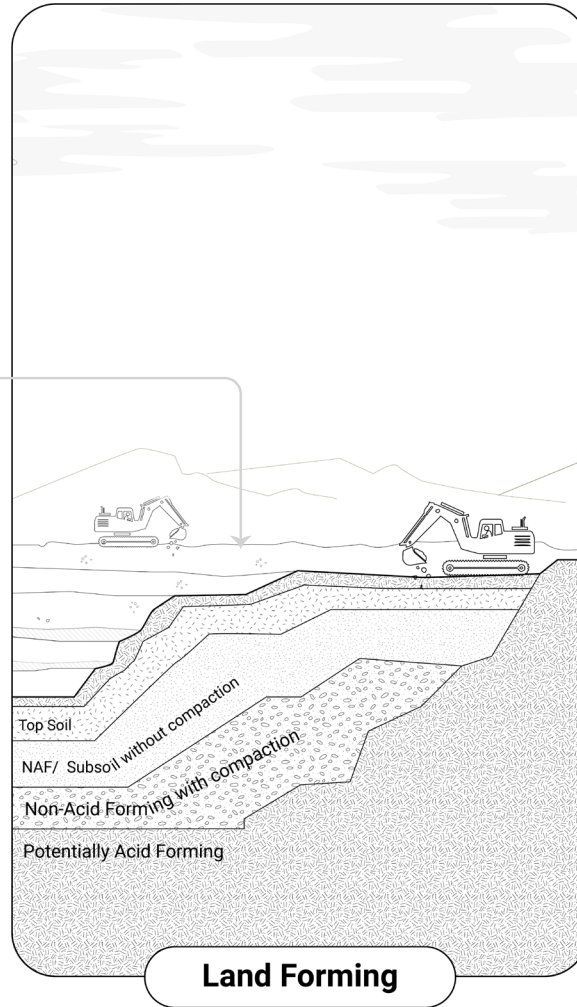
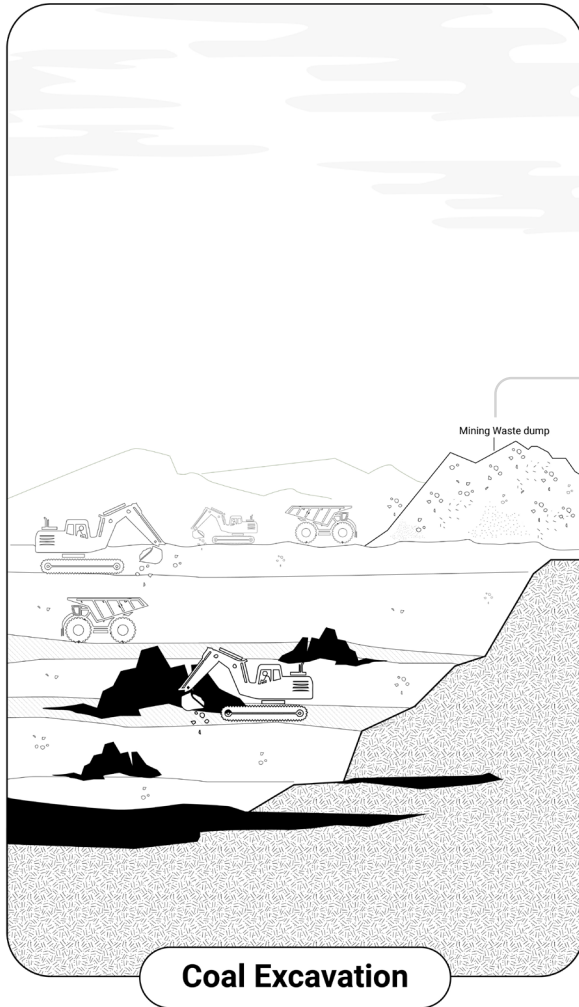
RESEARCH

Translated into Spatial Strategy

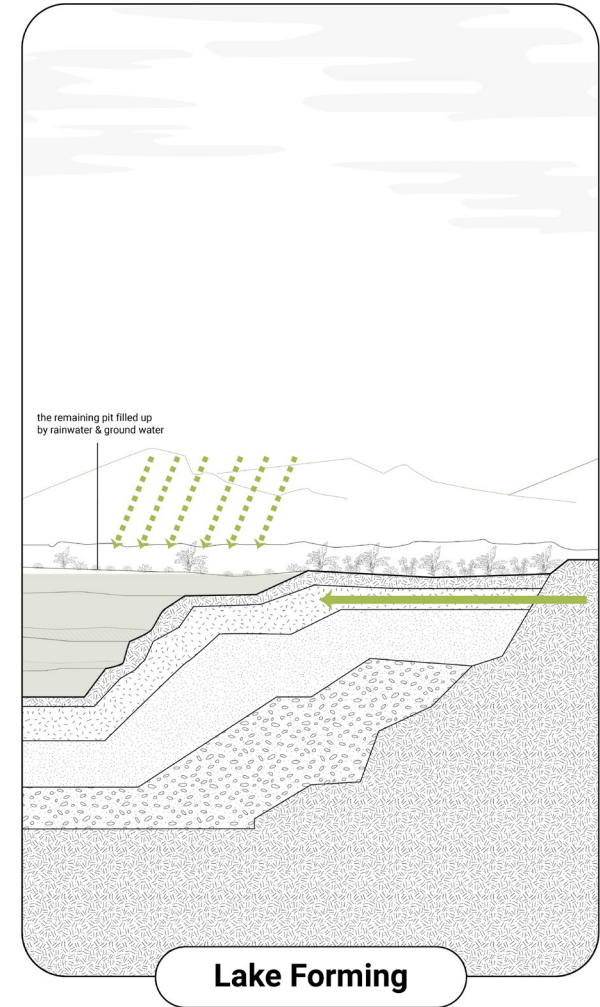


RESEARCH

Reclamation Process



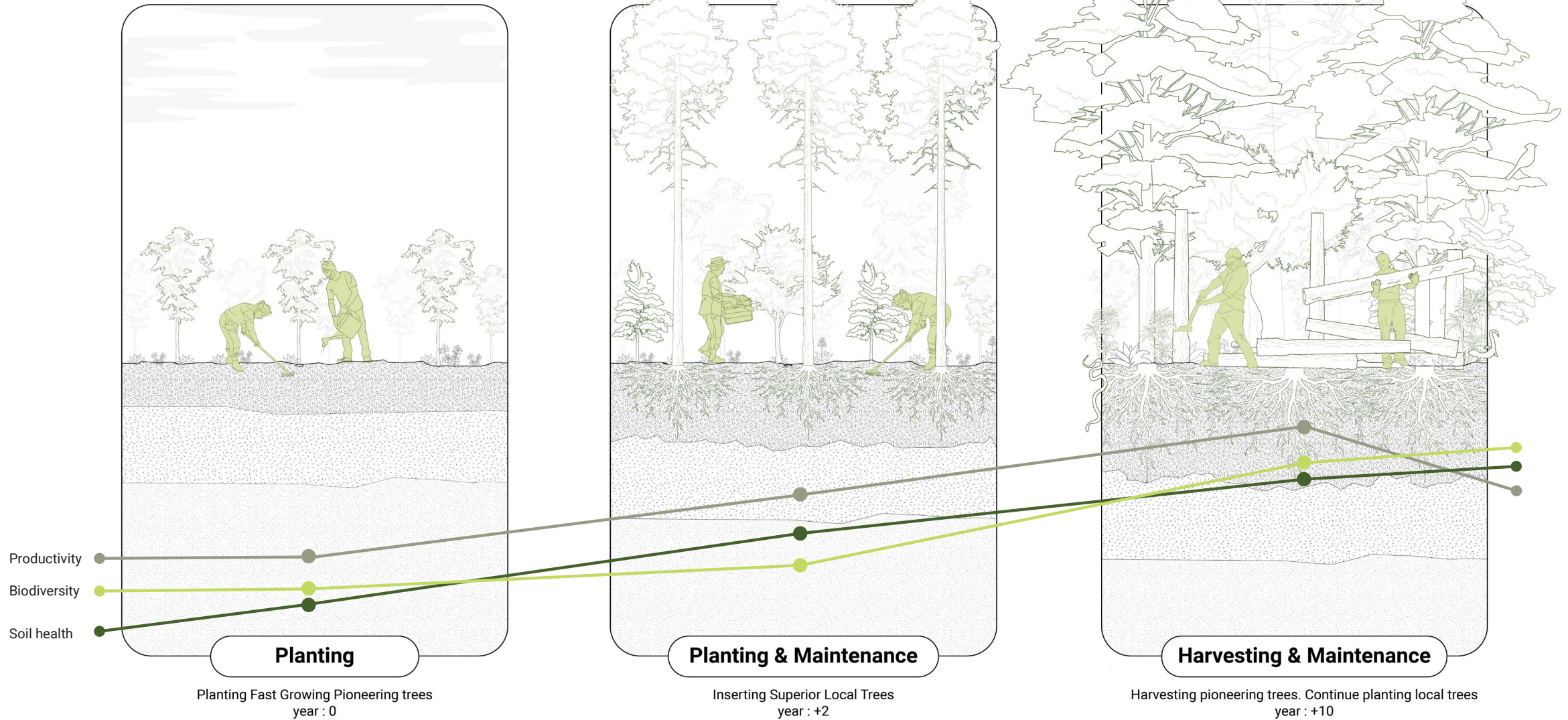
Using existing mining waste and preserved top soils



The remaining pit filled up by rainwater & ground water

RESEARCH

Planting Sequences



RESEARCH

Starting point for Interventions

Local Regional Context

Culture

Agroforestry fish products as local cuisine

Needs

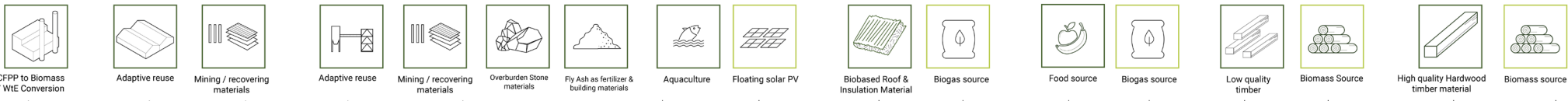
Economy Energy Food Product building materials

Other Potentials

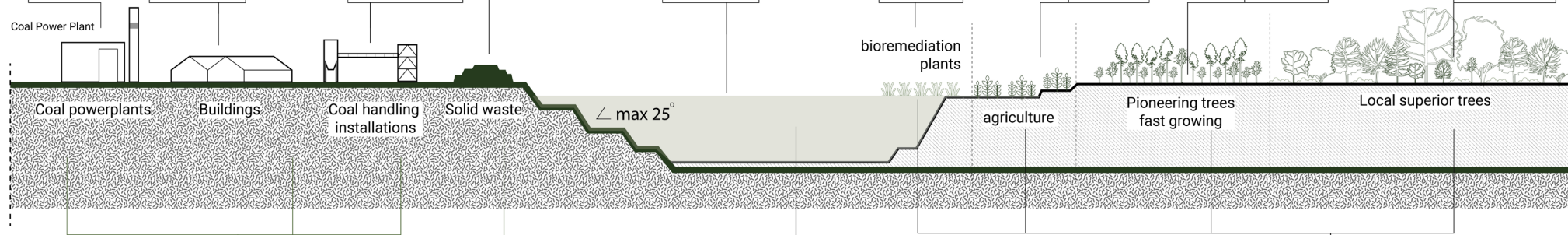
Existing forest & Plantation Access to the mining site

Coal mining site

Potentials



coal closure output



Infrastructure

Apart from the coal powerplants, buildings on site are mostly in steel frame structure and easy to dismantle and recover the material.

Solid waste

Waste materials from the coal mine activity and coal powerplants

Void

Potentially contaminated water with high pH and heavy metal concentration

Reclamation Land

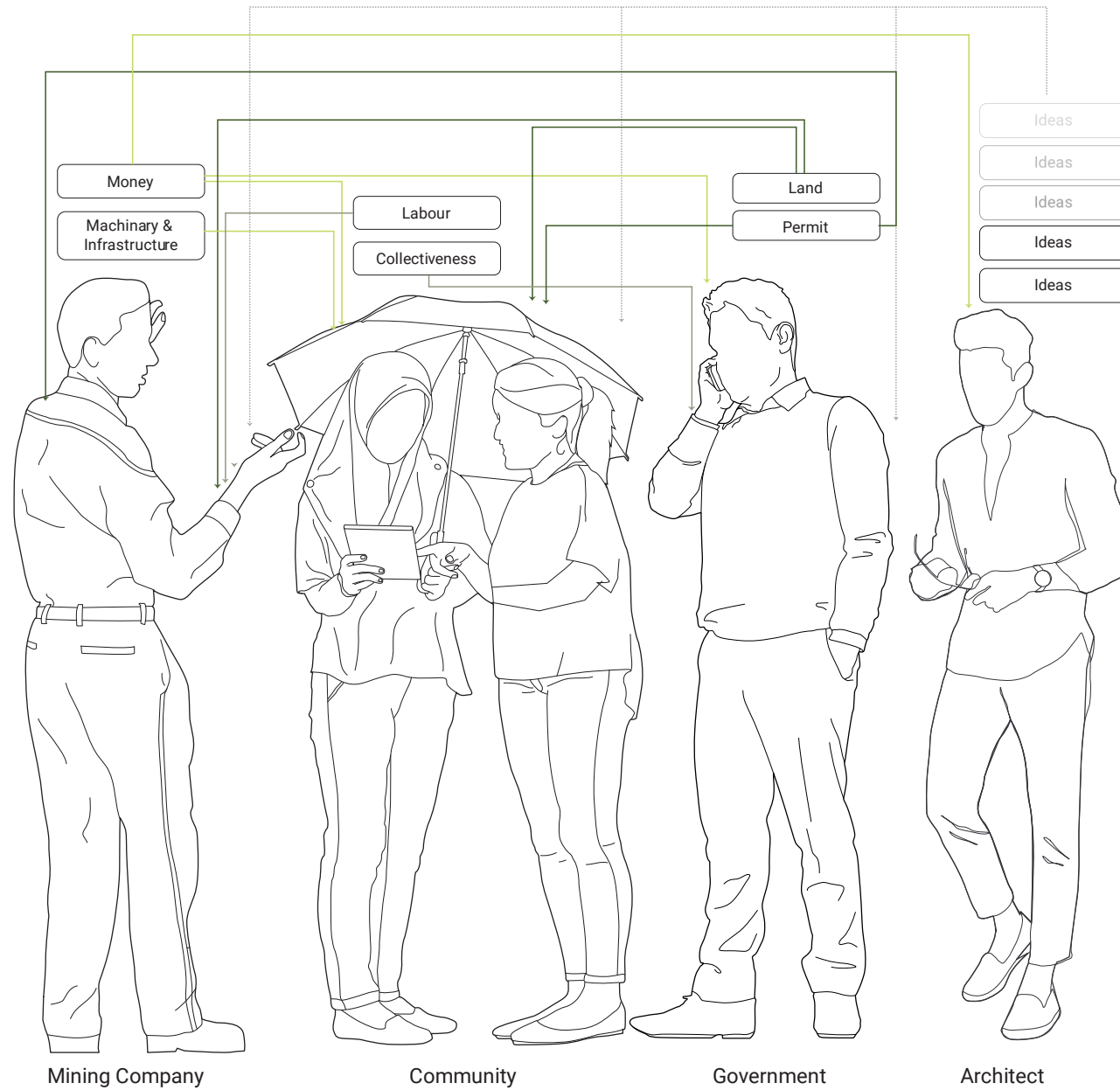
Compacted land that can be shaped and used for various functions. Replantation process using pioneering trees & bioremediation plants are needed to restore the soil health and structure.

An architectural rendering of a residential development. The scene shows several houses with traditional-style gabled roofs, arranged in a cluster. In the background, there is a large body of water, possibly a lake or a wide river, with distant hills on the horizon. The foreground features some trees and a wooden walkway. The overall style is a soft, muted color palette, typical of a conceptual architectural presentation.

PROPOSAL:
MASTERPLAN.

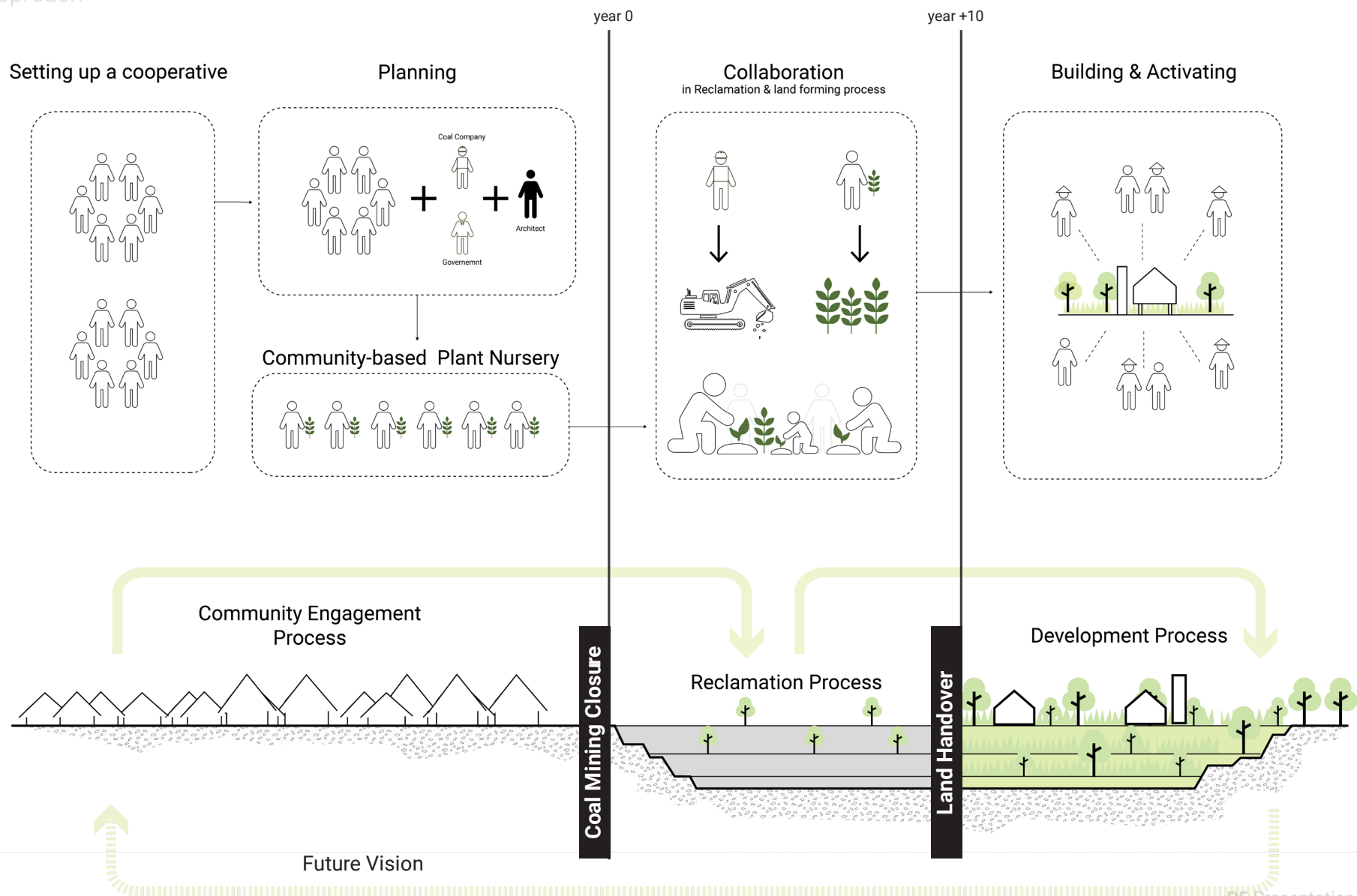
PROPOSAL

Actors



PROPOSAL

public participation approach





PROPOSAL

Site



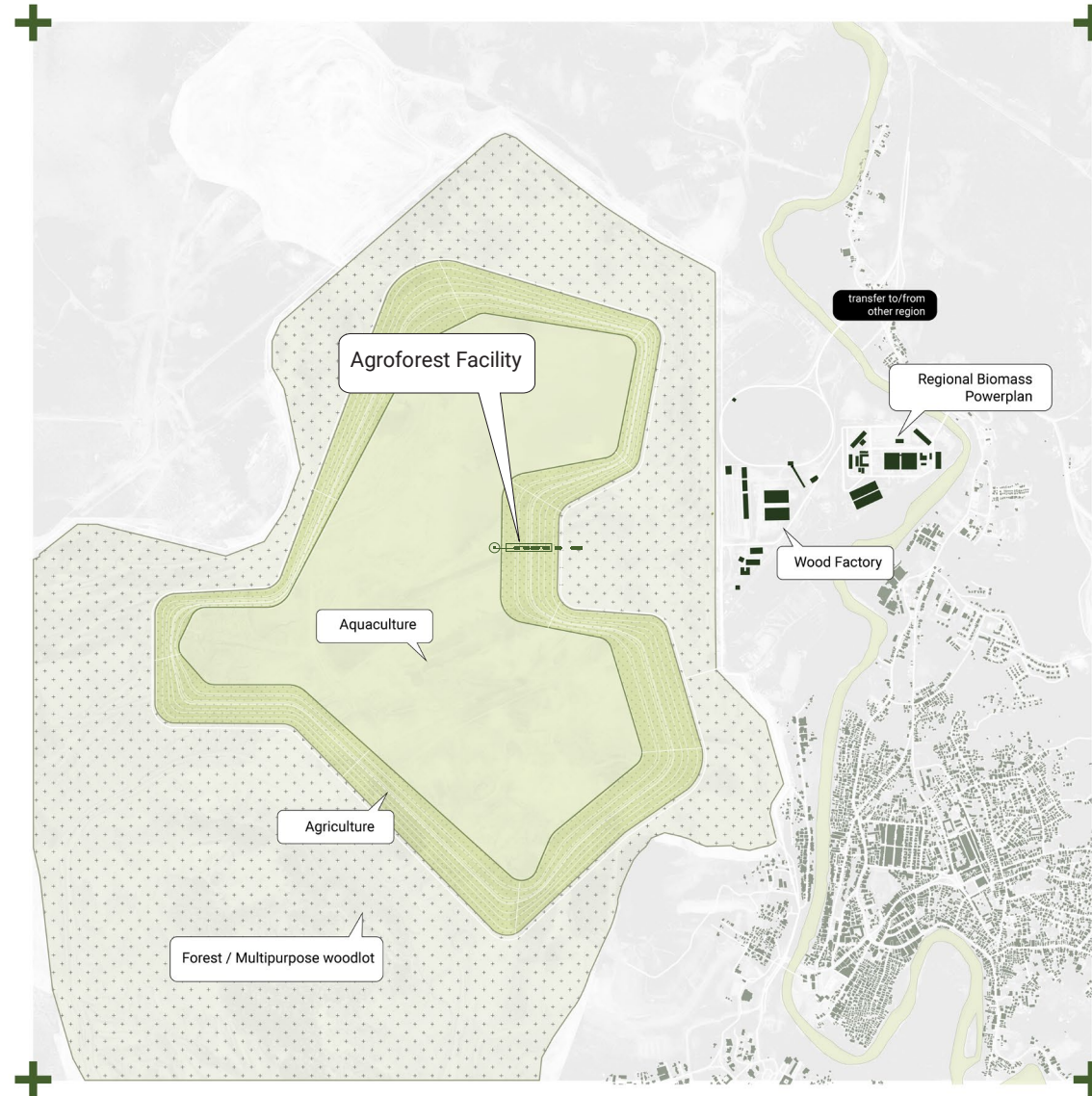
PROPOSAL

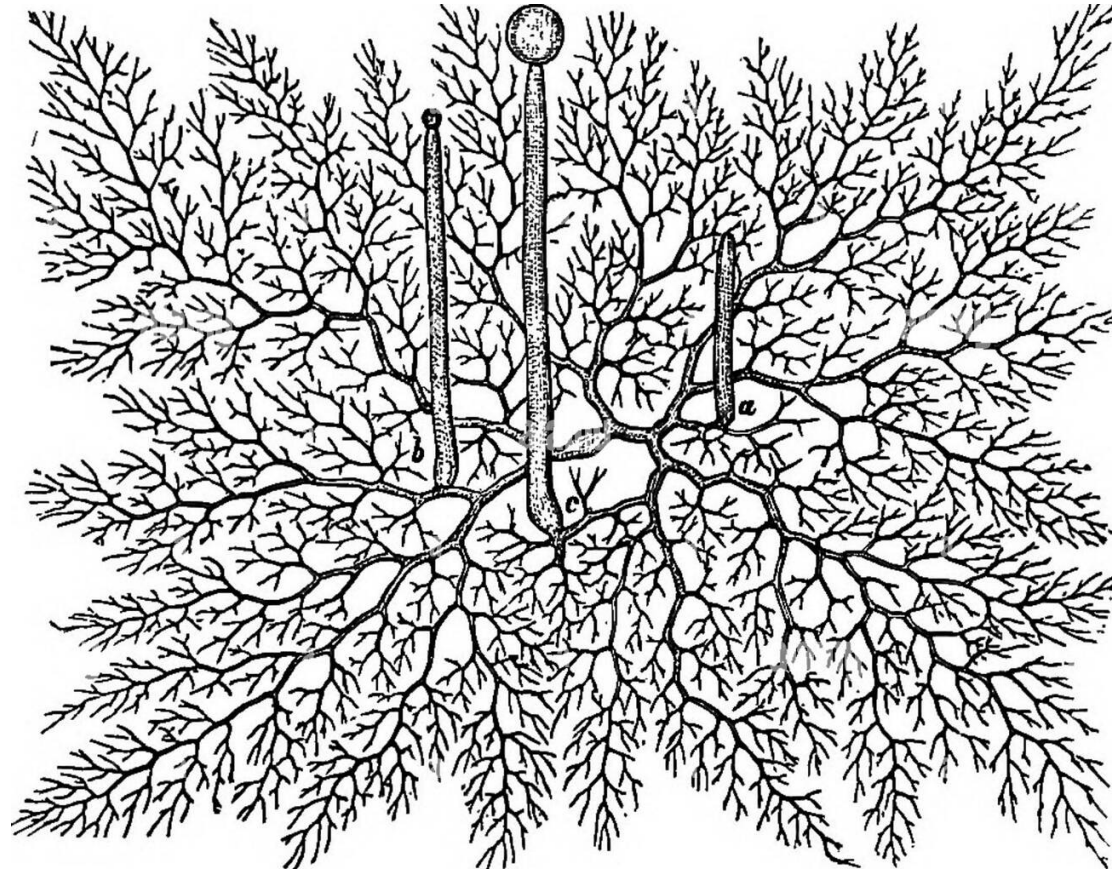
Site



PROPOSAL

Site



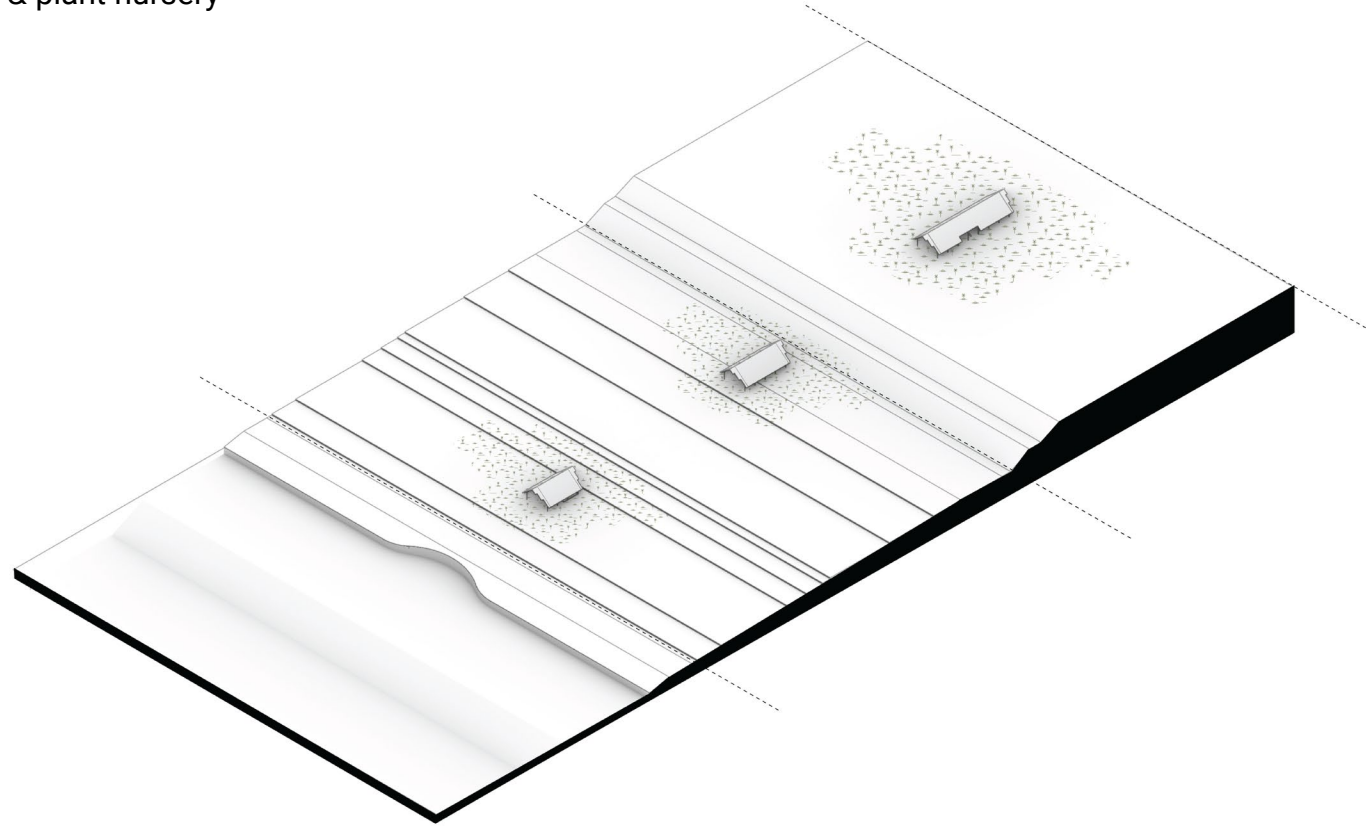


Foundations of botany (1901)

PROPOSAL

Phase 1 : Replantation Process

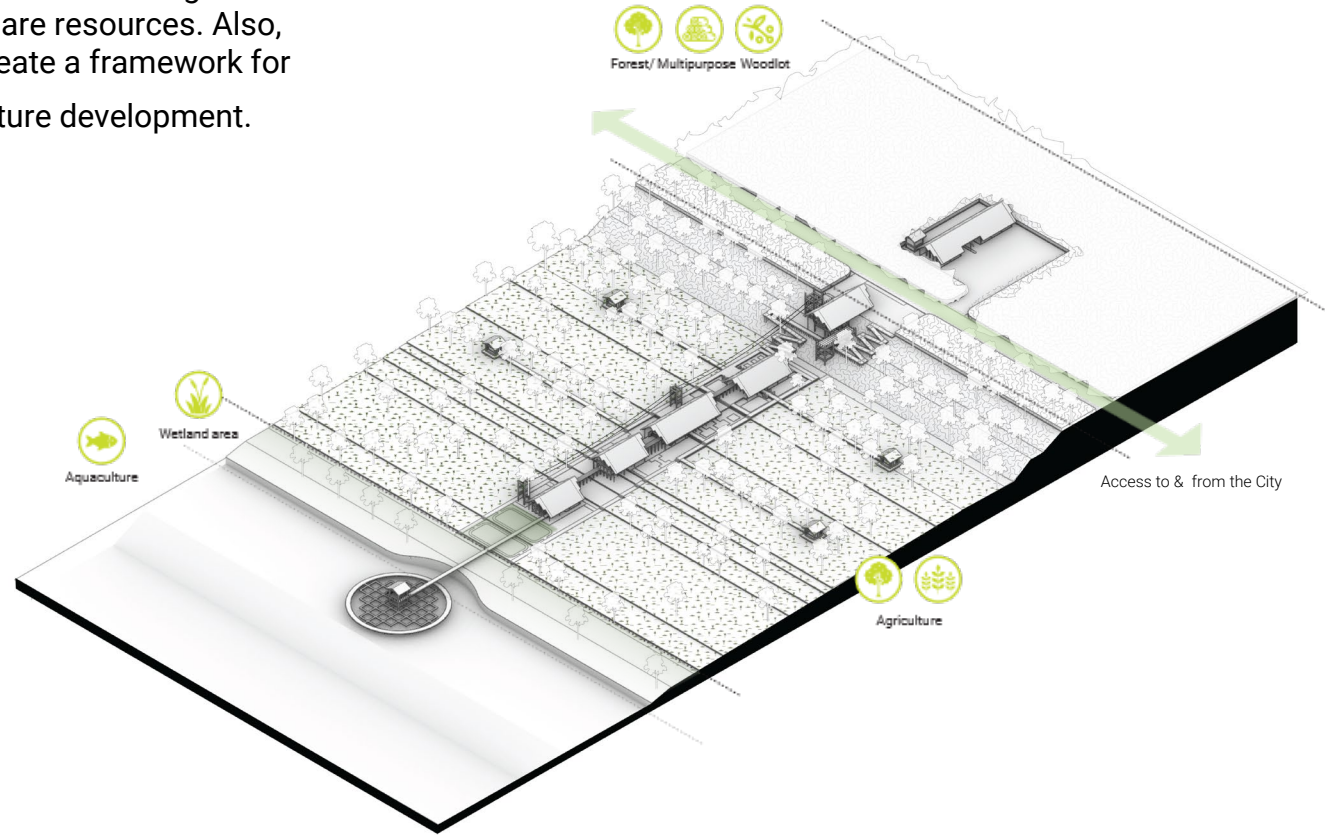
- Reusing existing Infrastructure
- Building shelter for maintenance & plant nursery



PROPOSAL

Phase 2 : Start of Cultivation Process

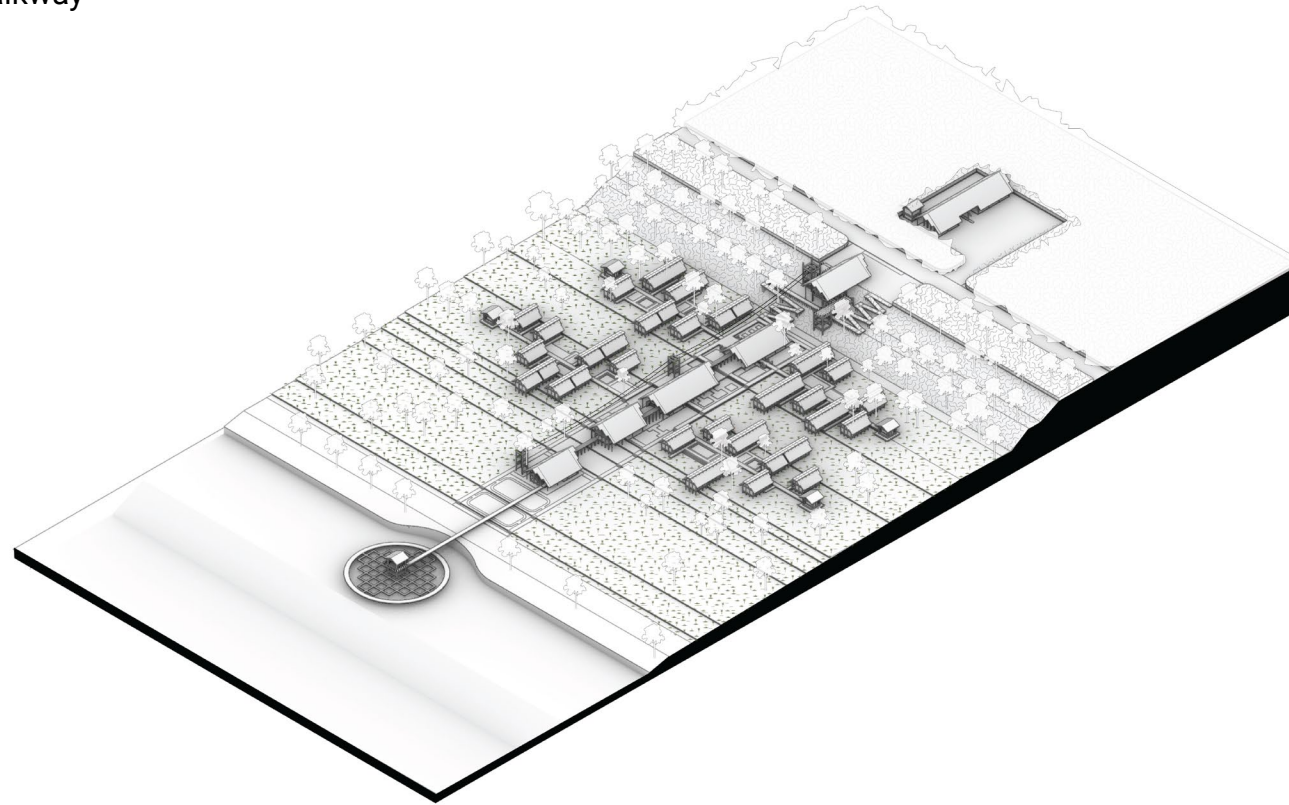
- Combining Existing Infrastructure & Biobased material
- Building the Agroforest Facility to provide food and material for the city
- Walkway system to connect building and share resources. Also, create a framework for future development.



PROPOSAL

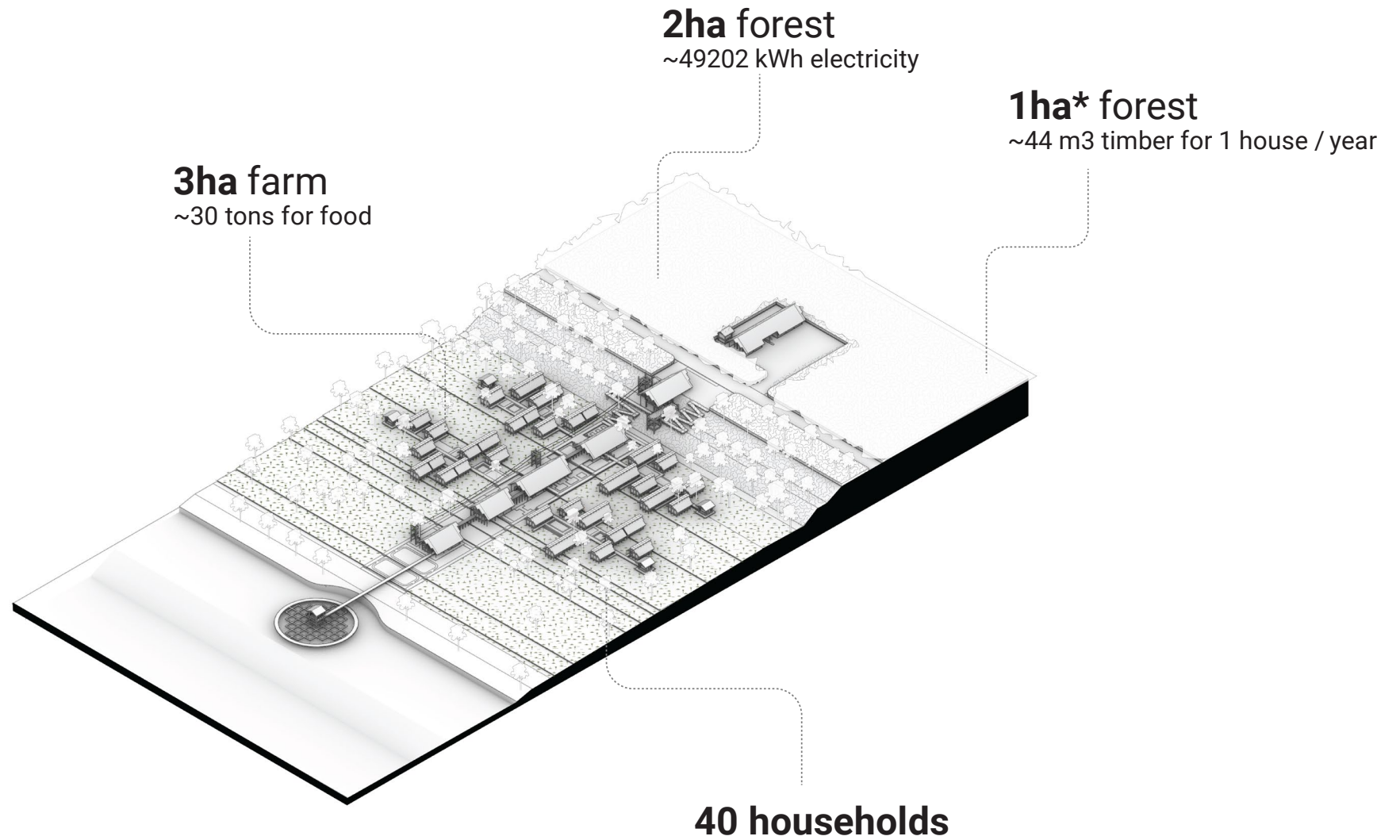
Phase 3 : Growing Village

- Mainly use Biobased material
- Self-built by the community members
- All buildings connected to the walkway



PROPOSAL

Estimation

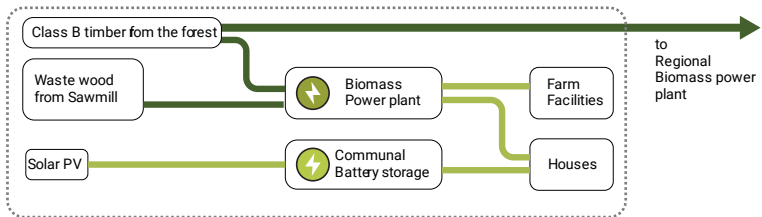


PROPOSAL

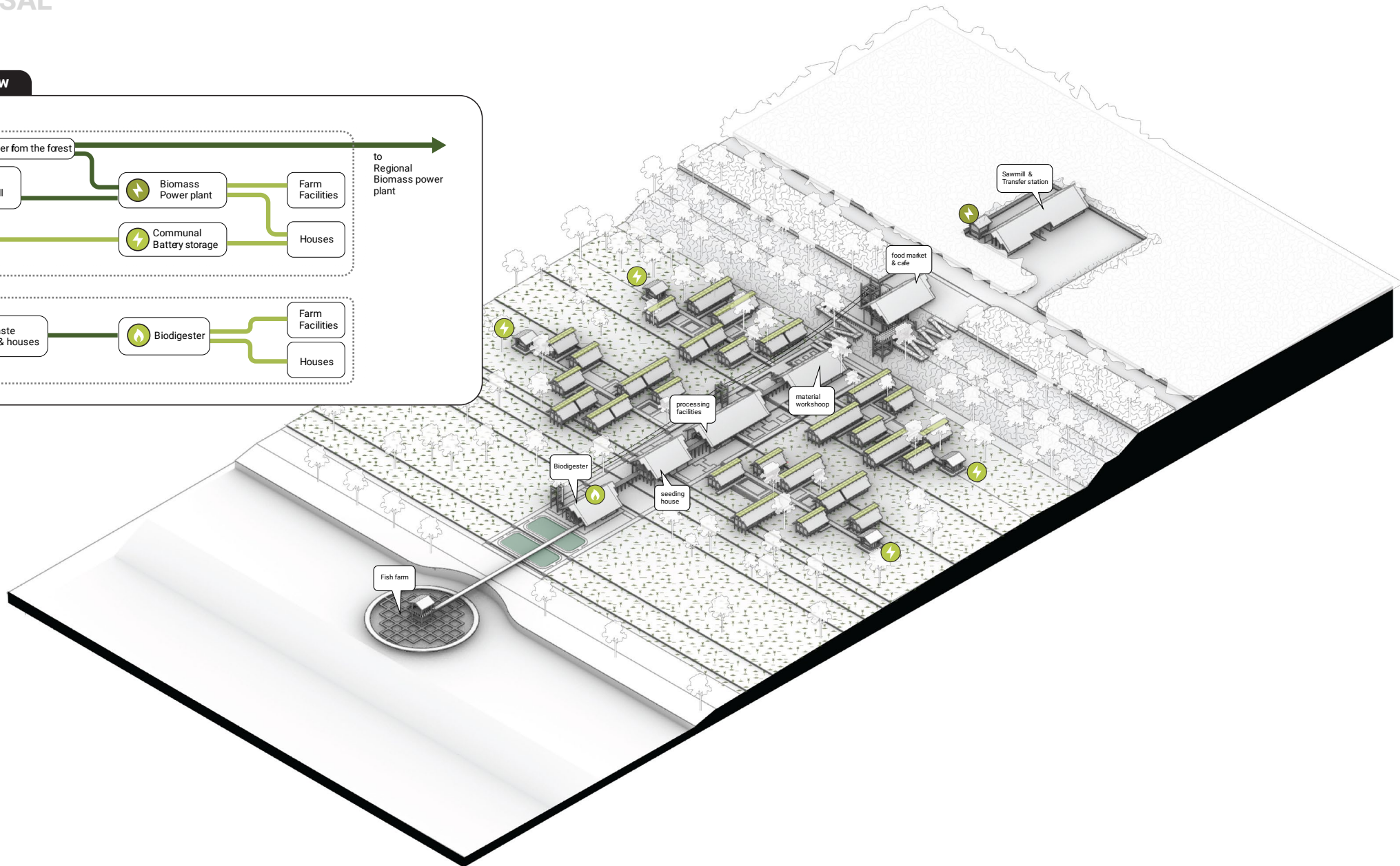
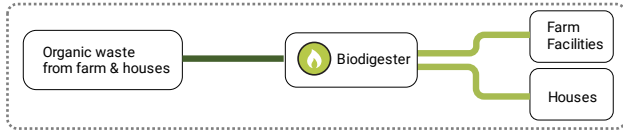
Flow

Energy Flow

Electricity

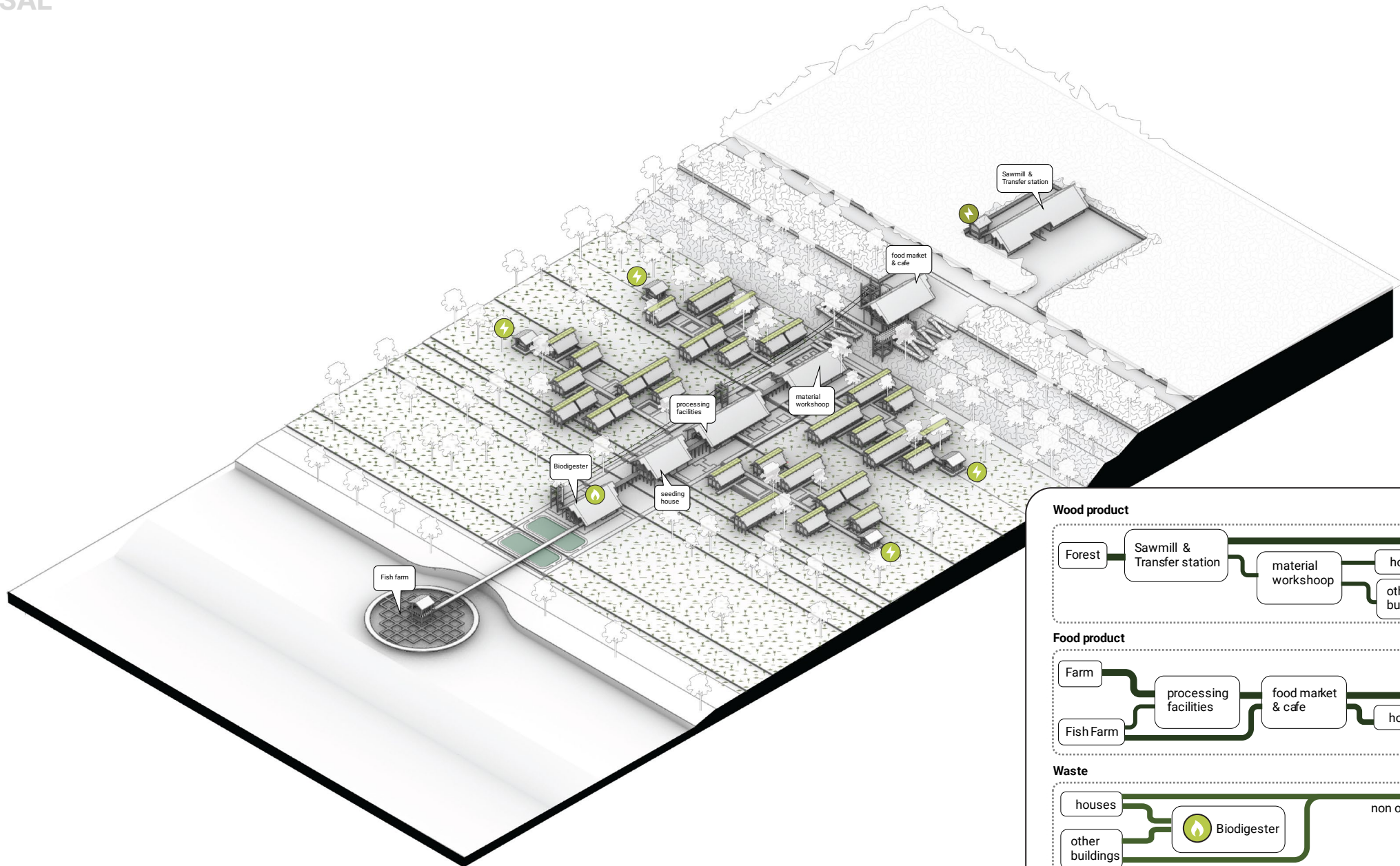


Cooking Gas

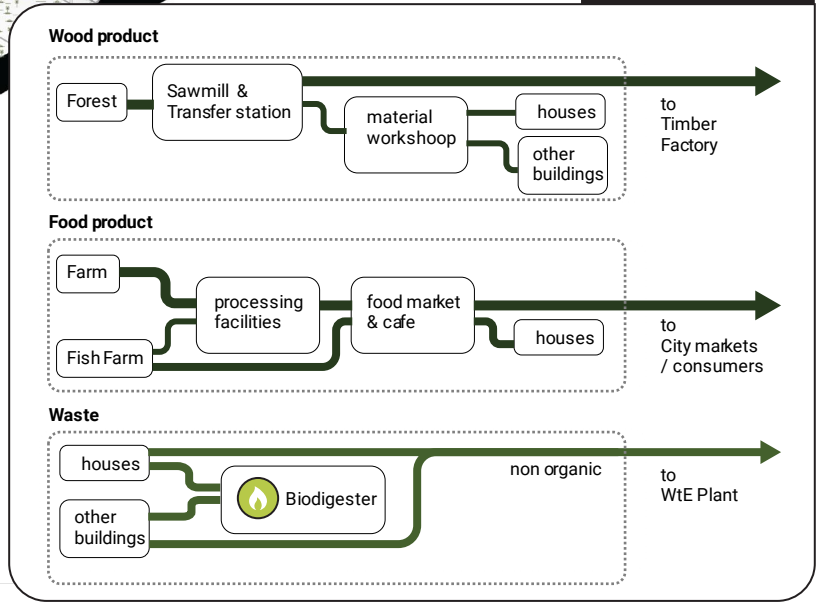


PROPOSAL

Flow

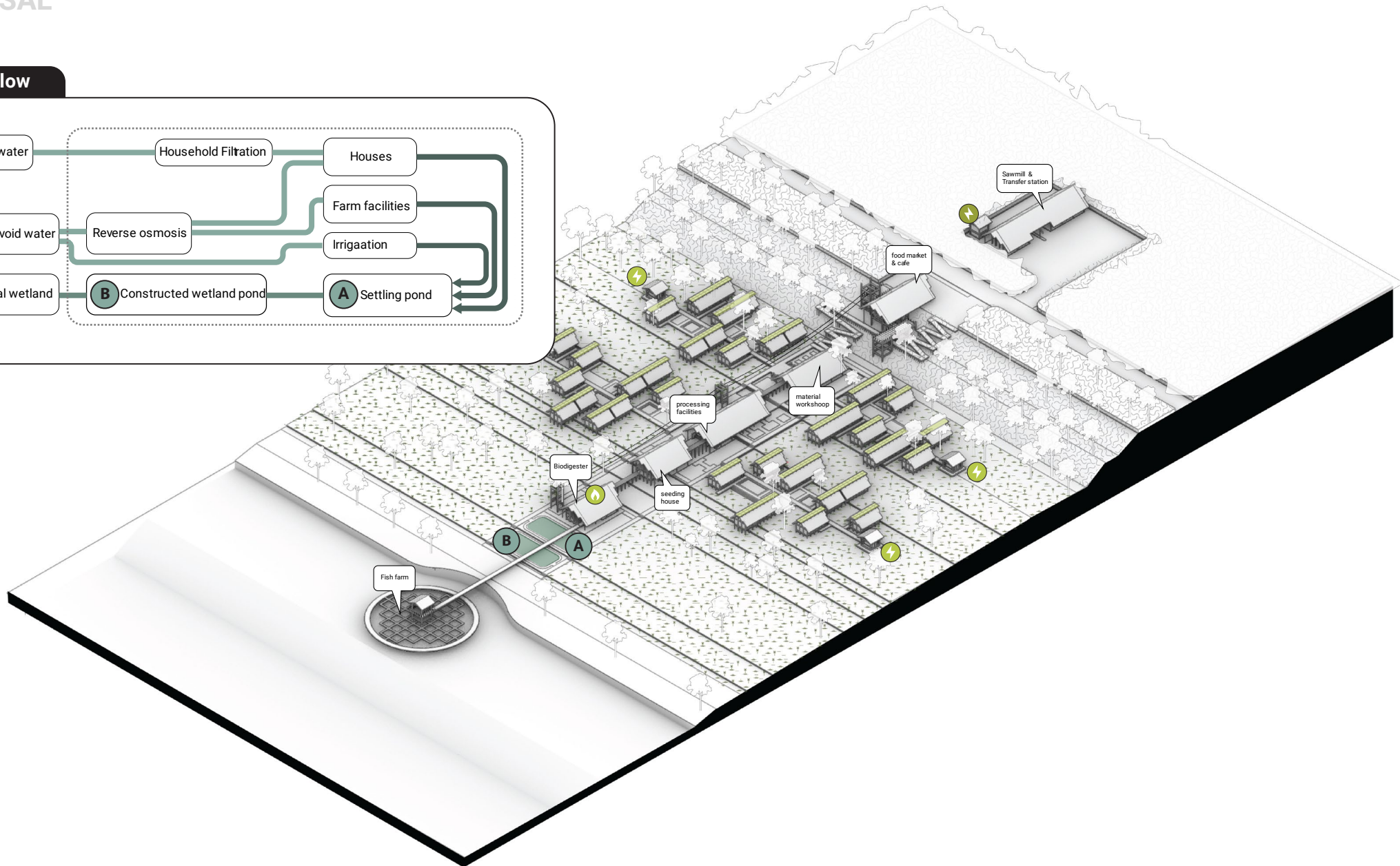
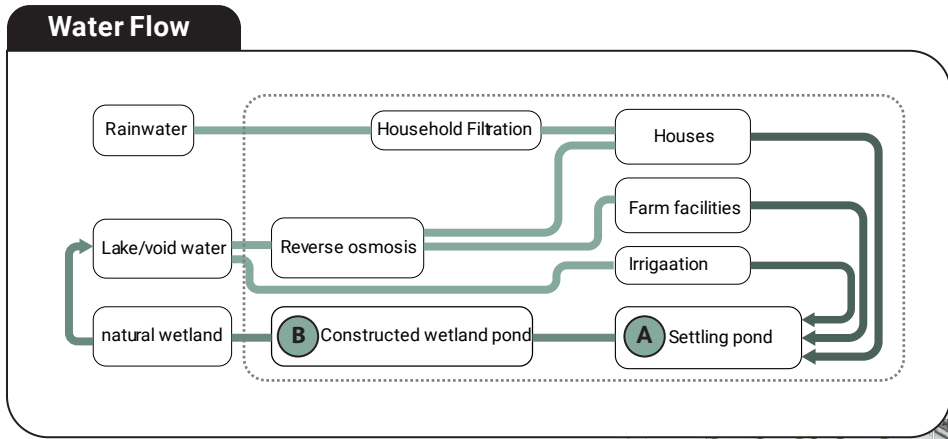


Material Flow



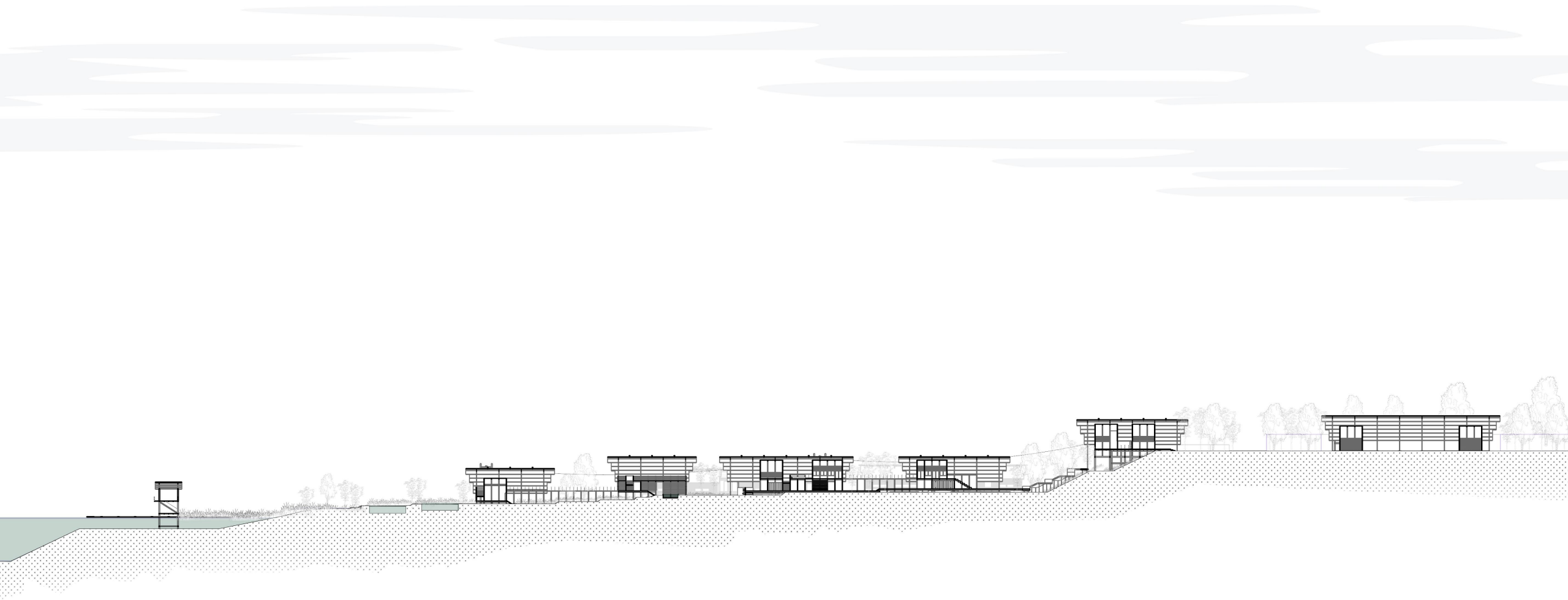
PROPOSAL

Flow



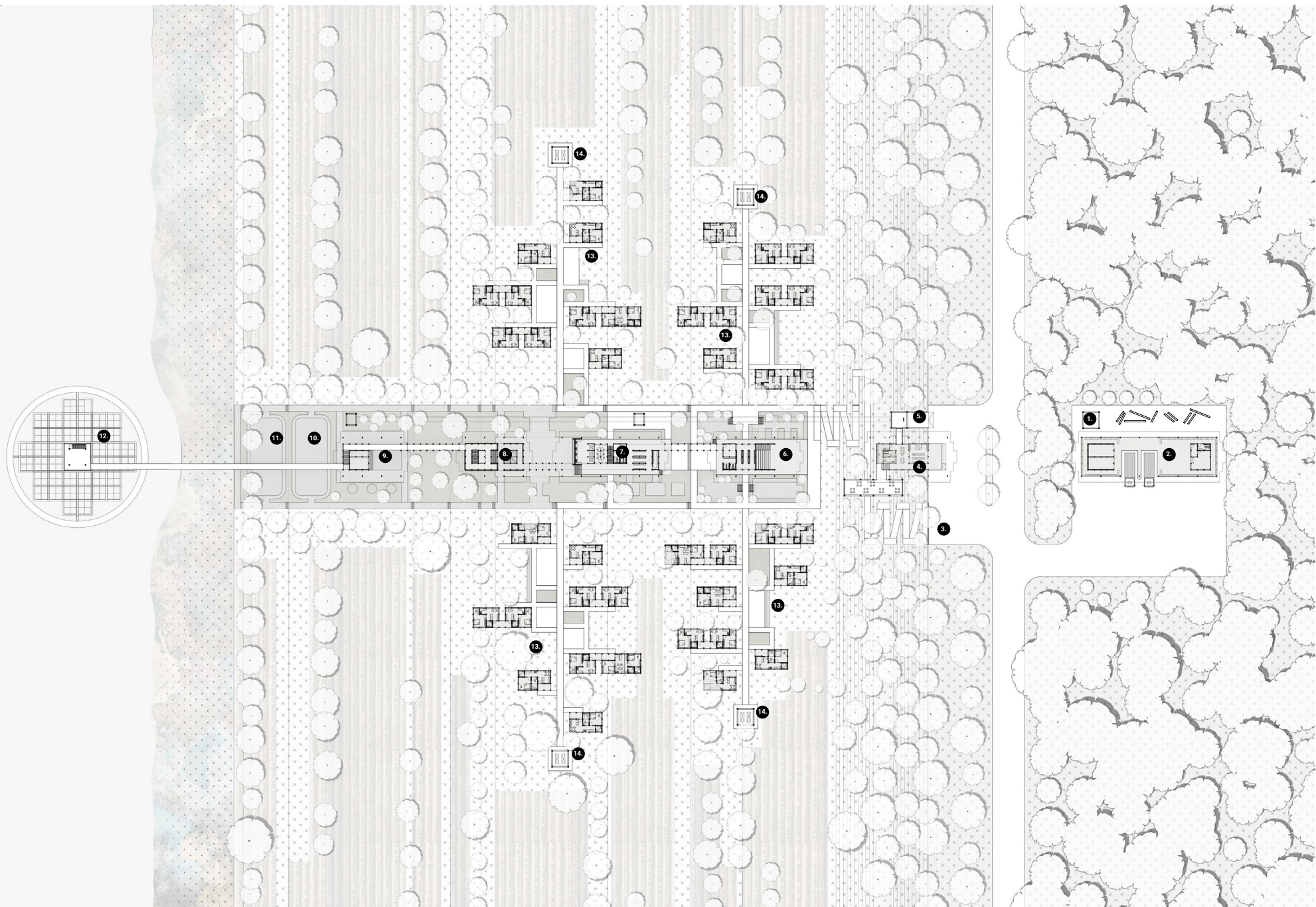
PROPOSAL

Flows : Material



PROPOSAL

Masterplan



↑ SITEPLAN

1. Small scale Biomass Powerplant
2. Sawmill & Transfer station
3. Parking area & Entrance walkway
4. Food market & Cafe
5. Logistic trasport
6. Community Space & Material workshop
7. Farm Harvesting Facility
8. Seeding house for Fish & Plants
9. Waste Management & Biodigester
10. Settling Pond
11. Constructed Wetland Pond
12. Caged Fish Farm
13. Housing area
14. Shared Energy Storage

0 10 30 60



"Land is not merely soil; it is a fountain of energy flowing through a circuit of soils, plants, and animals"

Aldo Leopold, A Sand County Almanac, 1949

An architectural rendering of a building design proposal. The image shows a large, modern building with a prominent, steeply pitched roof. The building's facade is composed of vertical slats or panels. In the foreground, there is a landscaped area with various plants and trees. Several human figures are scattered throughout the scene, providing a sense of scale. The overall aesthetic is clean and professional, typical of architectural presentations.

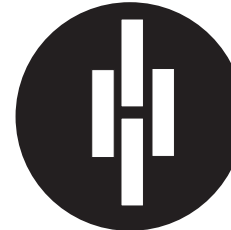
PROPOSAL:
BUILDING DESIGN.



Coal Closure-Related
materials



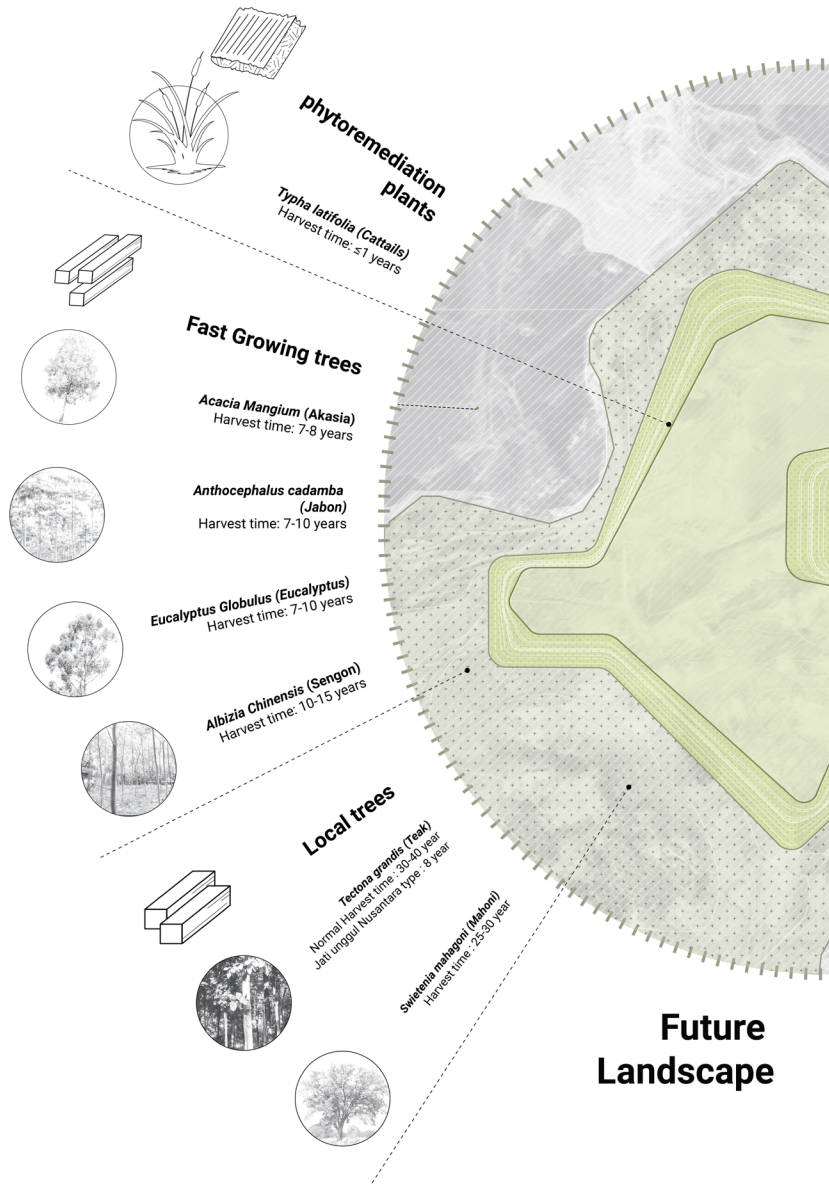
Highlighting Local
identity



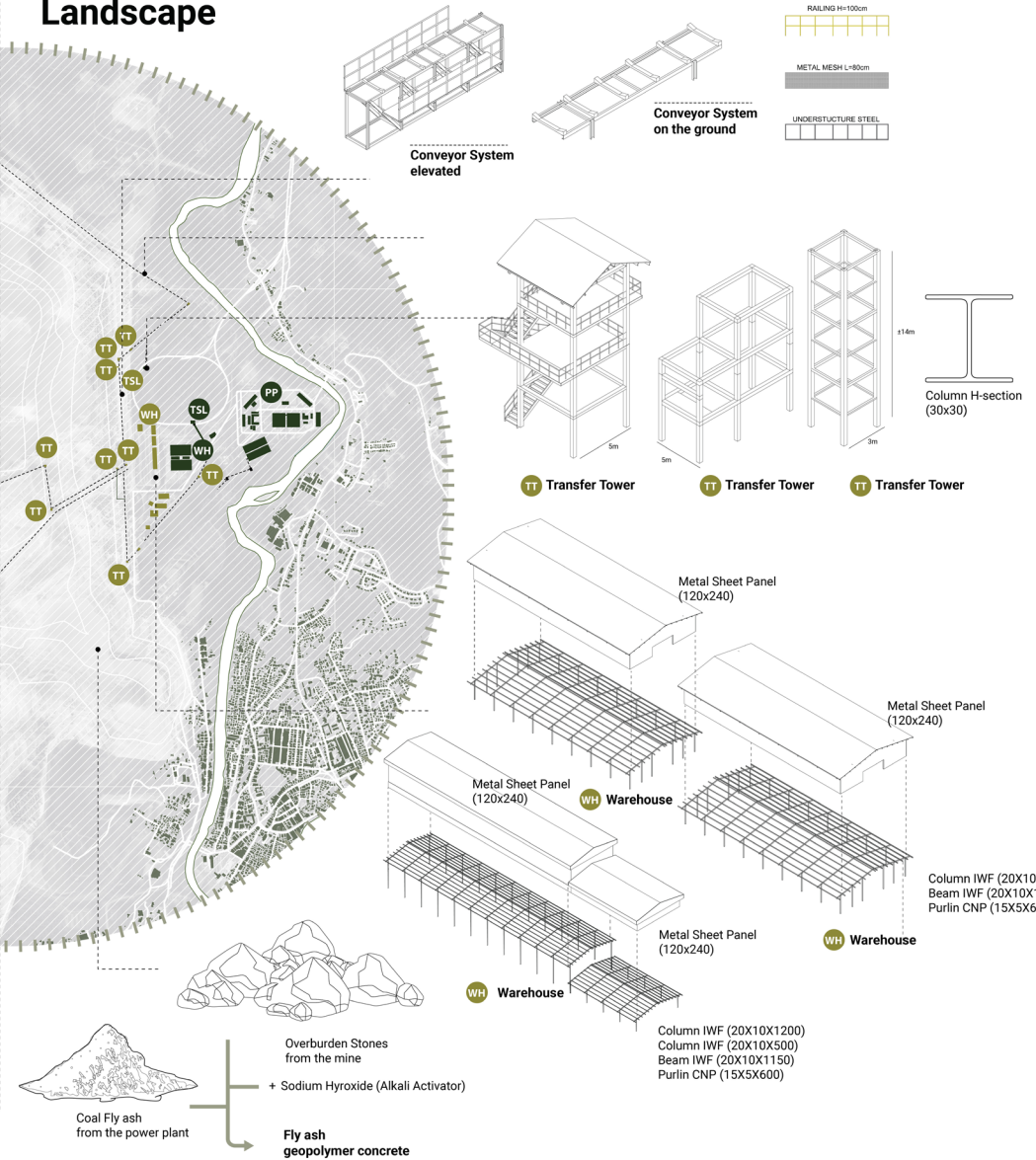
Adaptive to change

BUILDING DESIGN

Material Source



Current Landscape

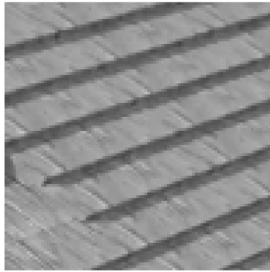


Future Landscape

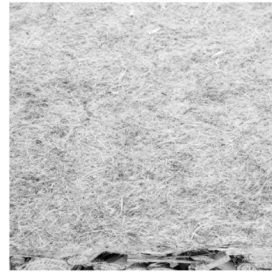
BUILDING DESIGN

Material Source

Phytoremediation Plants



Typha latifolia (Cattails)
Thatch Roof



Typha latifolia (Cattails)
Fiber Insulation

Selected Fast Growing Timber

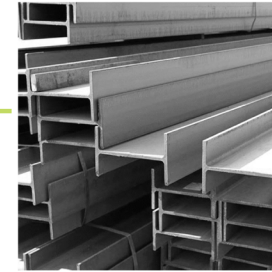


Acacia Mangium x Auriculiformis
Density : 445-465 kg/m³
Average Diameter age 8-10 : 23.3cm

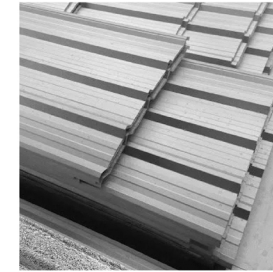


Falcataria Moluccana
Density : 230-500 kg/m³
Average Diameter age 8-10 : 40cm

Existing Warehouse & Infrastructure



Steel Profile
IWF & CNP



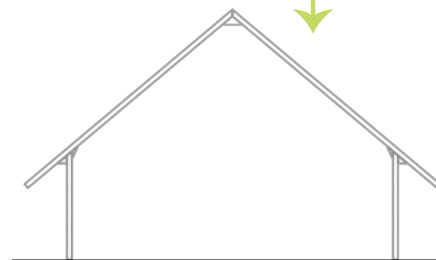
Corrugated Metal Sheet



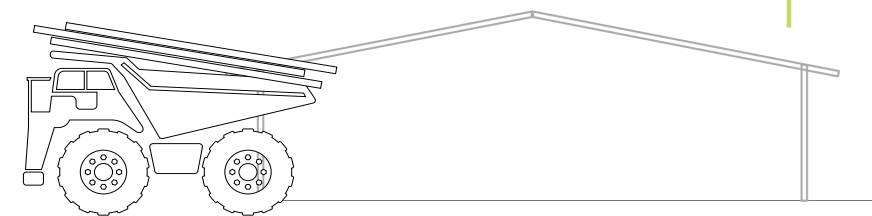
Safety Railing



Fly Ash Geopolymer Concrete



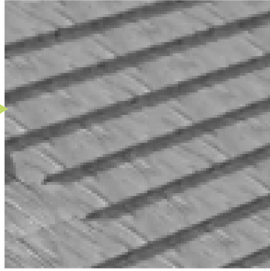
Dismantling & Rearranging



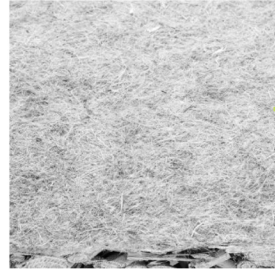
BUILDING DESIGN

Material Source

Phytoremediation Plants



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Thatch Roof



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Fiber Insulation

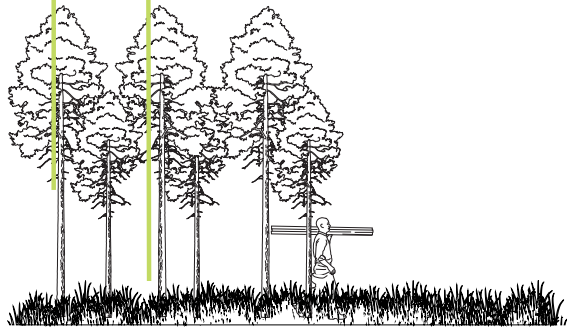
Selected Fast Growing Timber



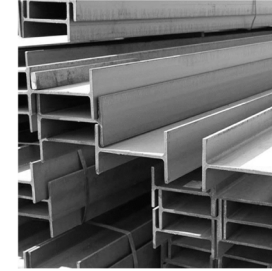
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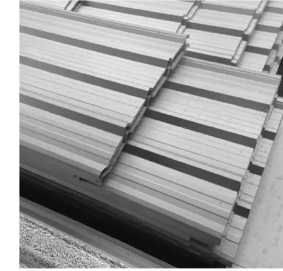
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Existing Warehouse & Infrastructure



Steel Profile
IWF & CNP



Corrugated Metal Sheet



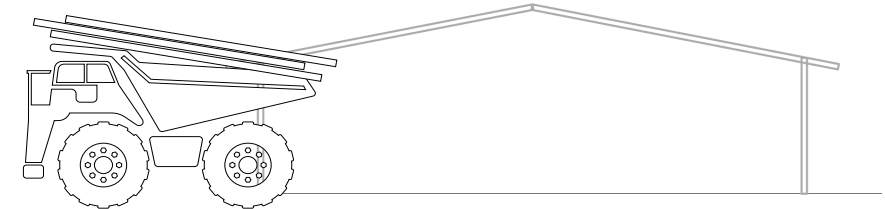
Safety Railing



Fly Ash Geopolymer Concrete



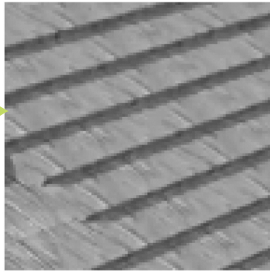
Infill & Layering



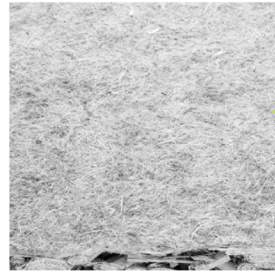
BUILDING DESIGN

Material Source

Phytoremediation Plants



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Thatch Roof



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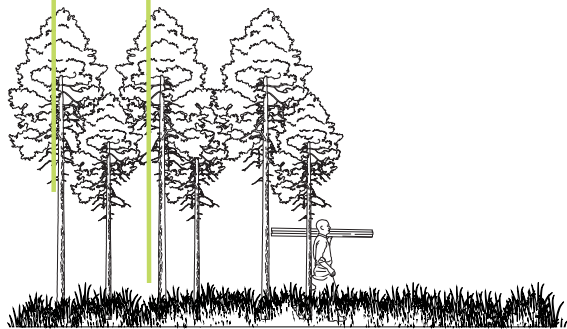
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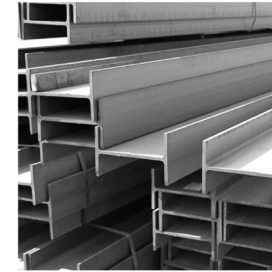
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Density : 445-465 kg/m³
Average Diameter age 8-10 : 23.3cm



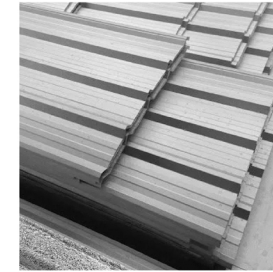
Falcataria Moluccana
Density : 230-500 kg/m³
Average Diameter age 8-10 : 40cm



Existing Warehouse & Infrastructure



Steel Profile
IWF & CNP



Corrugated Metal Sheet



Safety Railing



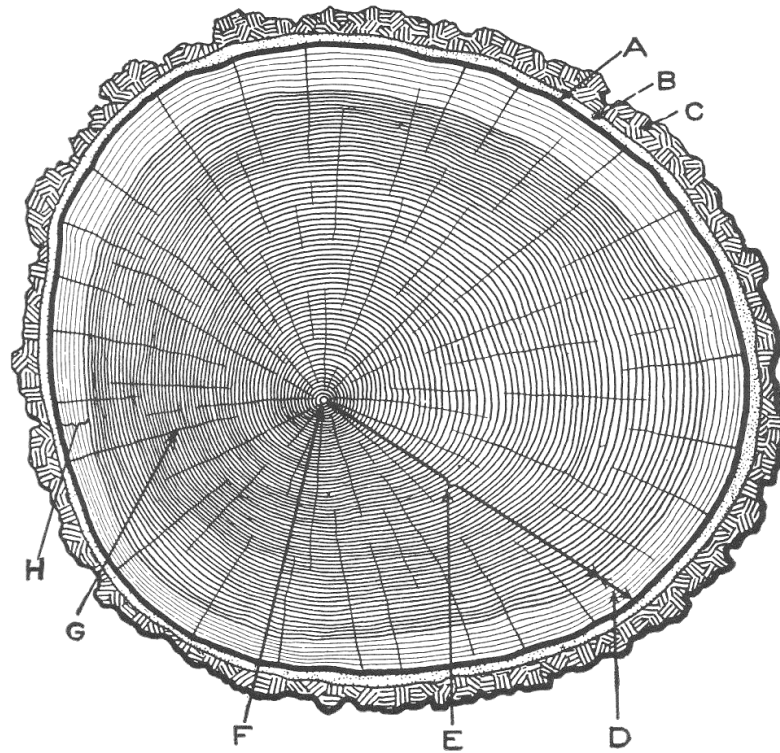
Fly Ash Geopolymer Concrete



Harvest & Build

BUILDING DESIGN

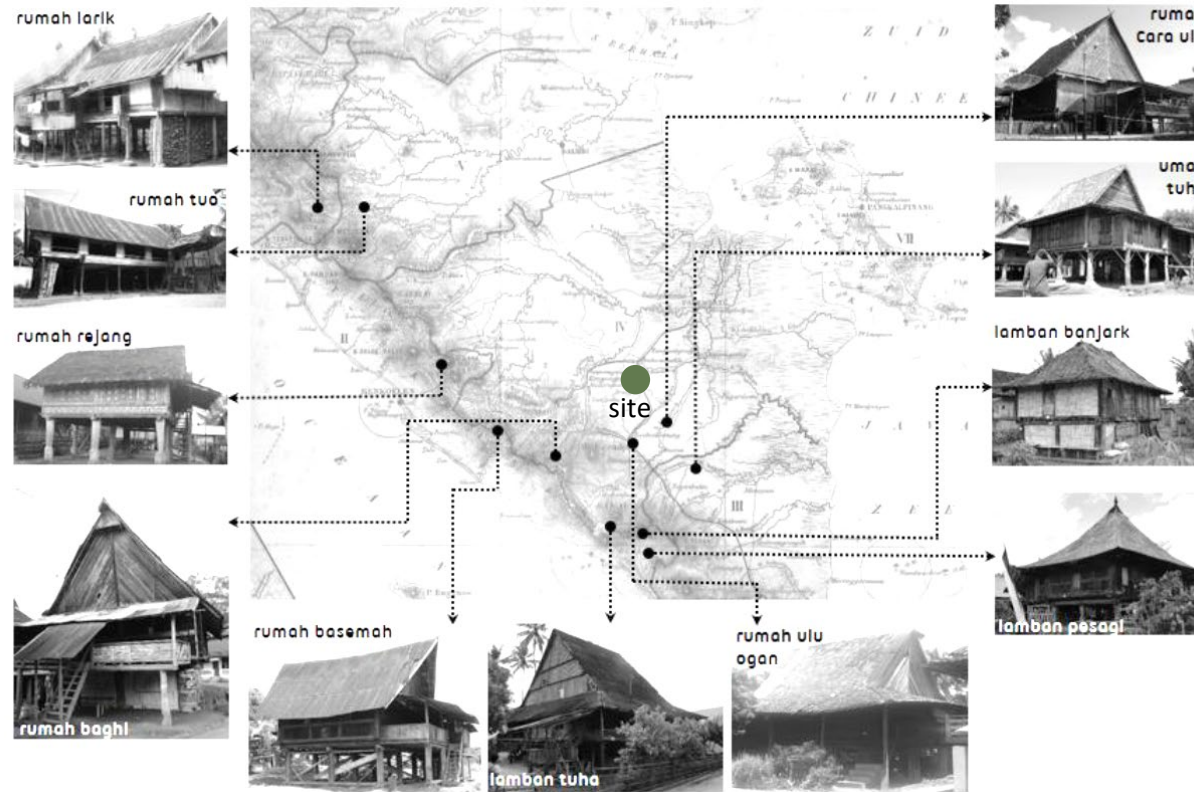
Local Identity & Building Culture



*Cross-Section of Tree Trunk
"American Woods" by Schoonover, pg. 8*

BUILDING DESIGN

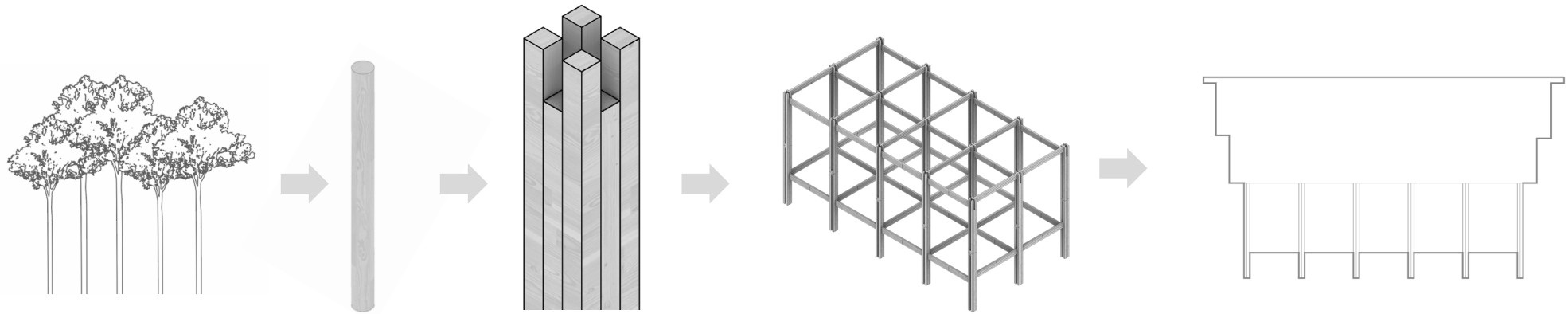
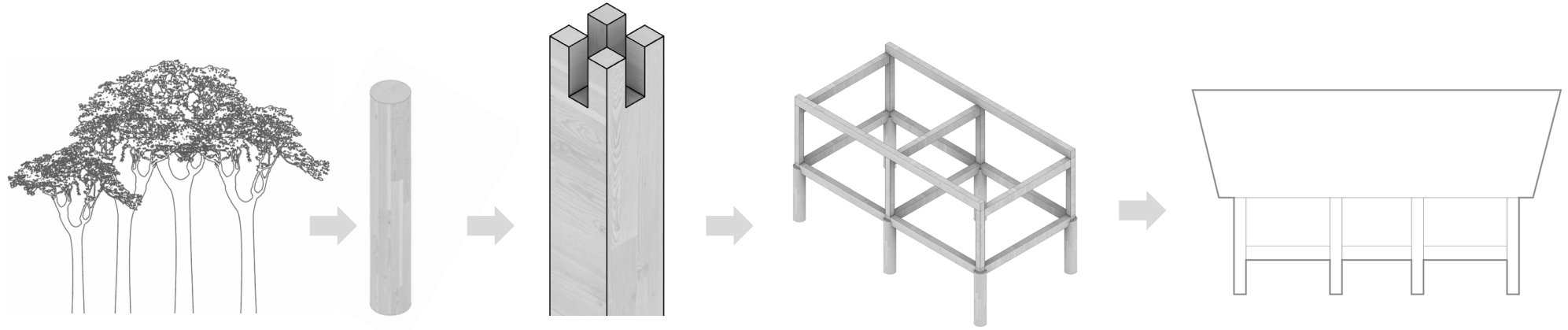
Local Identity & Building Culture



Sebaran Artefak Arsitektur Nusantara di Uluan Sumatera Bagian Selatan (Sumber: Putri & Ibnu, 2017, p. 501)

BUILDING DESIGN

Adaptation

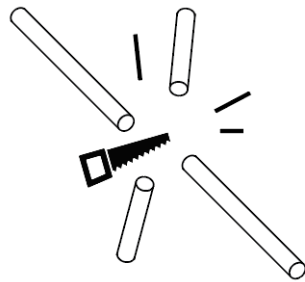


BUILDING DESIGN

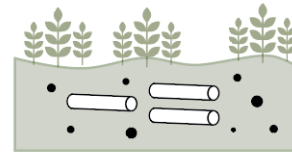
Fast Growing Timber : Preservation



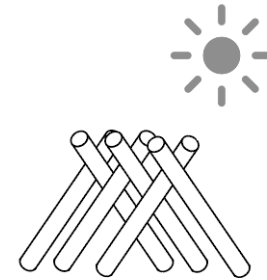
Growing
8-10 year



Harvesting & Sawmilling



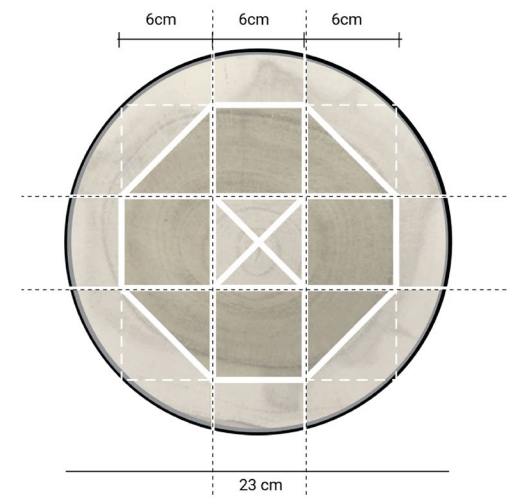
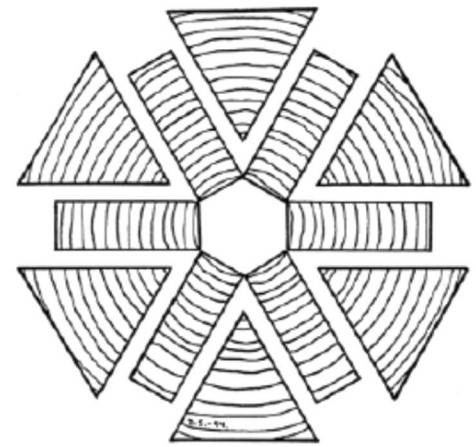
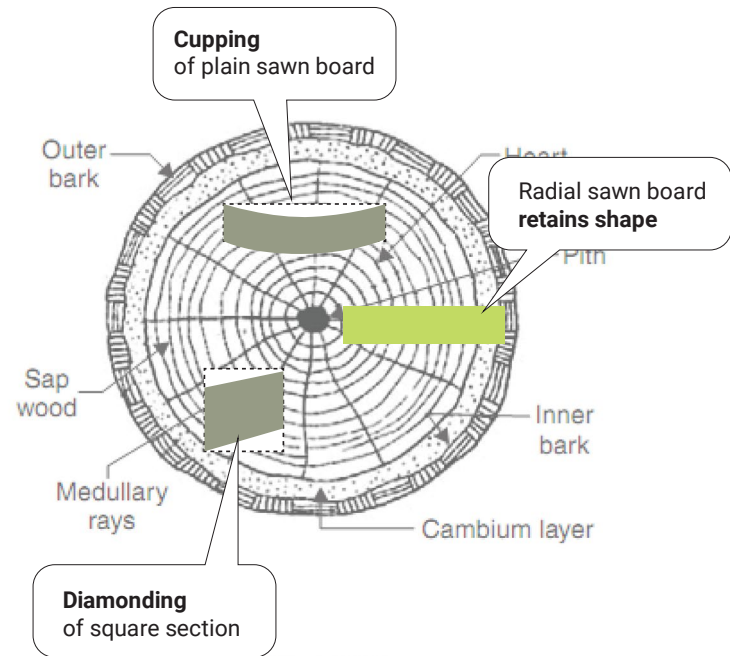
Soaking under the mud
1-2 year



Drying
1-2 year

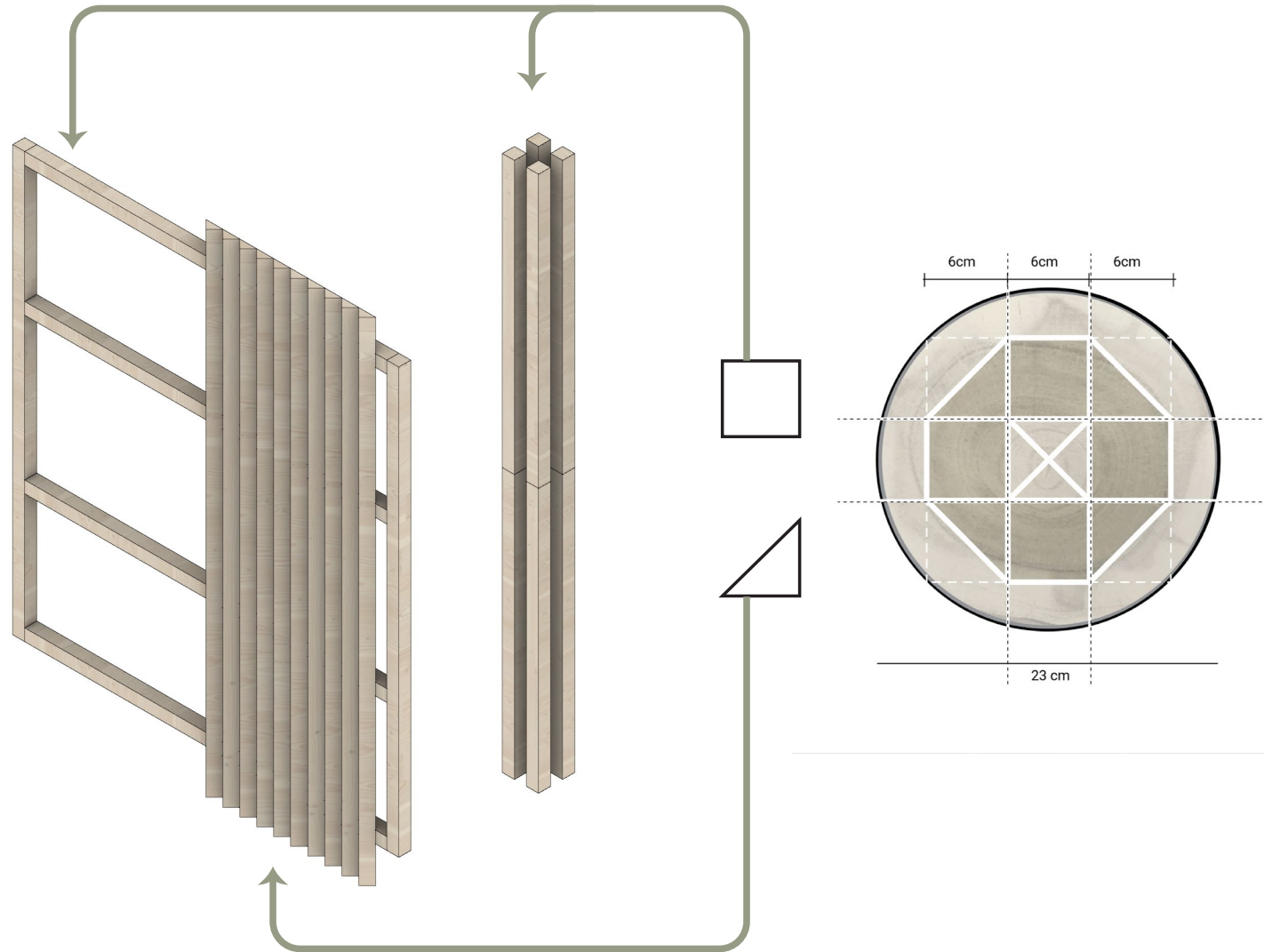
BUILDING DESIGN

Fast Growing Timber : Sawing & Dimension



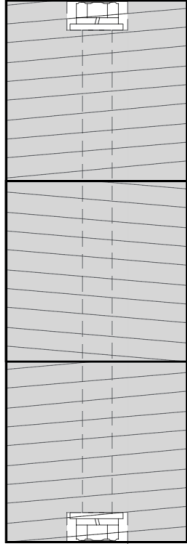
BUILDING DESIGN

Fast Growing Timber : Sawing & Dimension

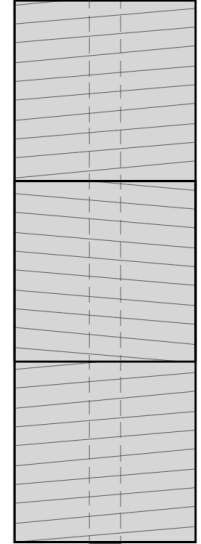
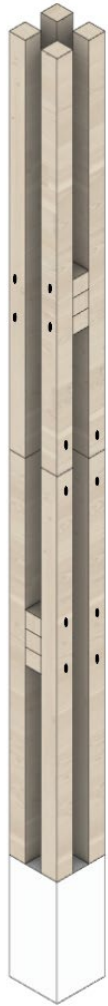


BUILDING DESIGN

Frame types



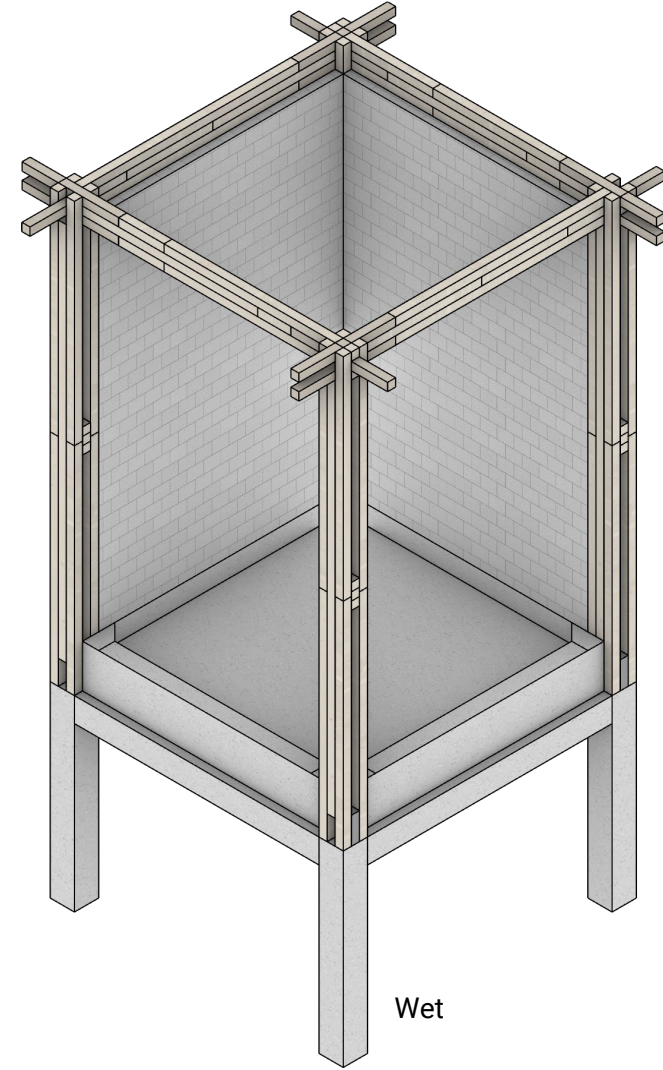
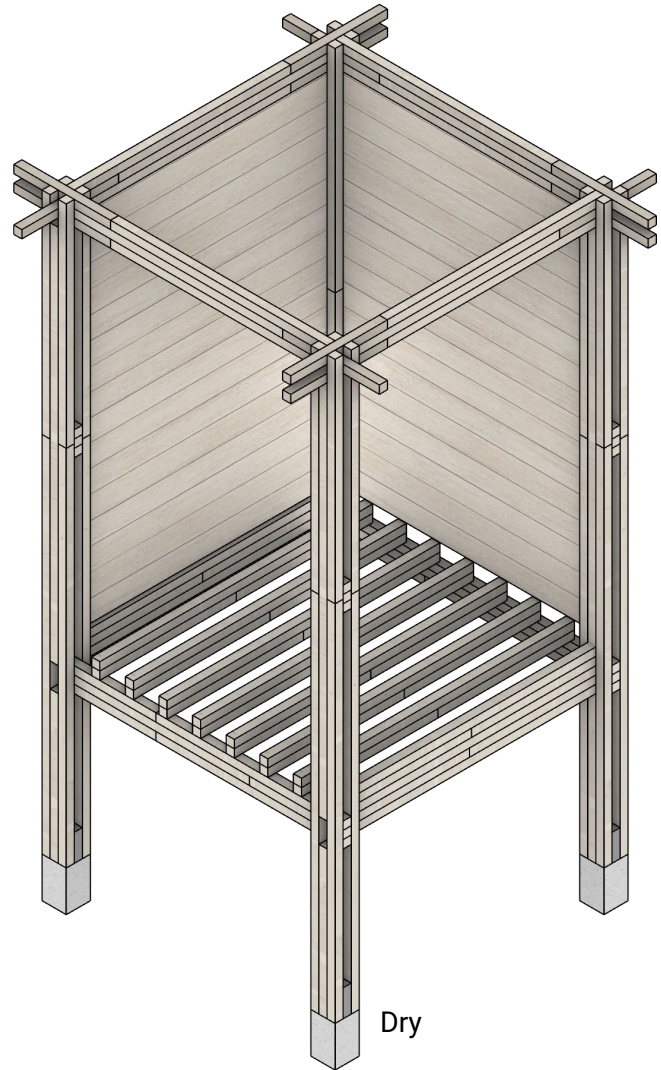
Bolts
Demountable
Expensive



Dowels
Rigid
Cheaper

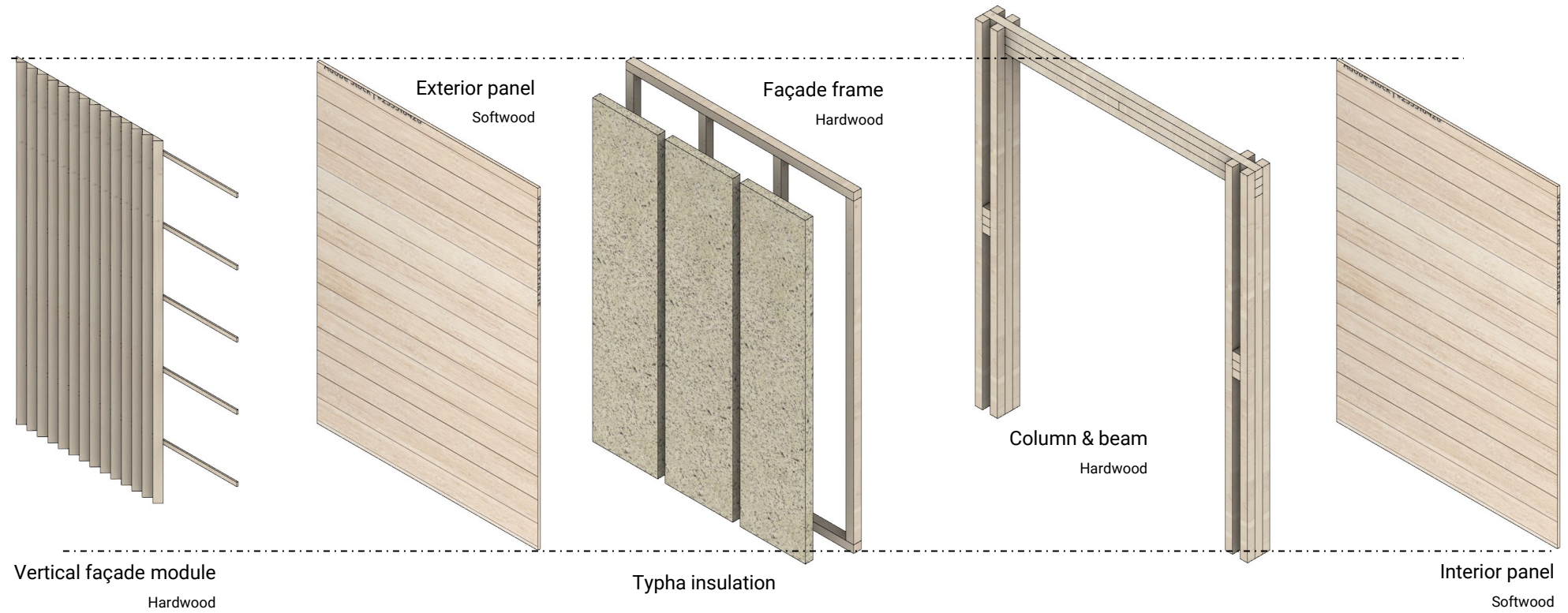
BUILDING DESIGN

Module Types



BUILDING DESIGN

Wall Construction

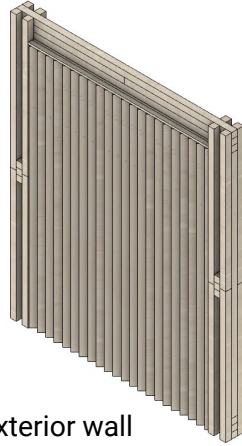


BUILDING DESIGN

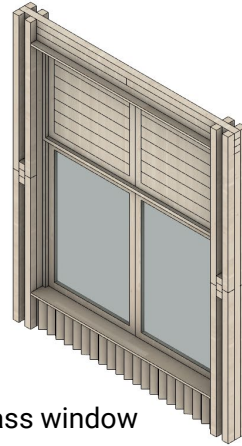
Wall Types



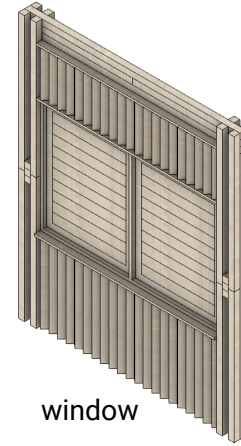
Interior wall



Exterior wall



Glass window



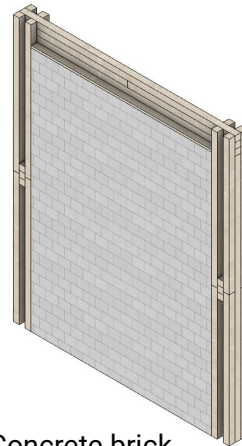
window



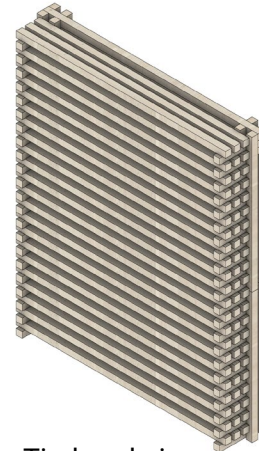
Door



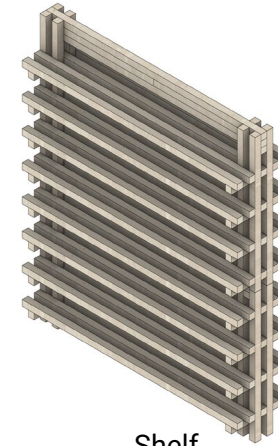
Folding door



Concrete brick



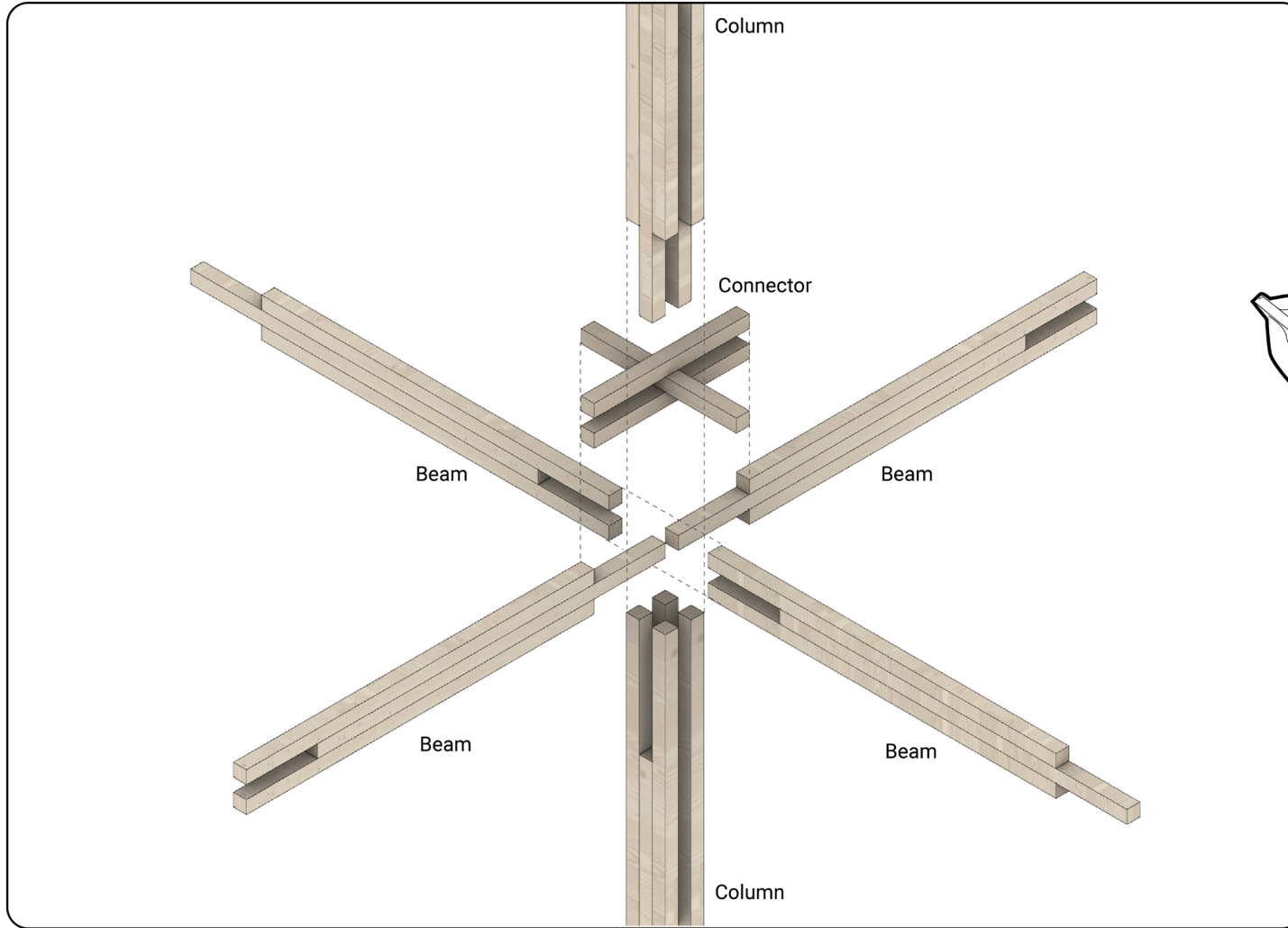
Timber drying



Shelf

BUILDING DESIGN

Vertical & Lateral Connection



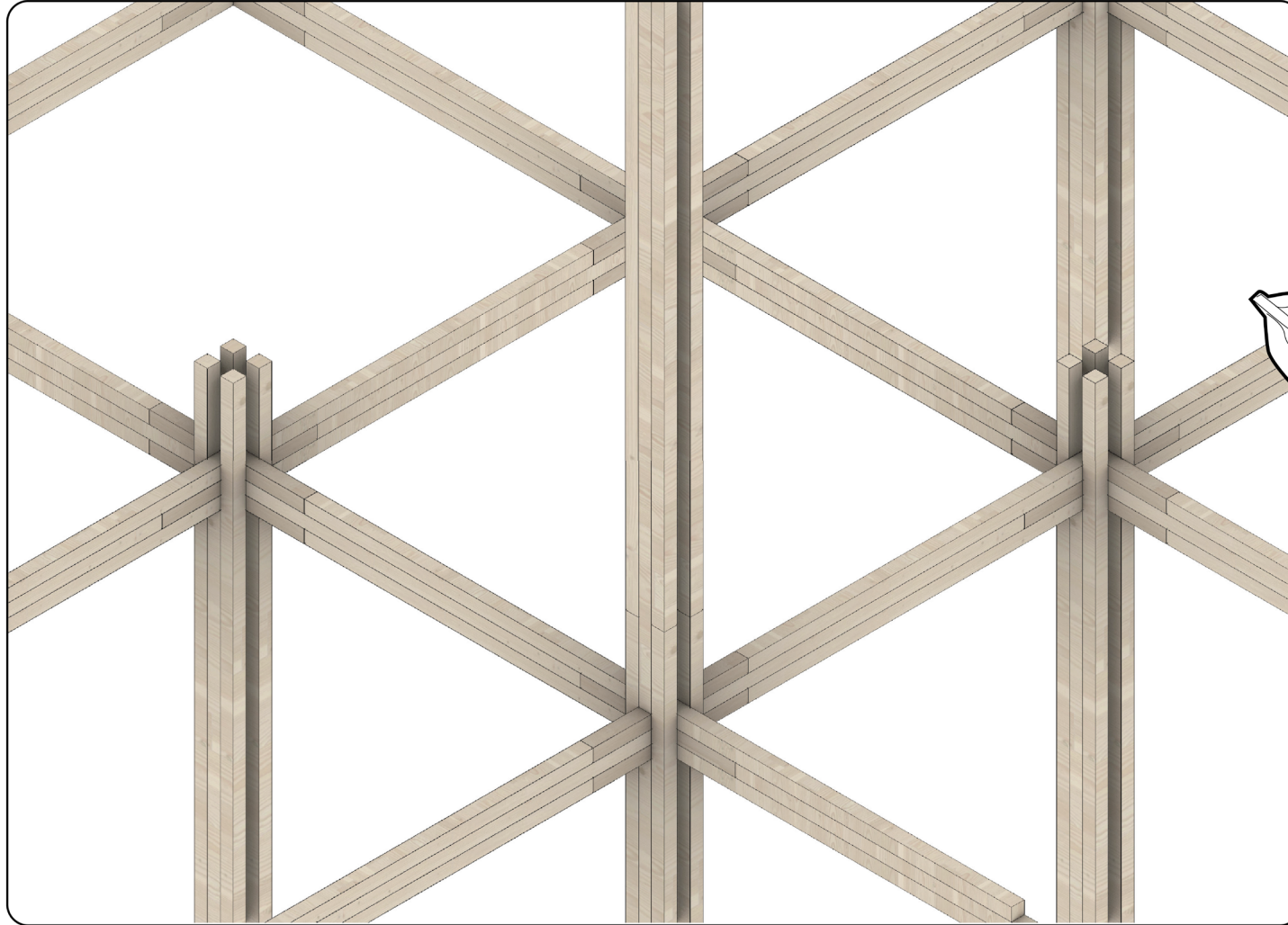
BUILDING DESIGN

Vertical & Lateral Connection



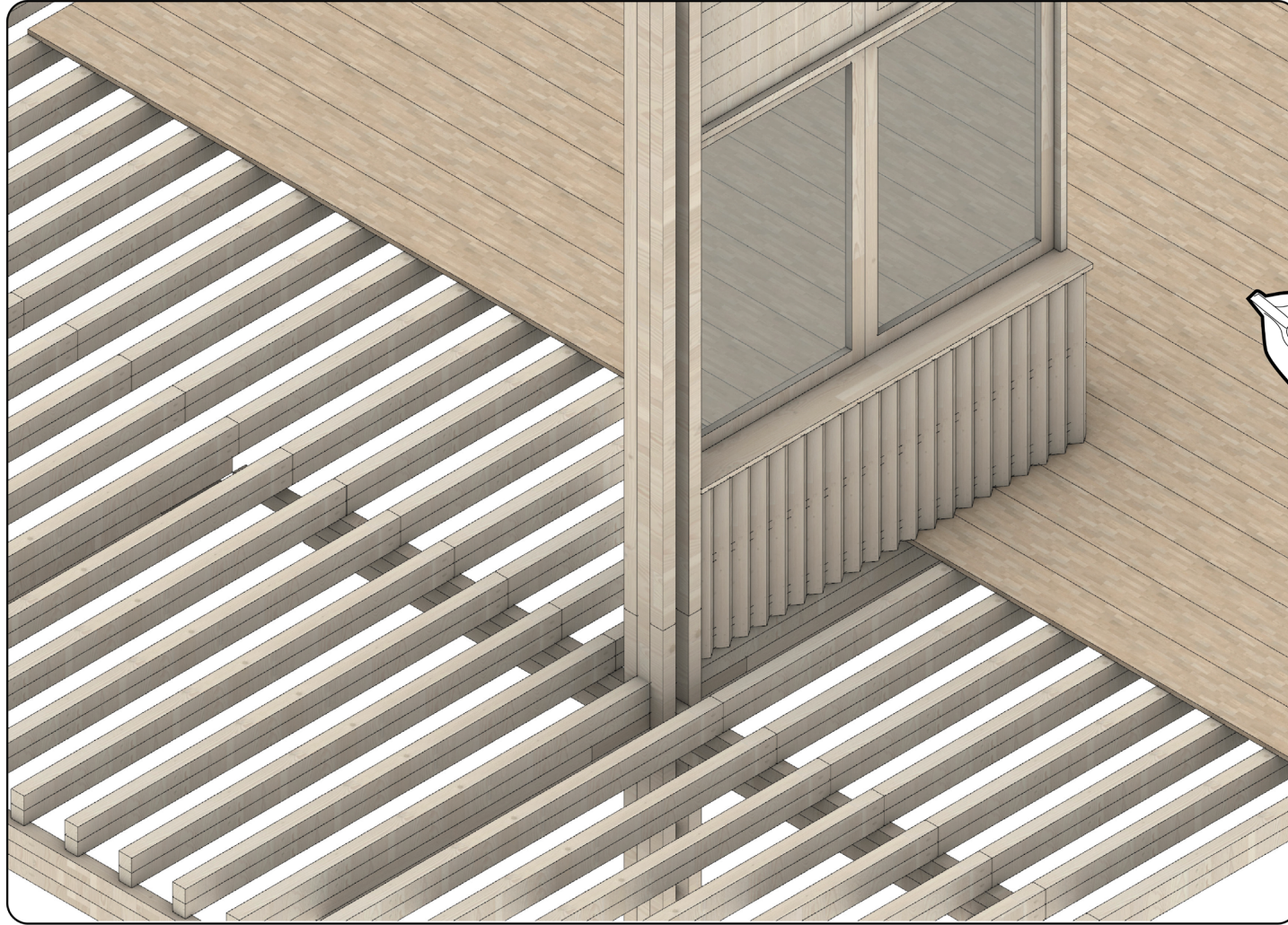
BUILDING DESIGN

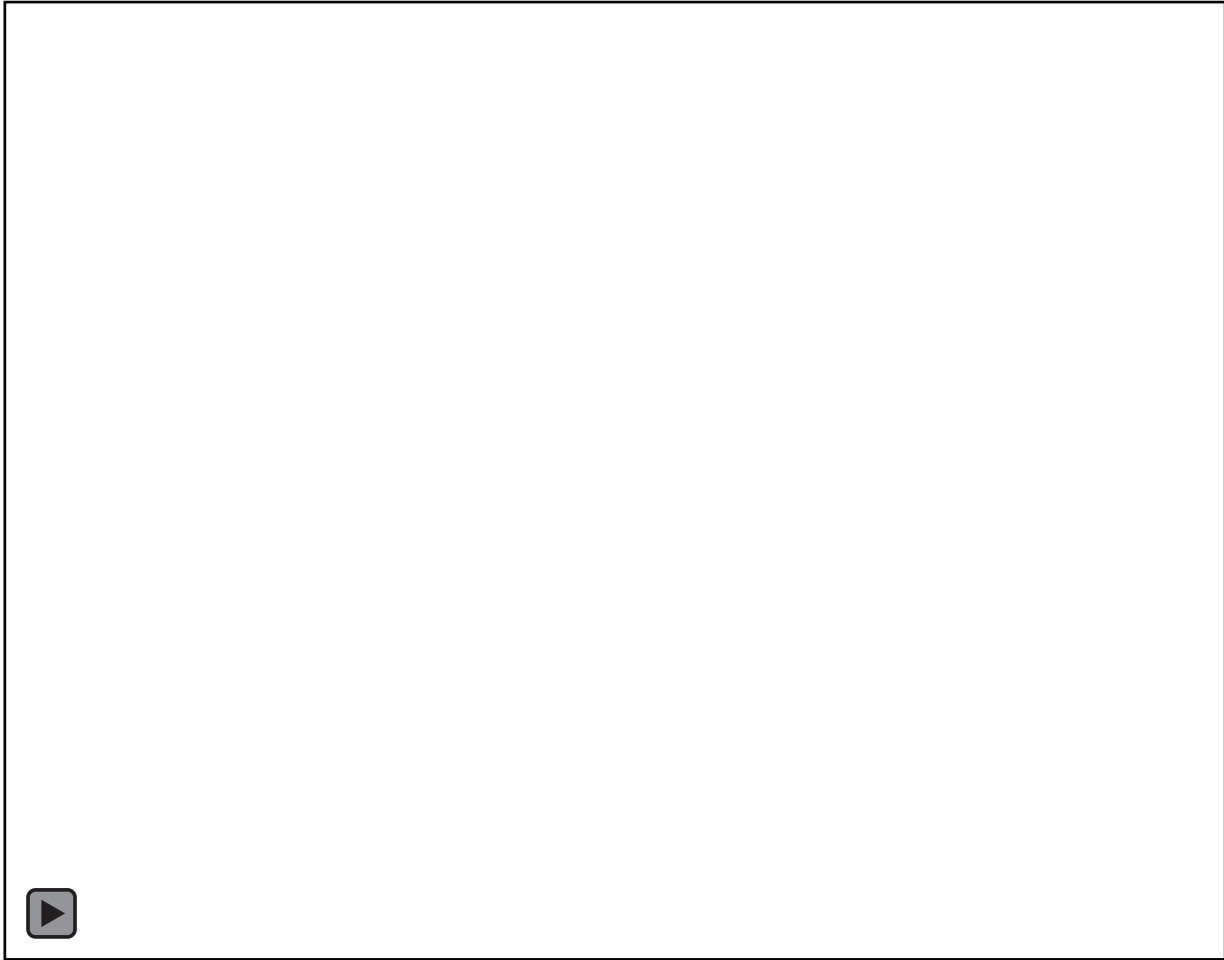
Vertical & Lateral Connection



BUILDING DESIGN

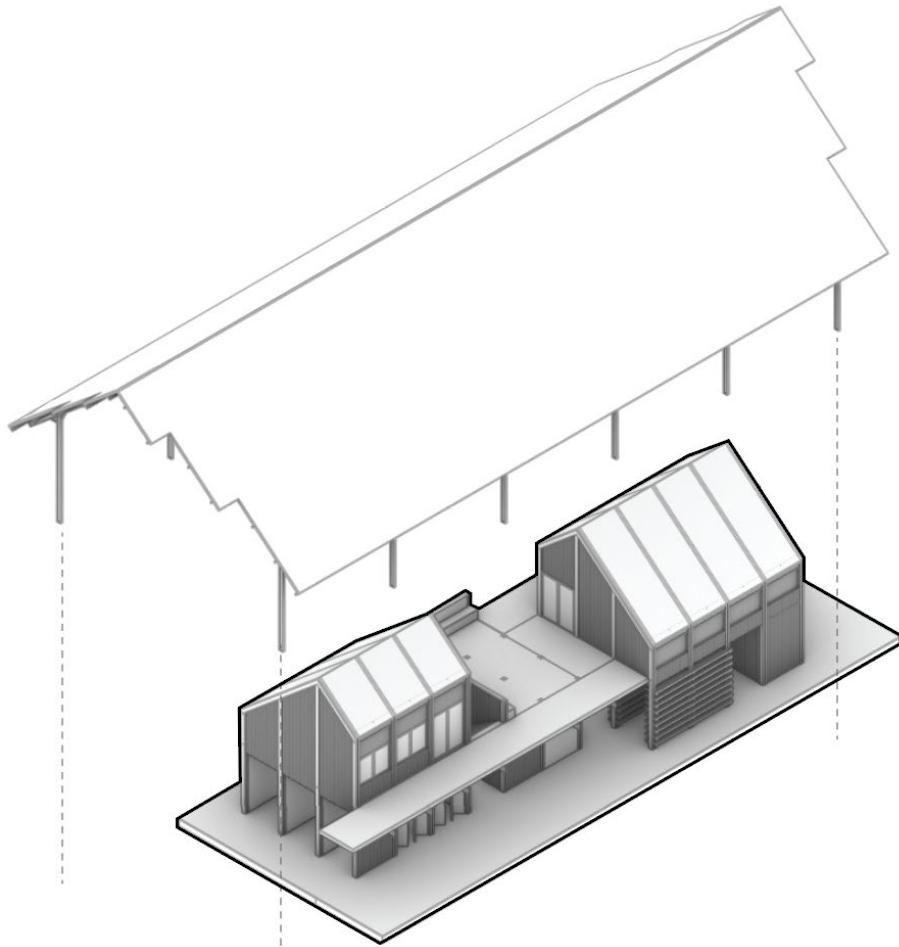
Vertical & Lateral Connection



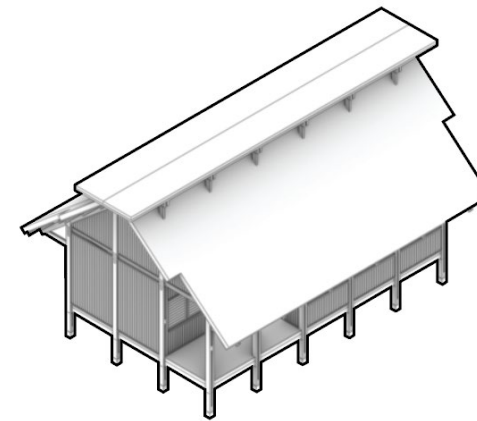


BUILDING DESIGN

Building Types



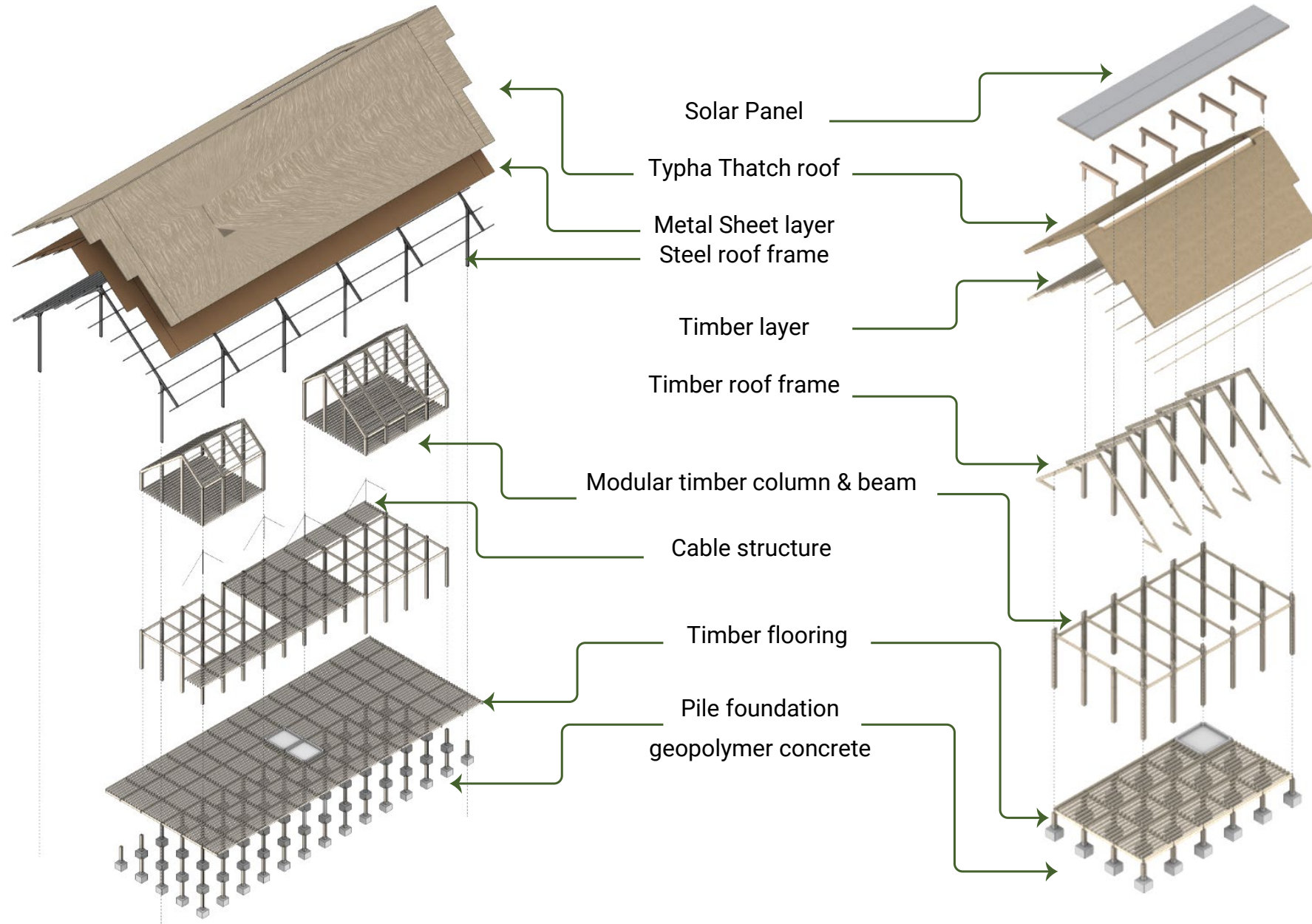
Facility Buildings



Housing

BUILDING DESIGN

Building Types



An architectural rendering of a farm facility. The scene features a long, modern building with a gabled roof and large glass windows. A cable car system is visible, with two cars suspended from cables. The foreground is filled with lush greenery, including various plants and trees. Several human figures are scattered throughout the scene, some standing near the building and others walking on a path. The overall atmosphere is bright and airy, with a soft, slightly desaturated color palette.

FARM FACILITIES

FARM FACILITIES

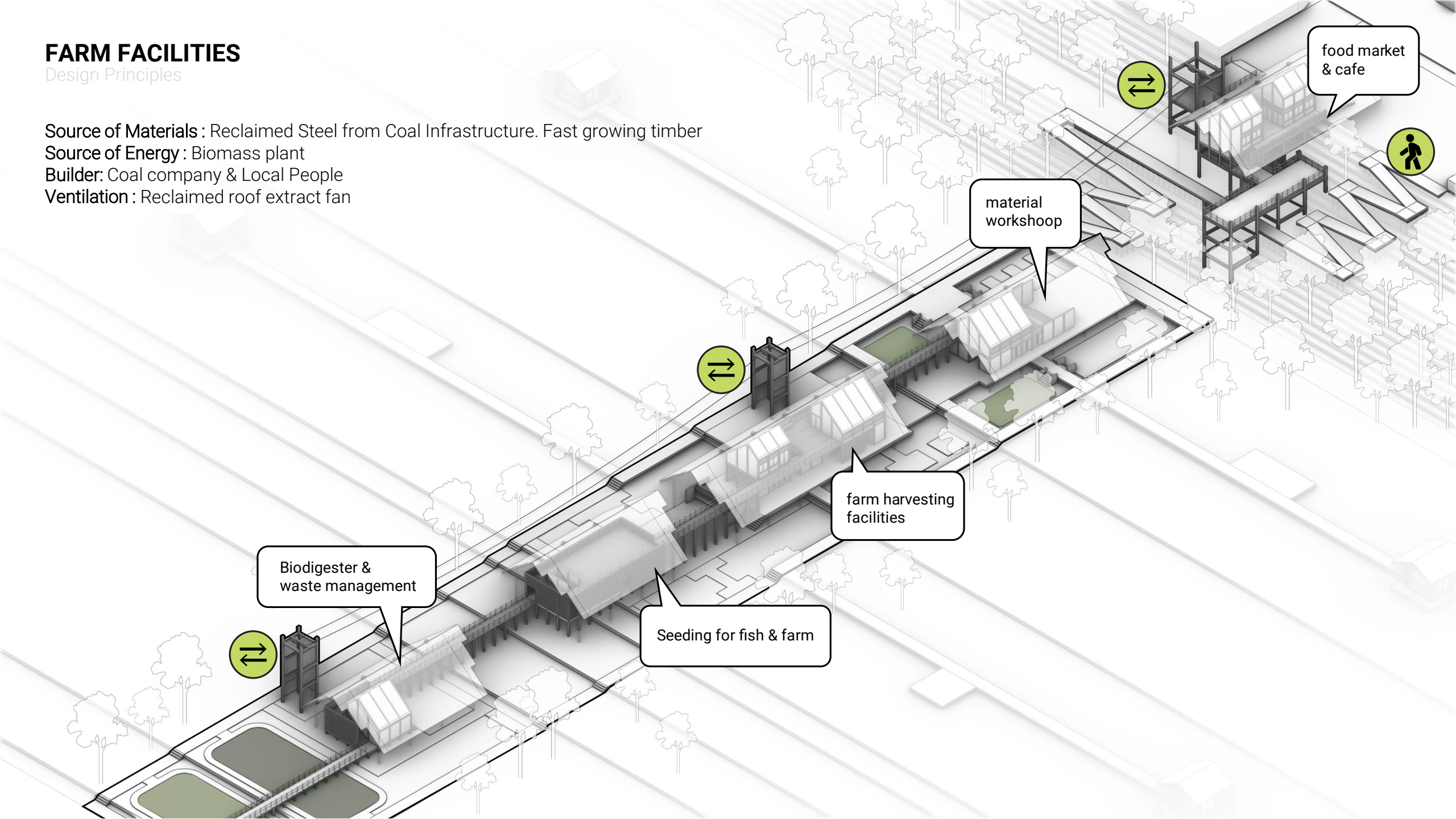
Design Principles

Source of Materials : Reclaimed Steel from Coal Infrastructure. Fast growing timber

Source of Energy : Biomass plant

Builder: Coal company & Local People

Ventilation : Reclaimed roof extract fan



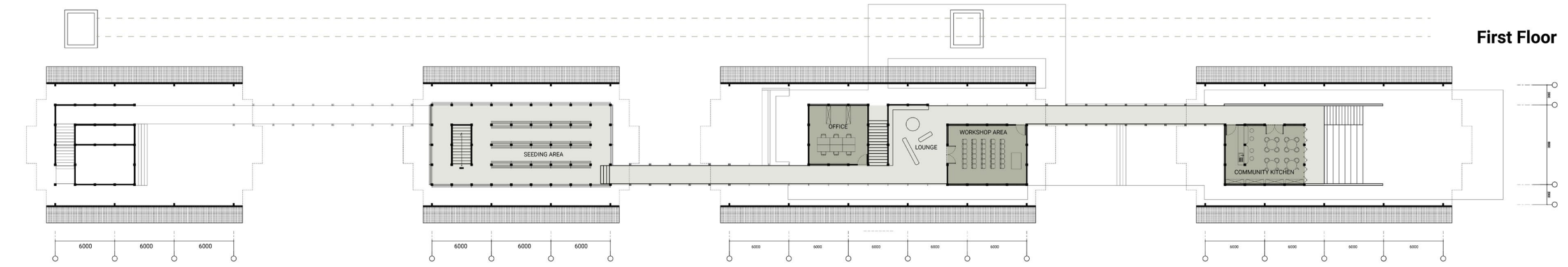




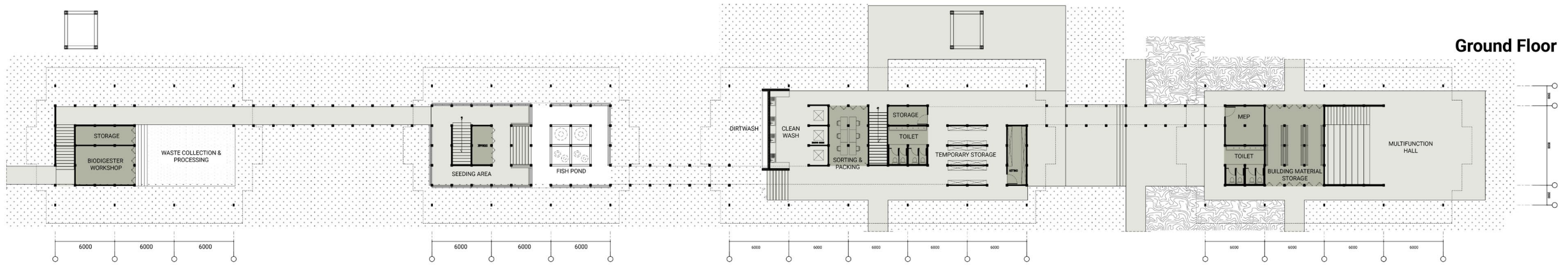


FARM FACILITIES

Floor Plan



First Floor



Ground Floor

Biodigester & waste management

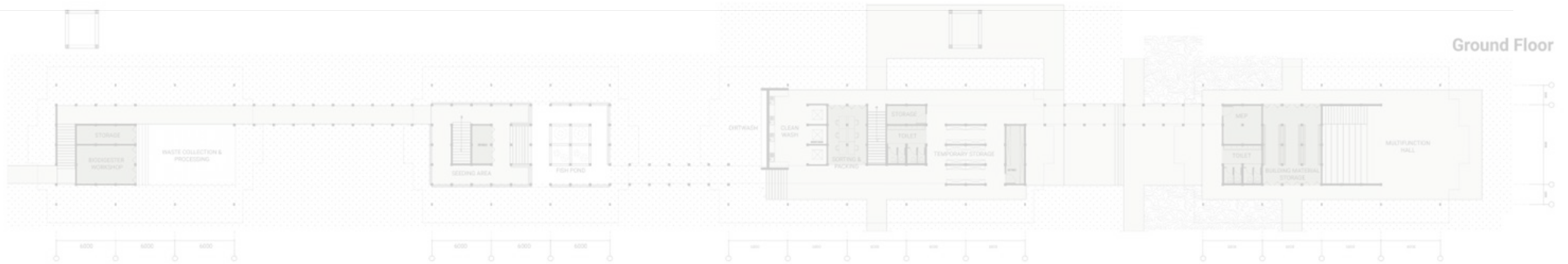
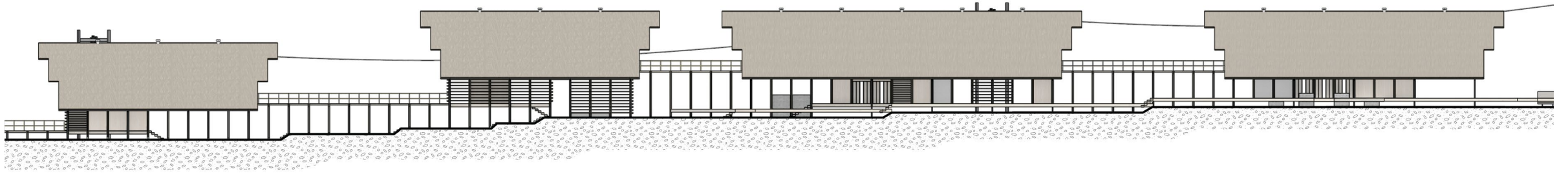
Seeding for fish & farm

Farm Harvesting Facility

Community Space

FARM FACILITIES

Elevation



FARM FACILITIES

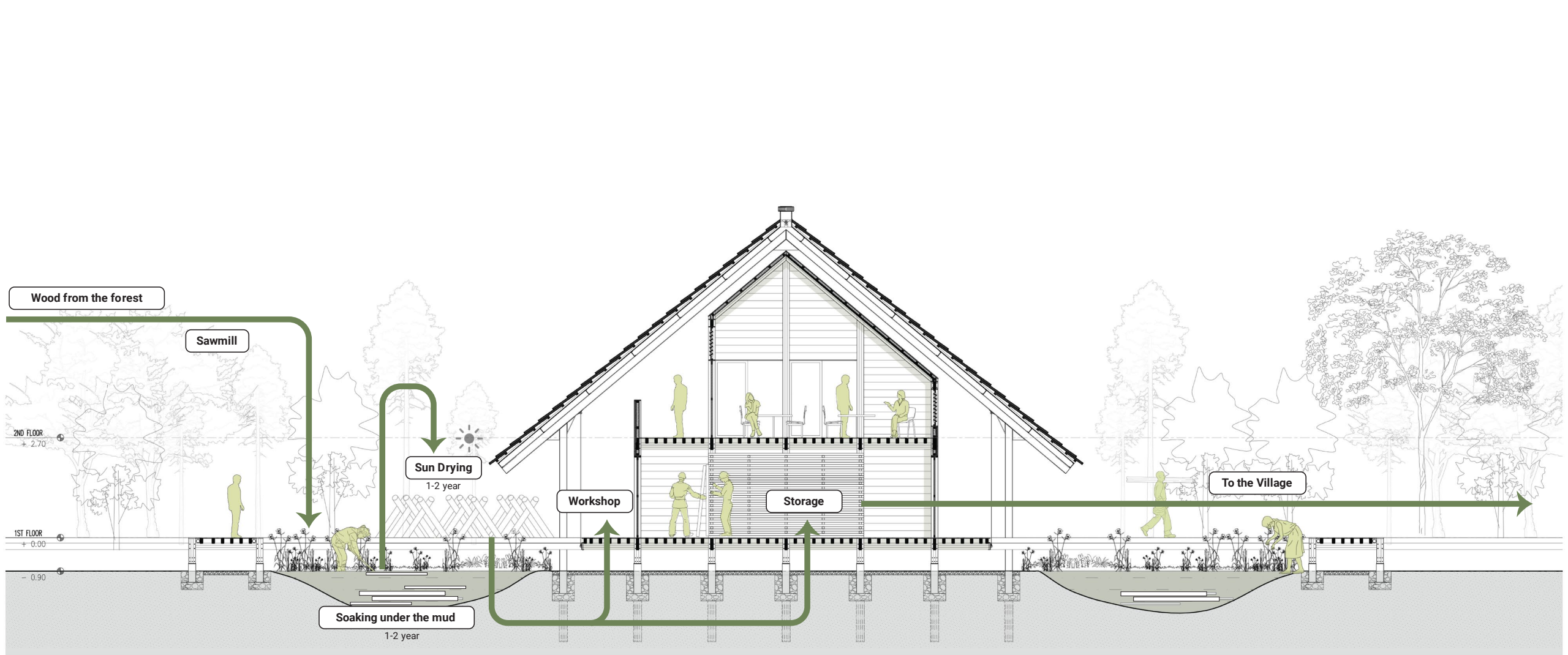
Section

Harvesting Facility

Community Space



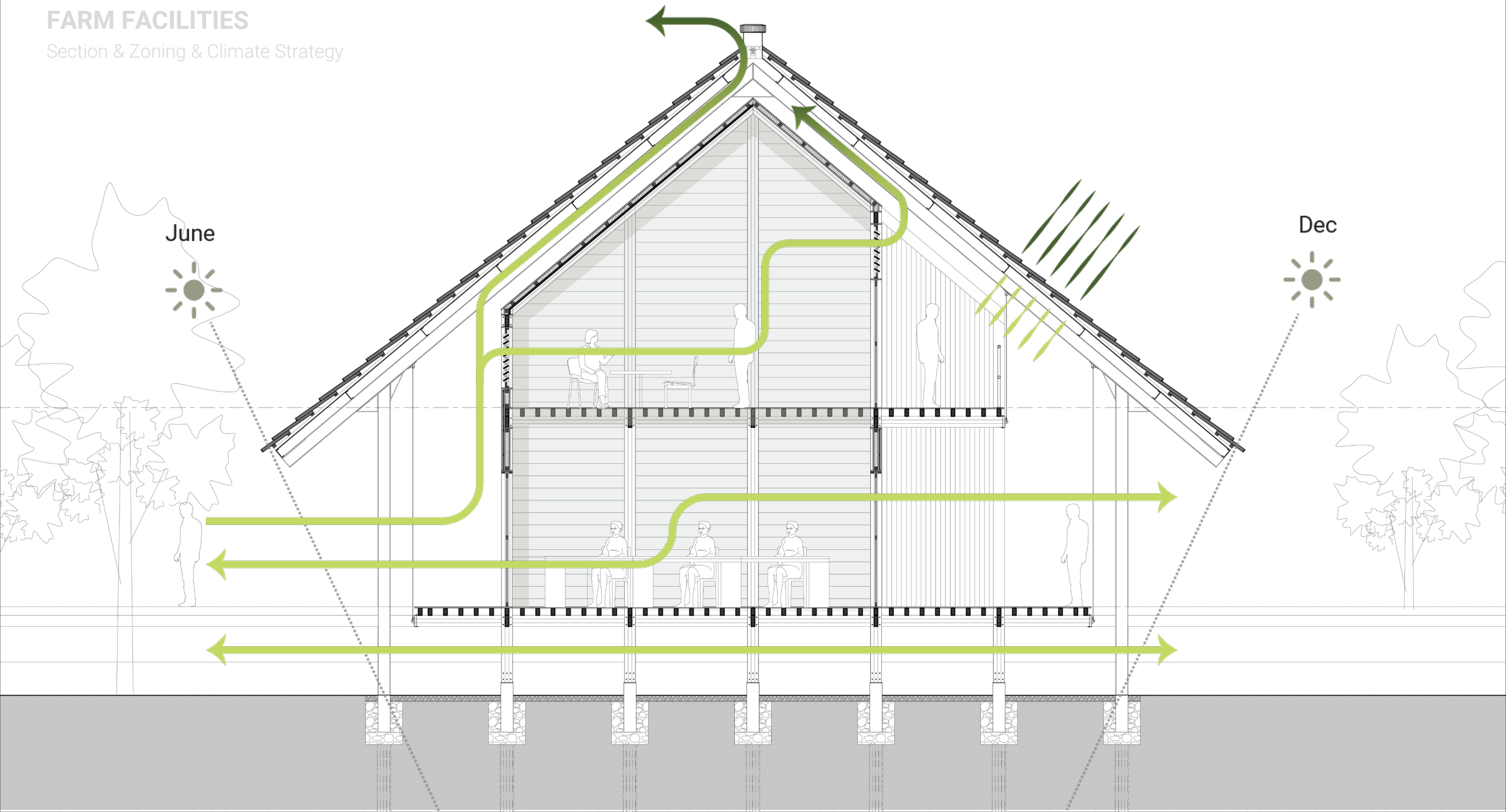






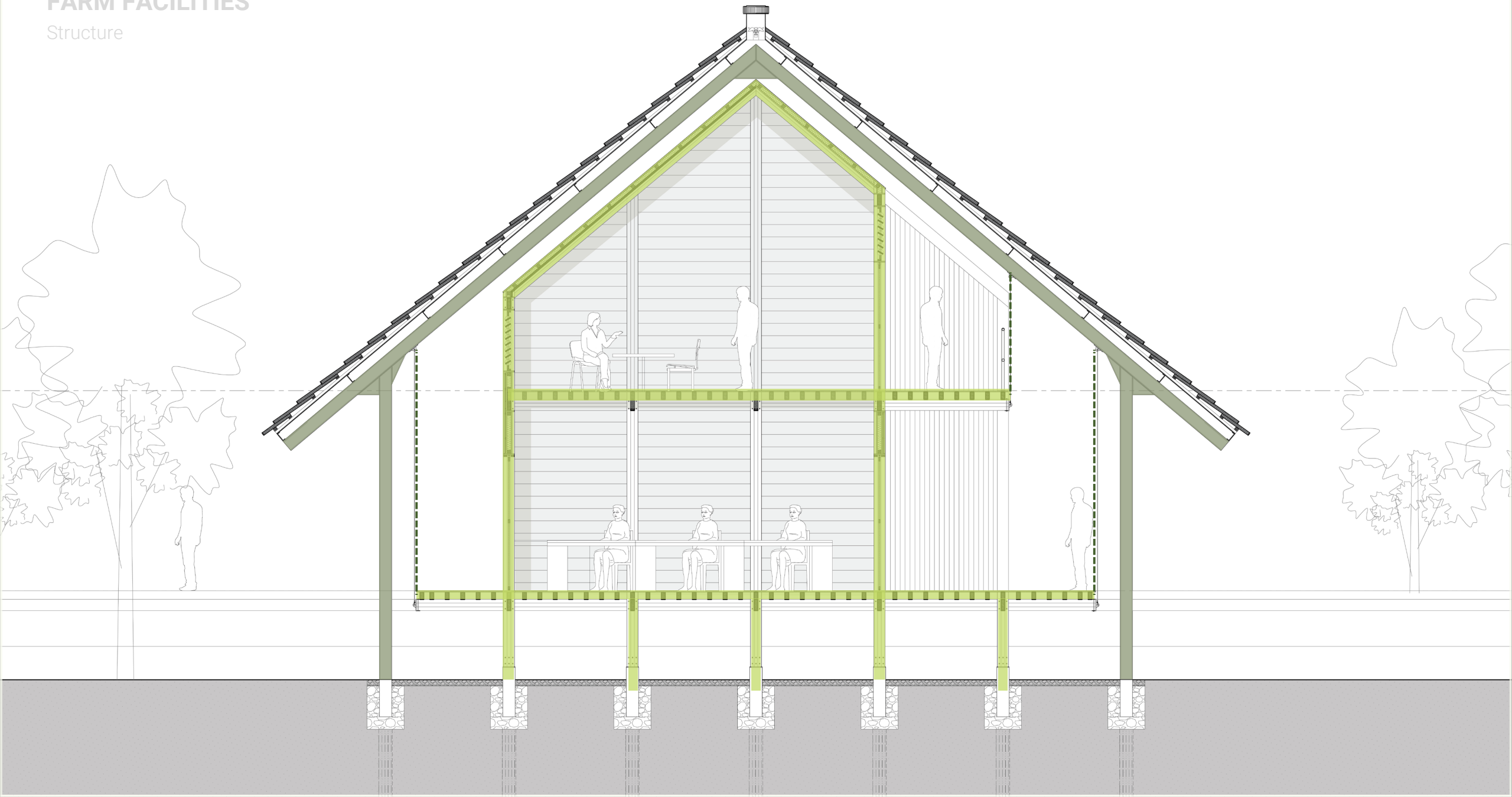
FARM FACILITIES

Section & Zoning & Climate Strategy



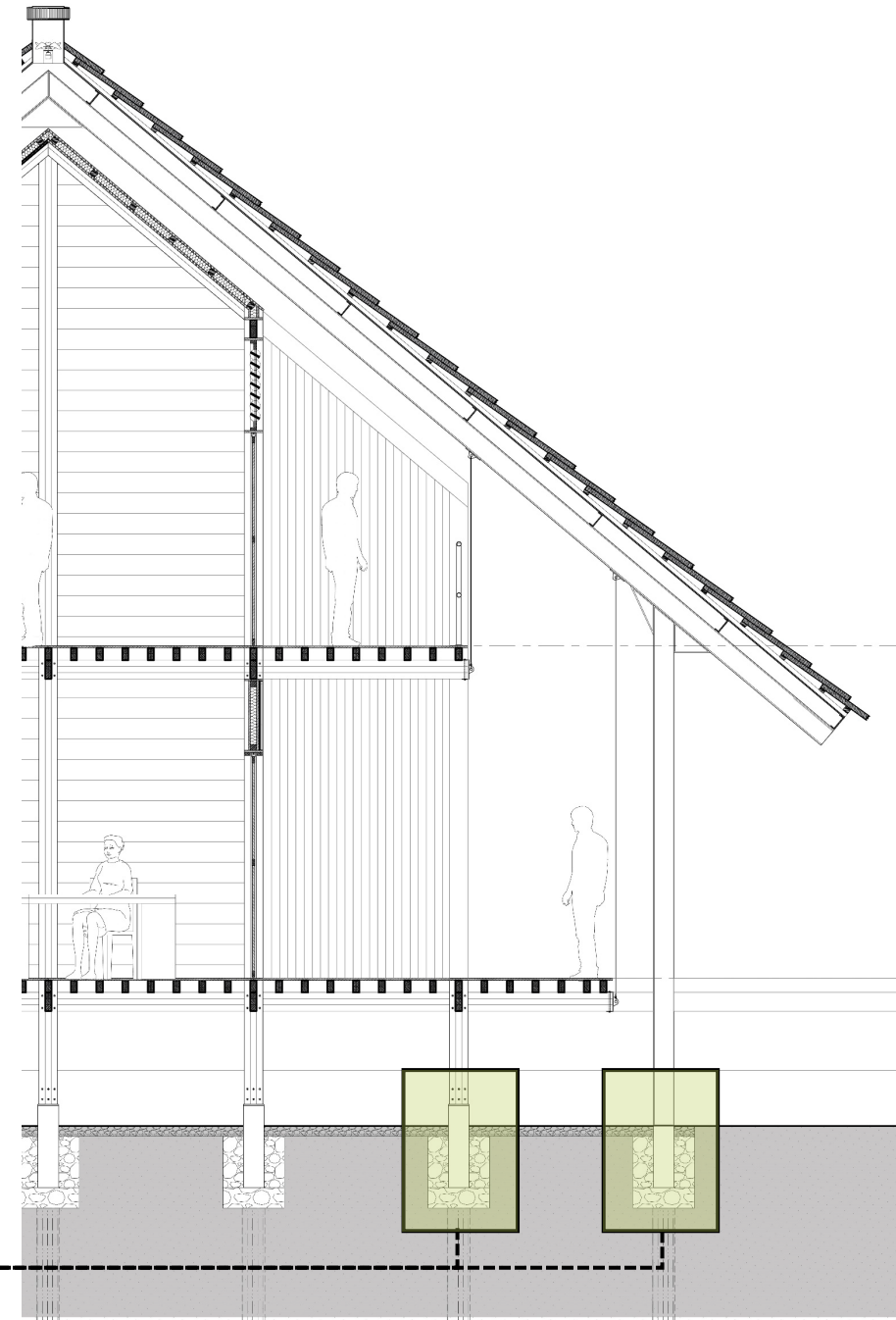
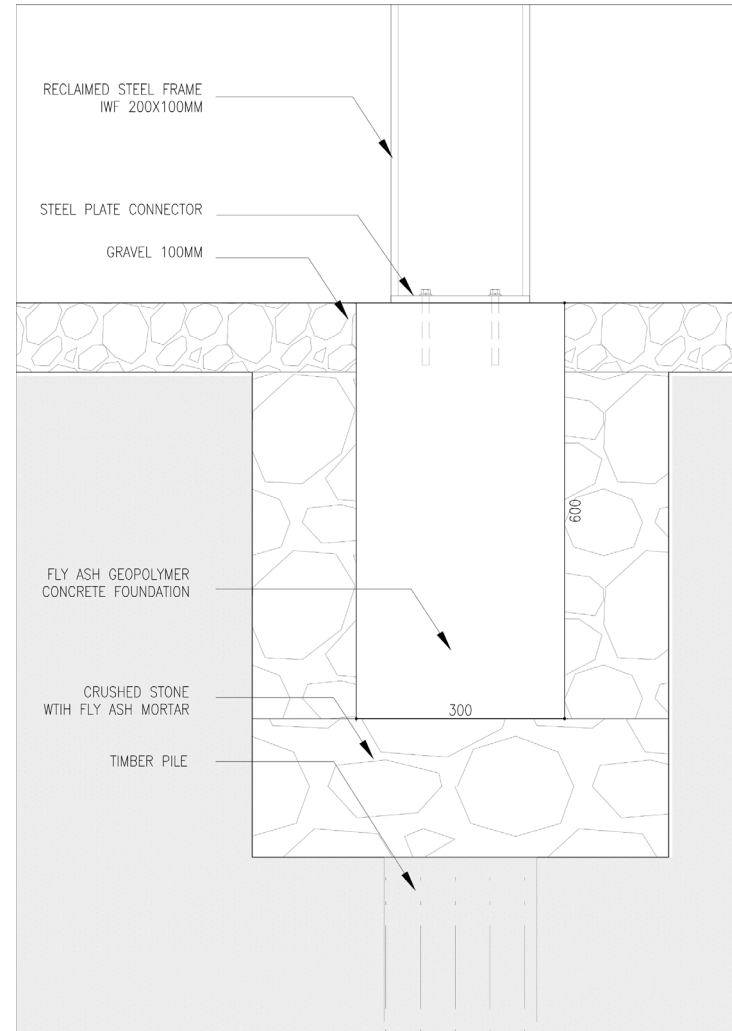
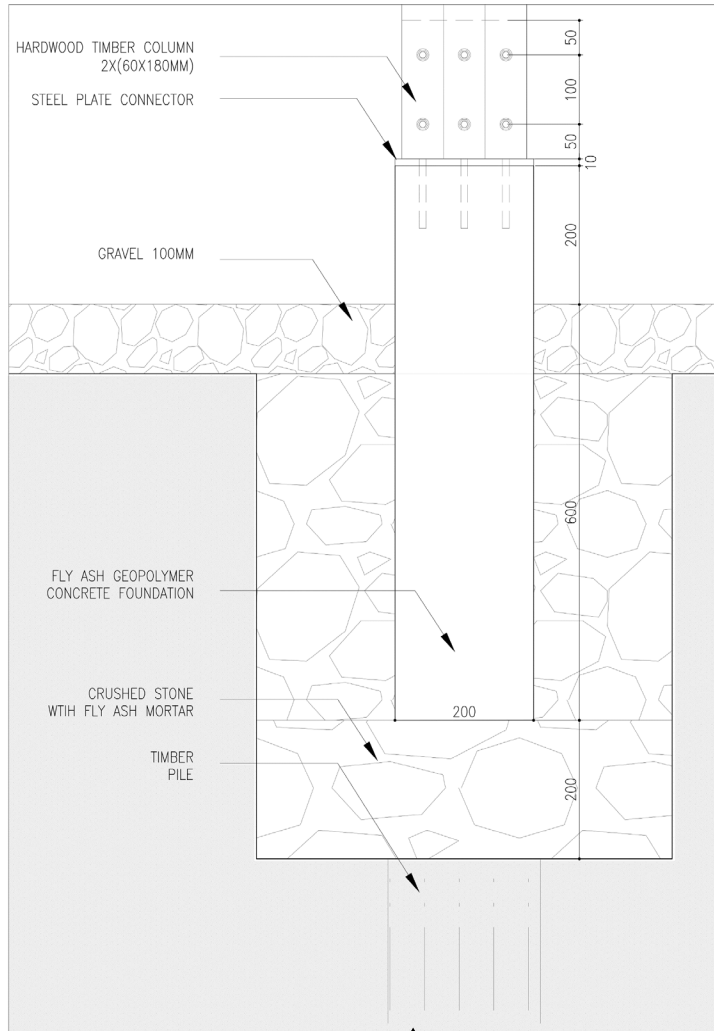
FARM FACILITIES

Structure



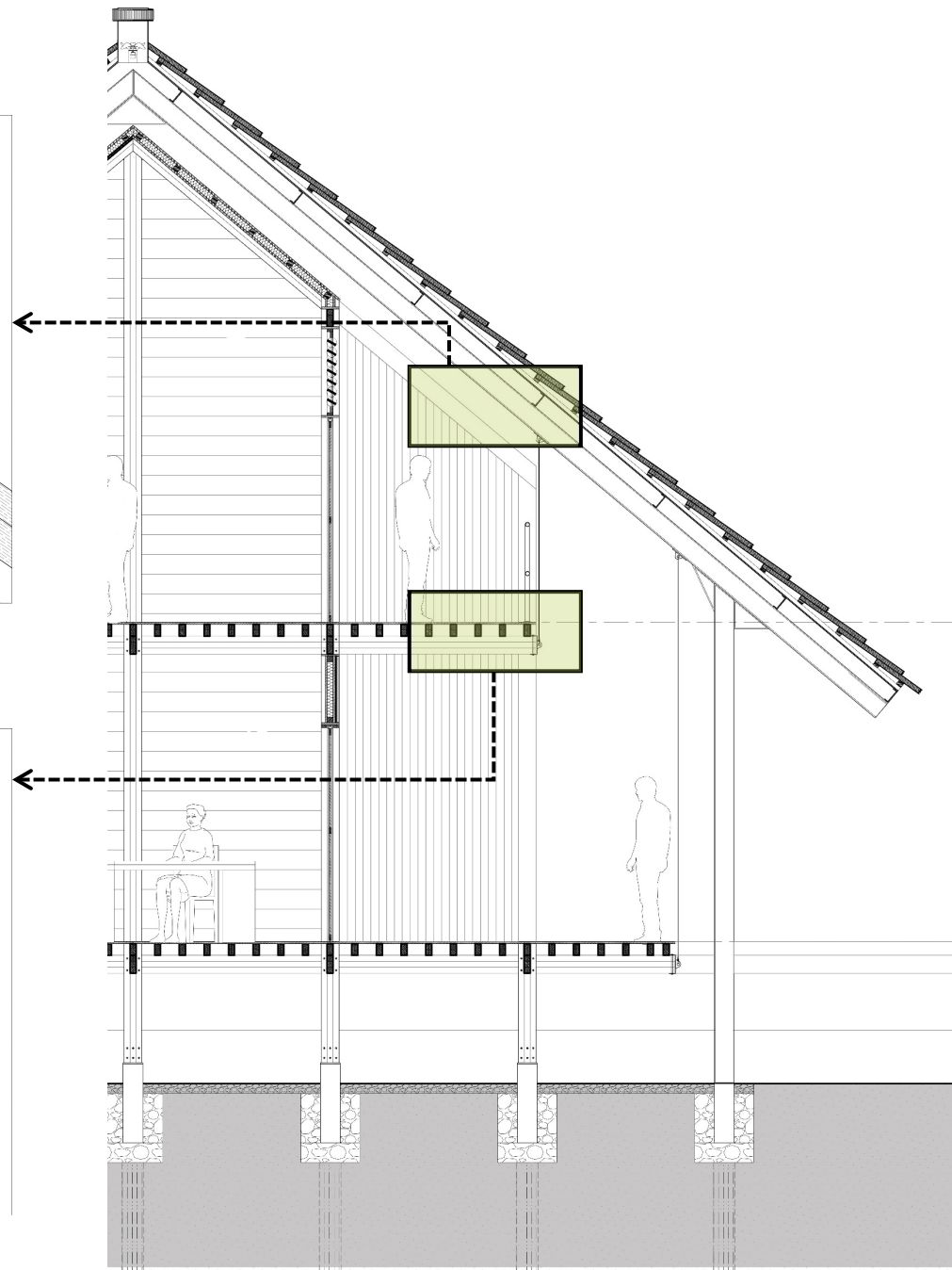
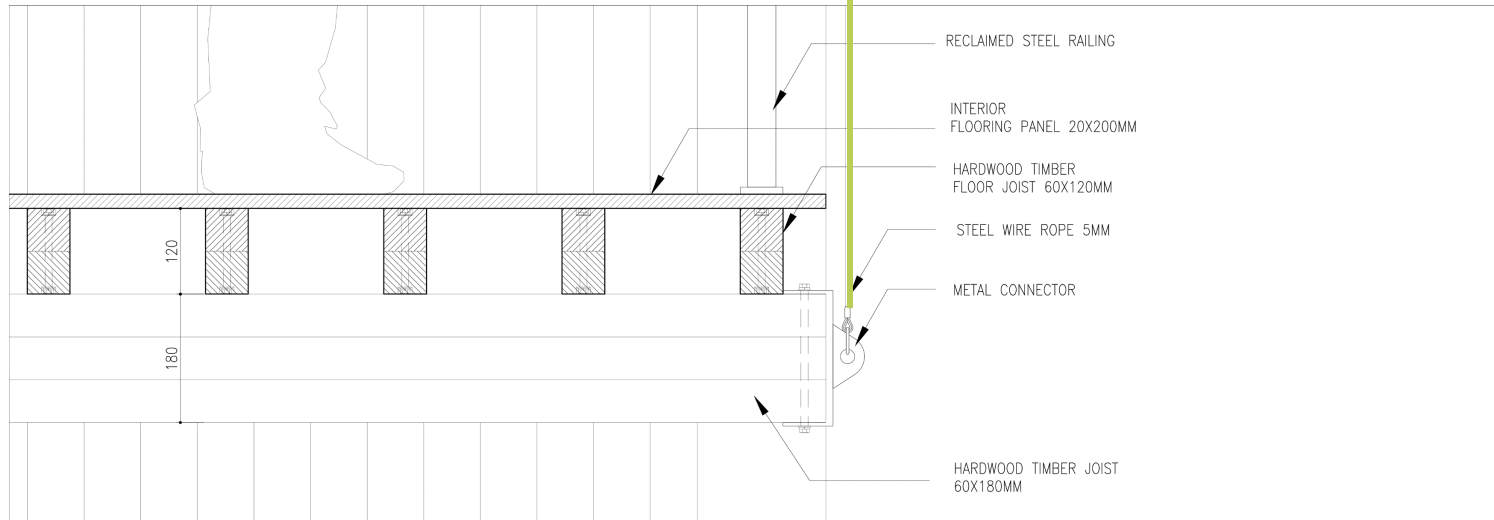
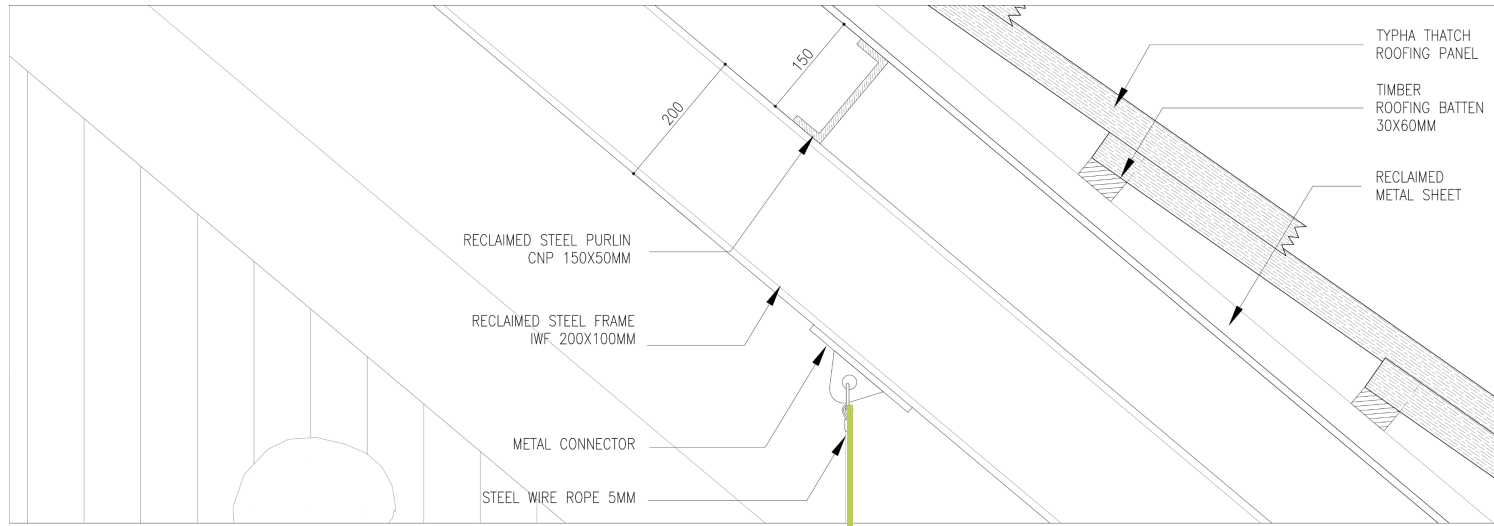
FARM FACILITIES

Structure



FARM FACILITIES

Section & Zoning & Climate Strategy





An architectural rendering of a modern housing complex. The scene features a central glass pavilion with a prominent gabled roof structure. To the left and right are residential buildings with similar gabled roofs and large windows. A wooden deck runs through the center, where several stylized human figures are shown: one sitting on a bench on the left, one walking in the middle, one standing on the right, and a small child on the far right. The background includes trees and a sky with soft clouds. The overall aesthetic is clean and modern.

HOUSING

HOUSING

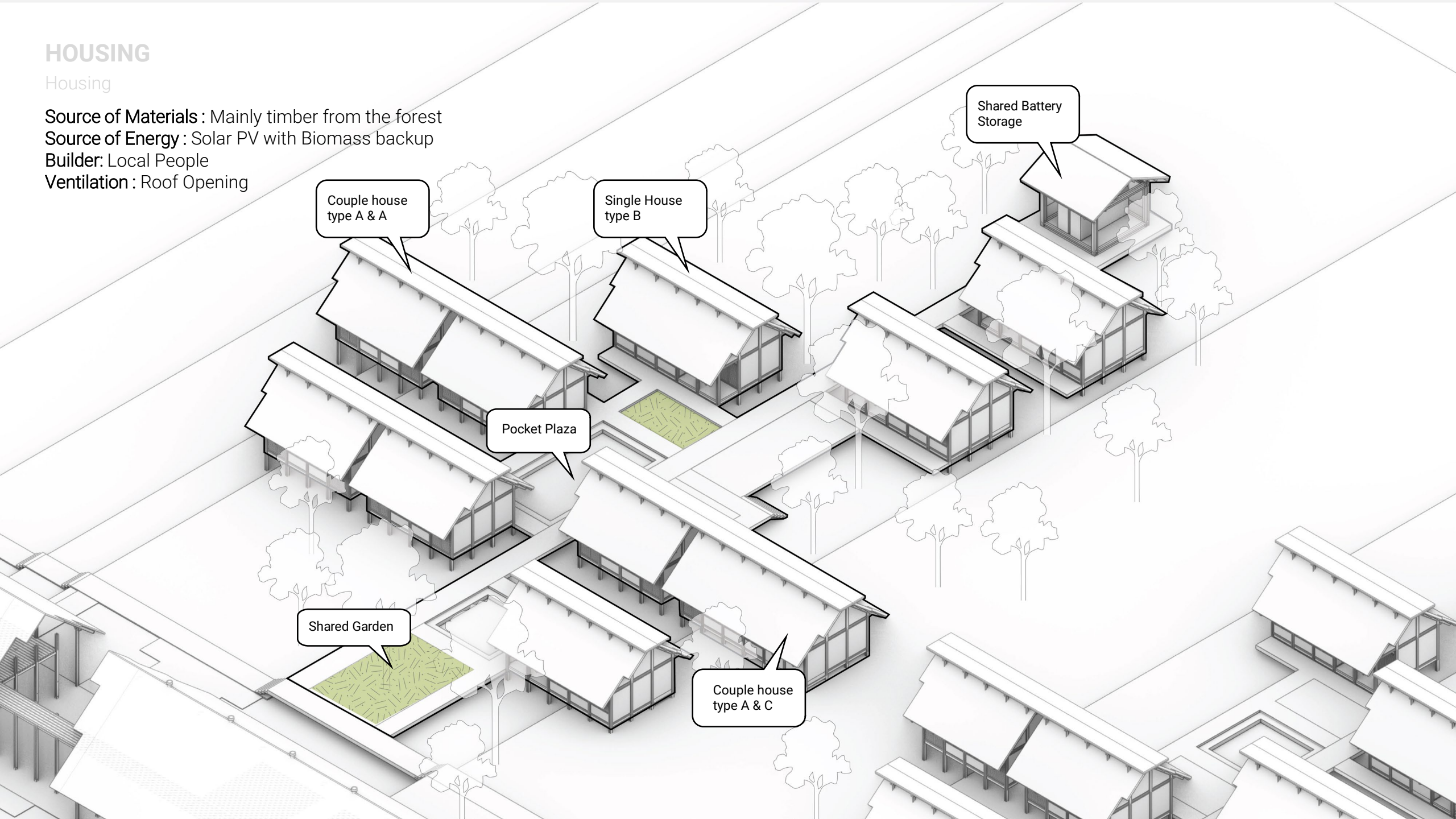
Housing

Source of Materials : Mainly timber from the forest

Source of Energy : Solar PV with Biomass backup

Builder: Local People

Ventilation : Roof Opening



Couple house
type A & A

Single House
type B

Shared Battery
Storage

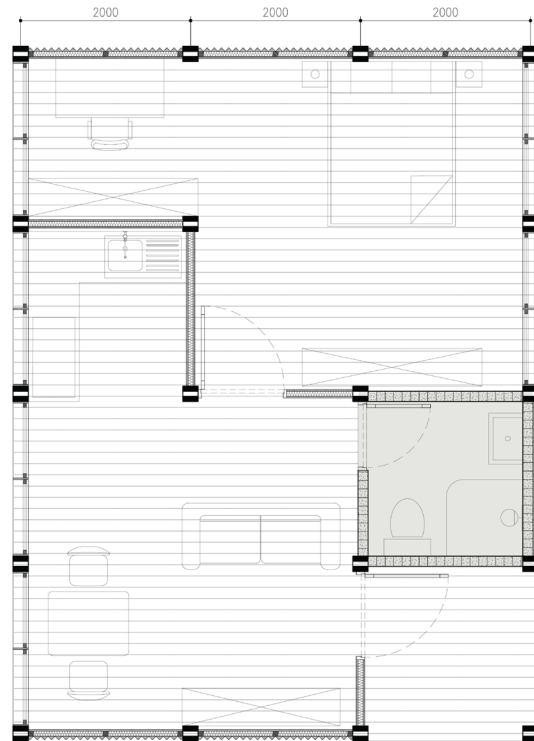
Pocket Plaza

Shared Garden

Couple house
type A & C

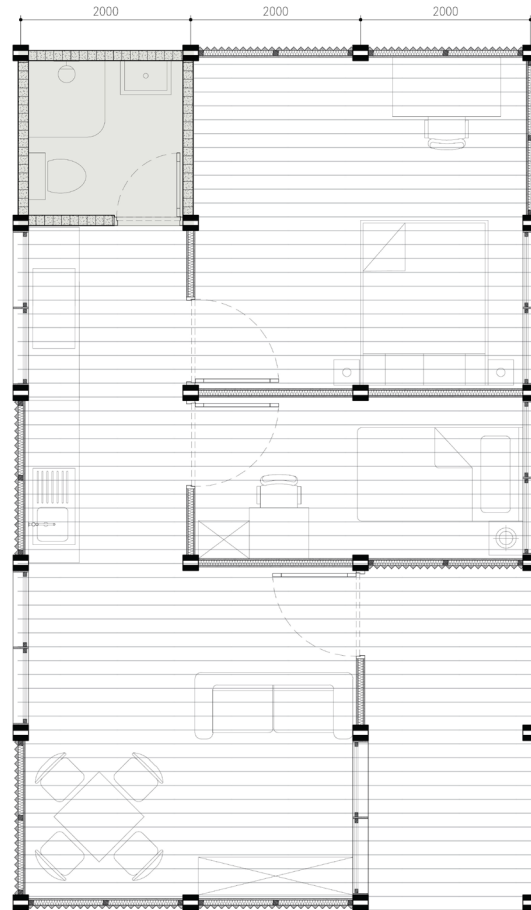
HOUSING

Types and Users



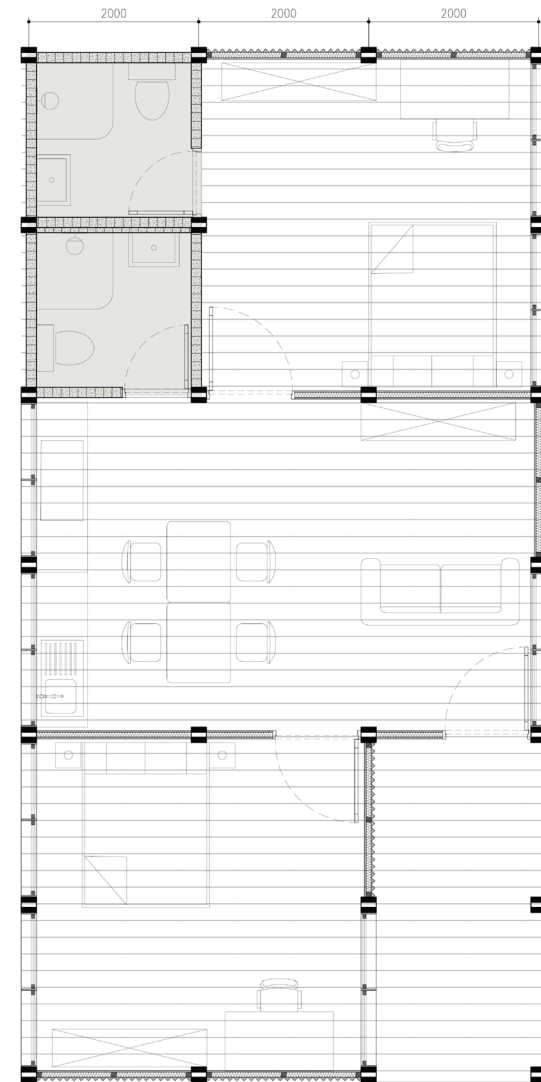
HOUSE TYPE A | 48 m²

1 MASTER BEDROOM
1 BATHROOM



HOUSE TYPE B | 60 m²

1 MASTER BEDROOM
1 BEDROOM
1 BATHROOM



HOUSE TYPE C | 72 m²

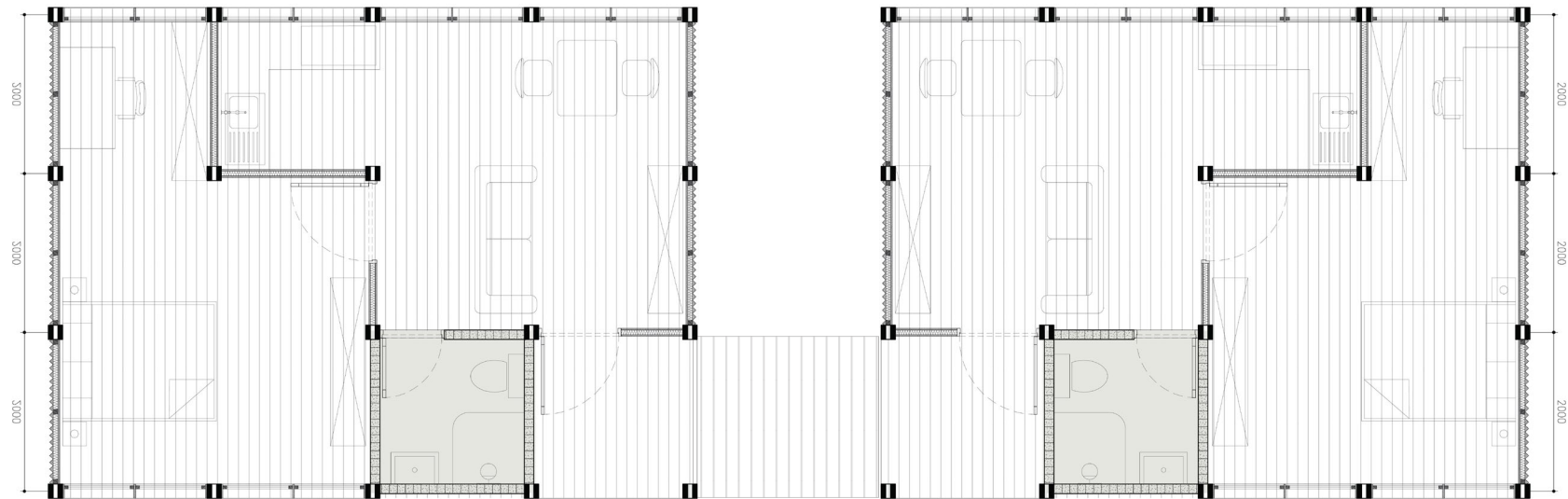
2 MASTER BEDROOM
2 BATHROOM





HOUSING

Floor plan



HOUSING

Elevation



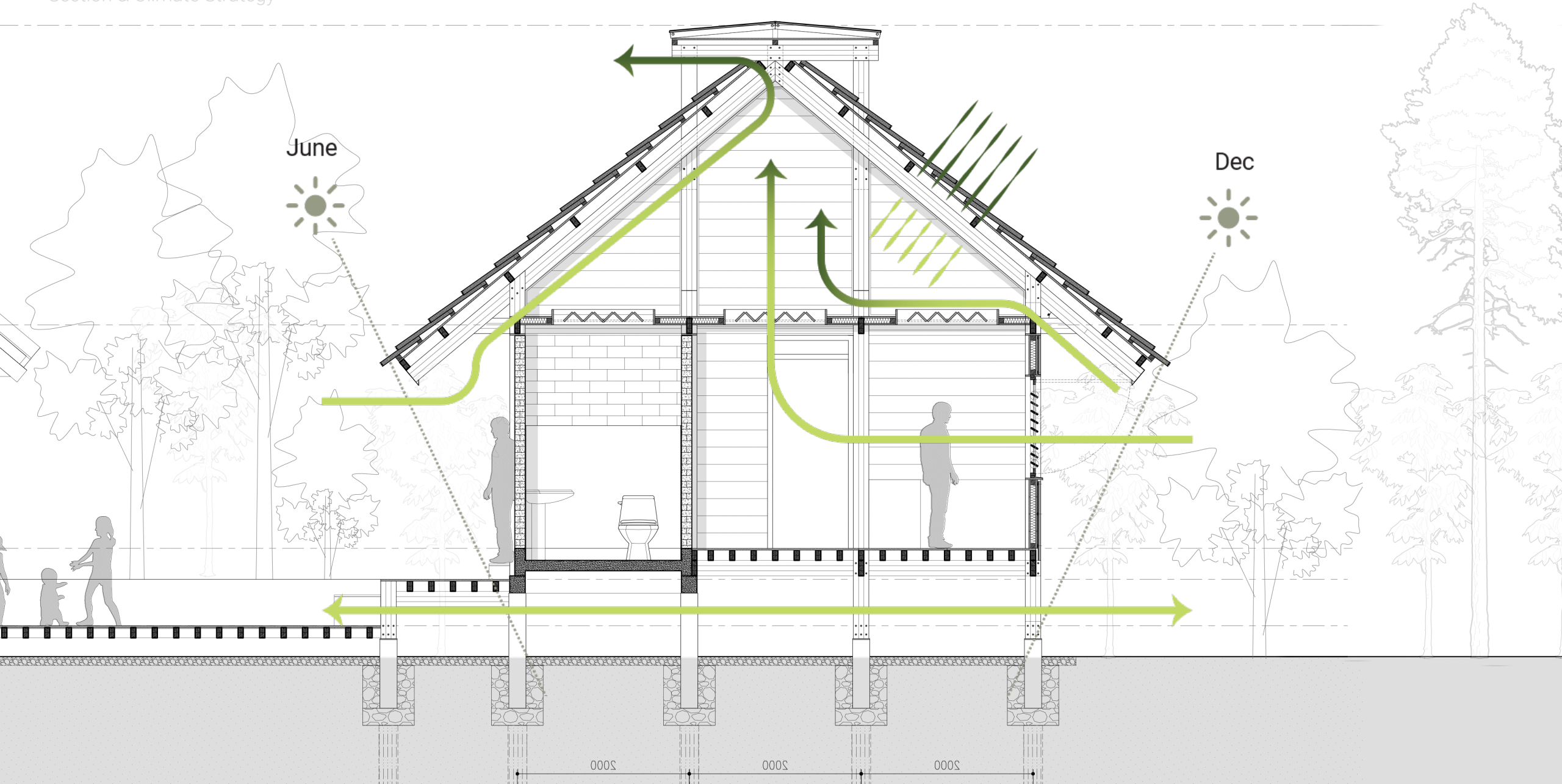
HOUSING

Section & Climate Strategy



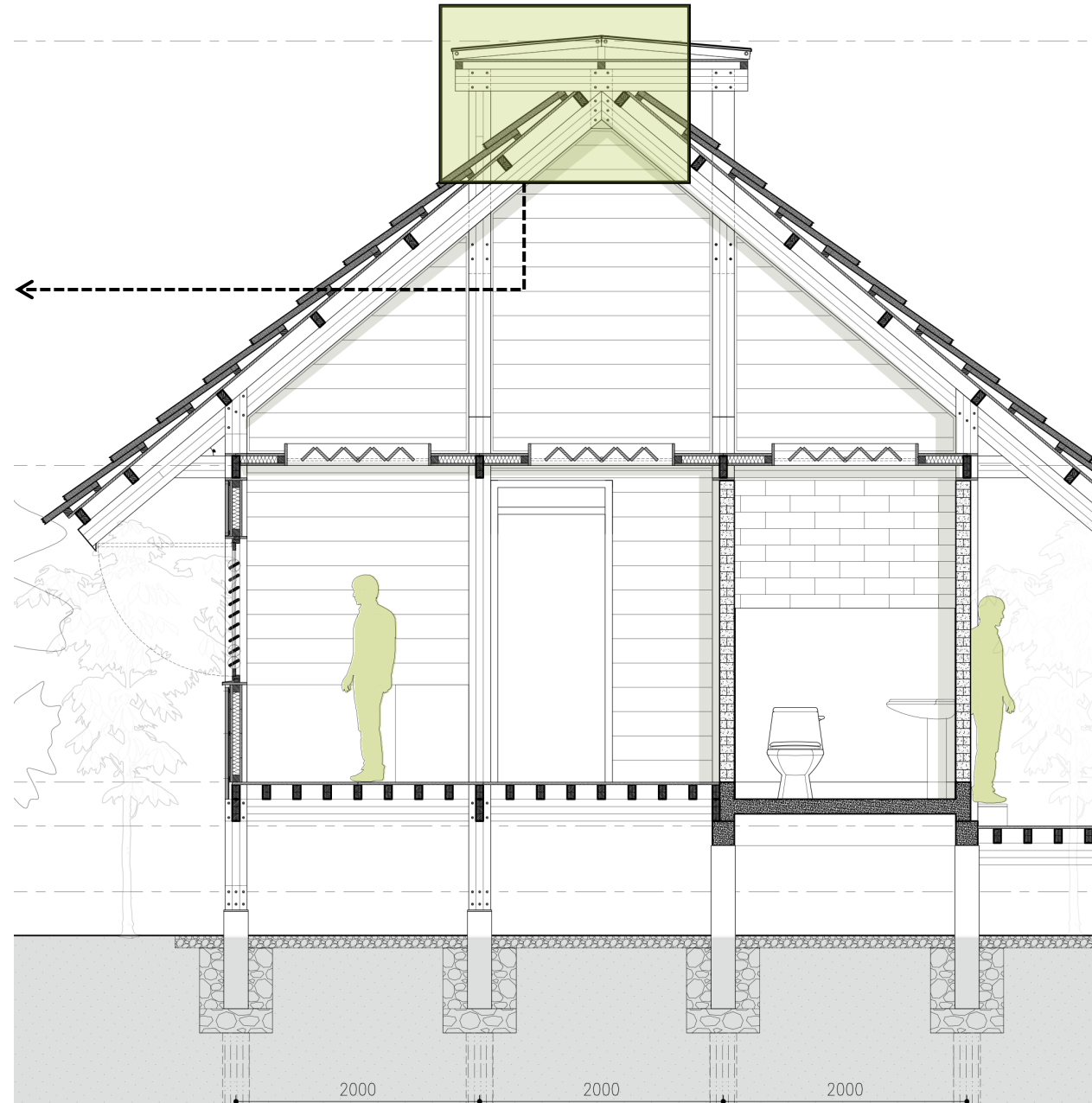
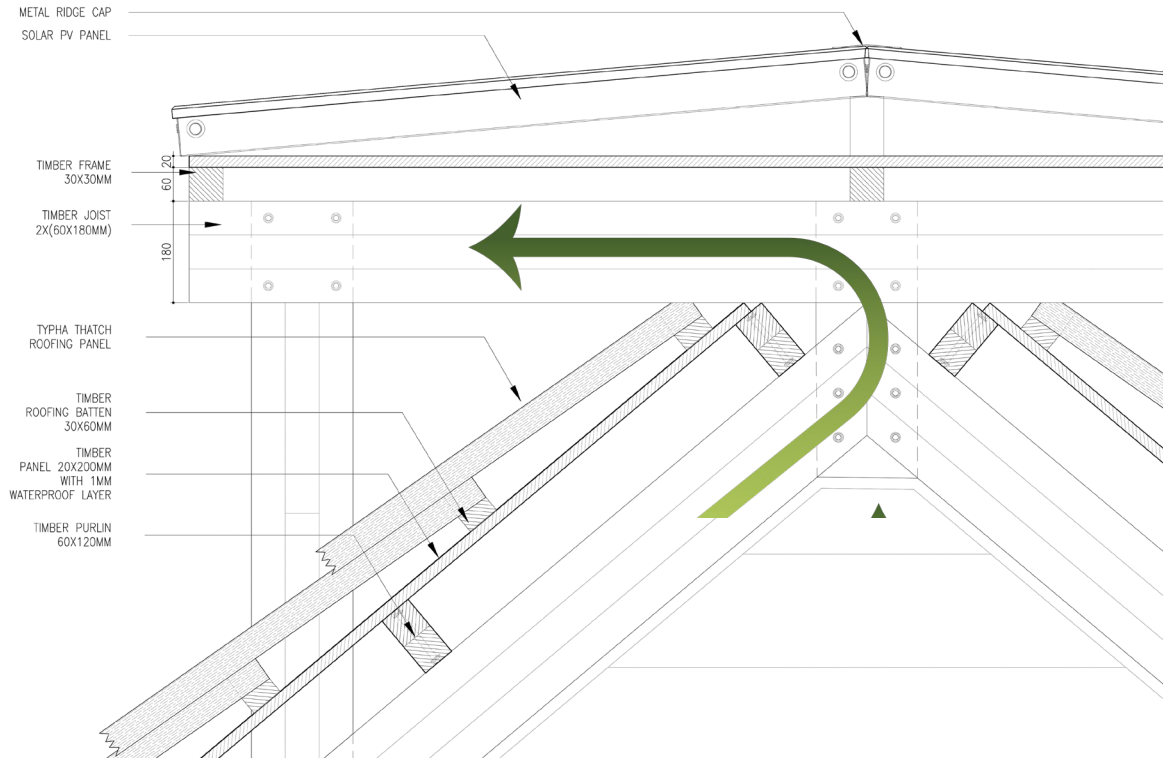
HOUSING

Section & Climate Strategy



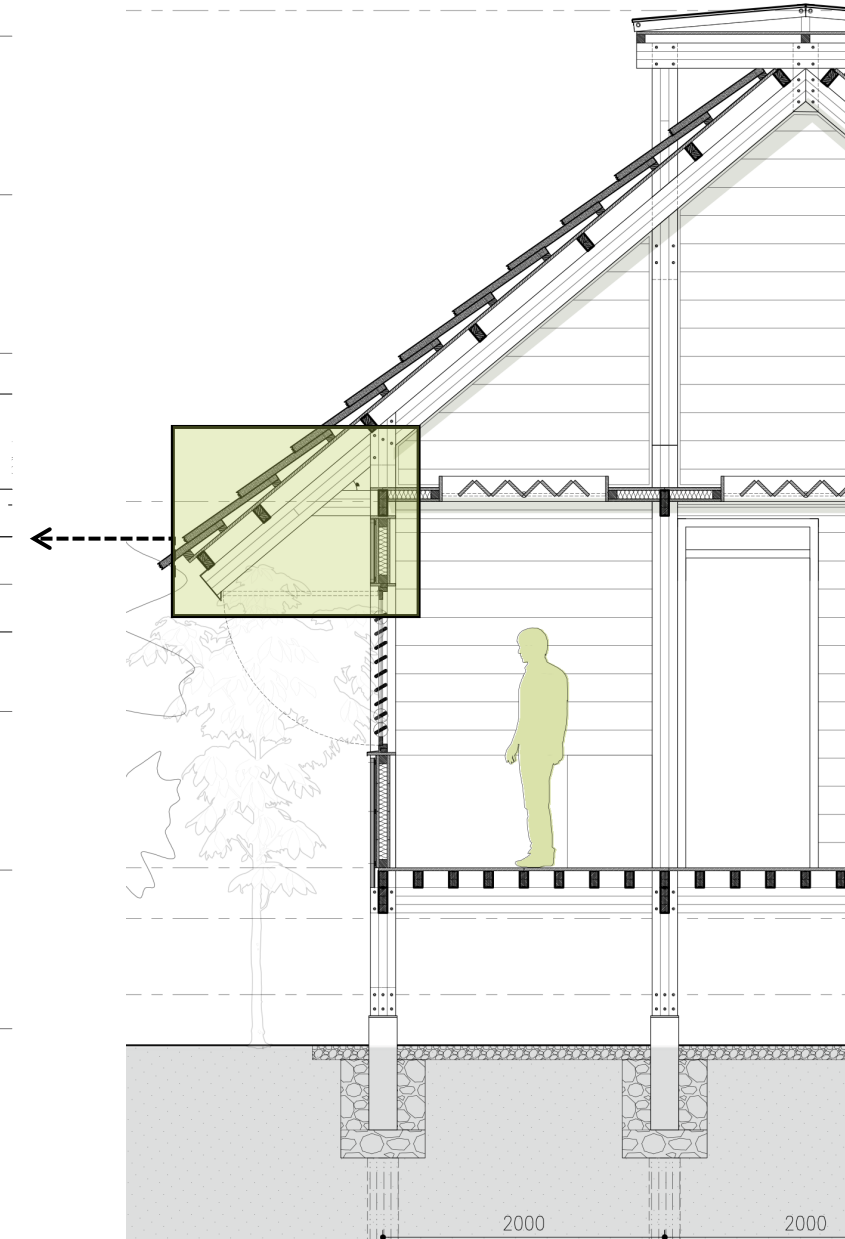
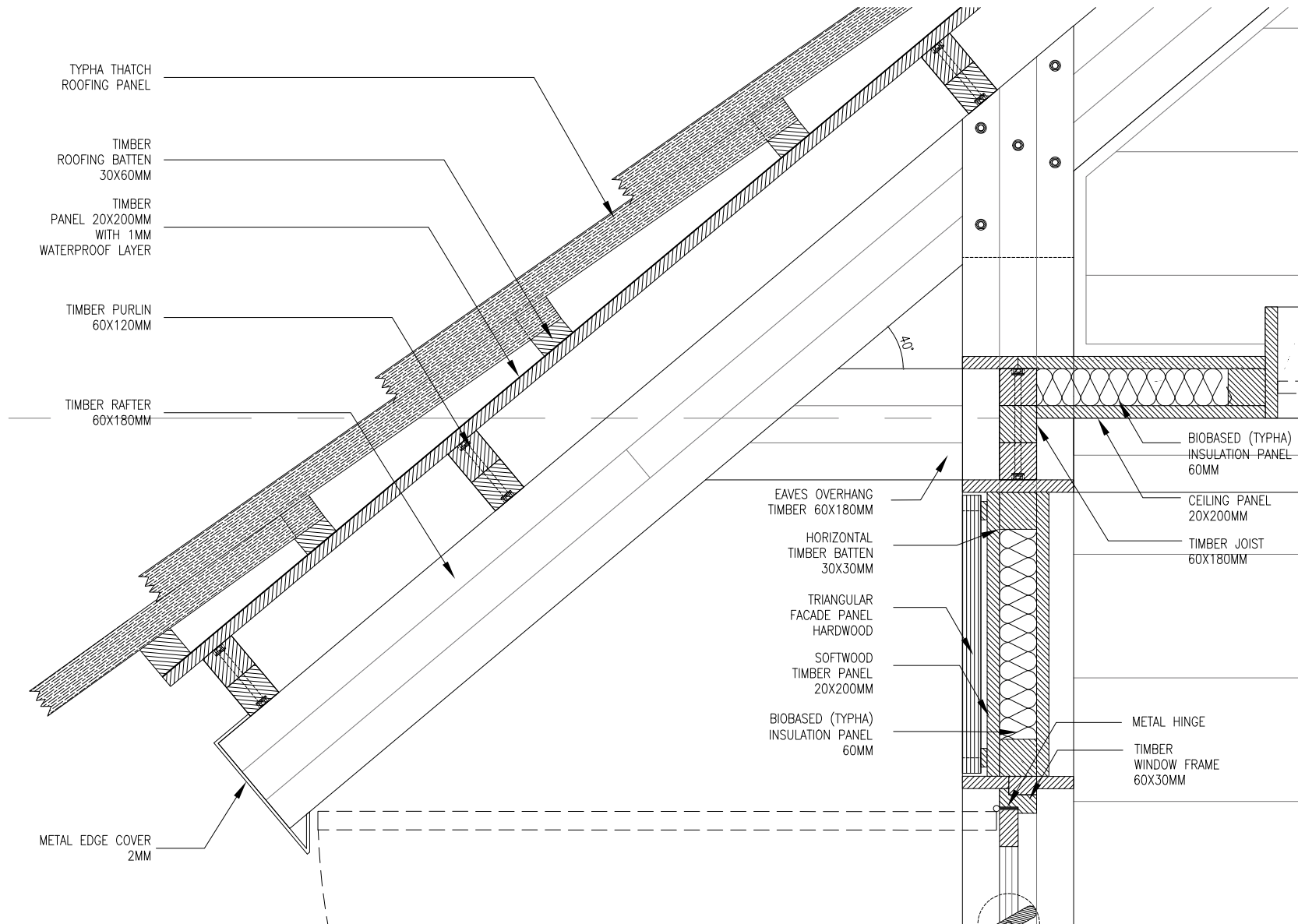
HOUSING

Section & Climate Strategy



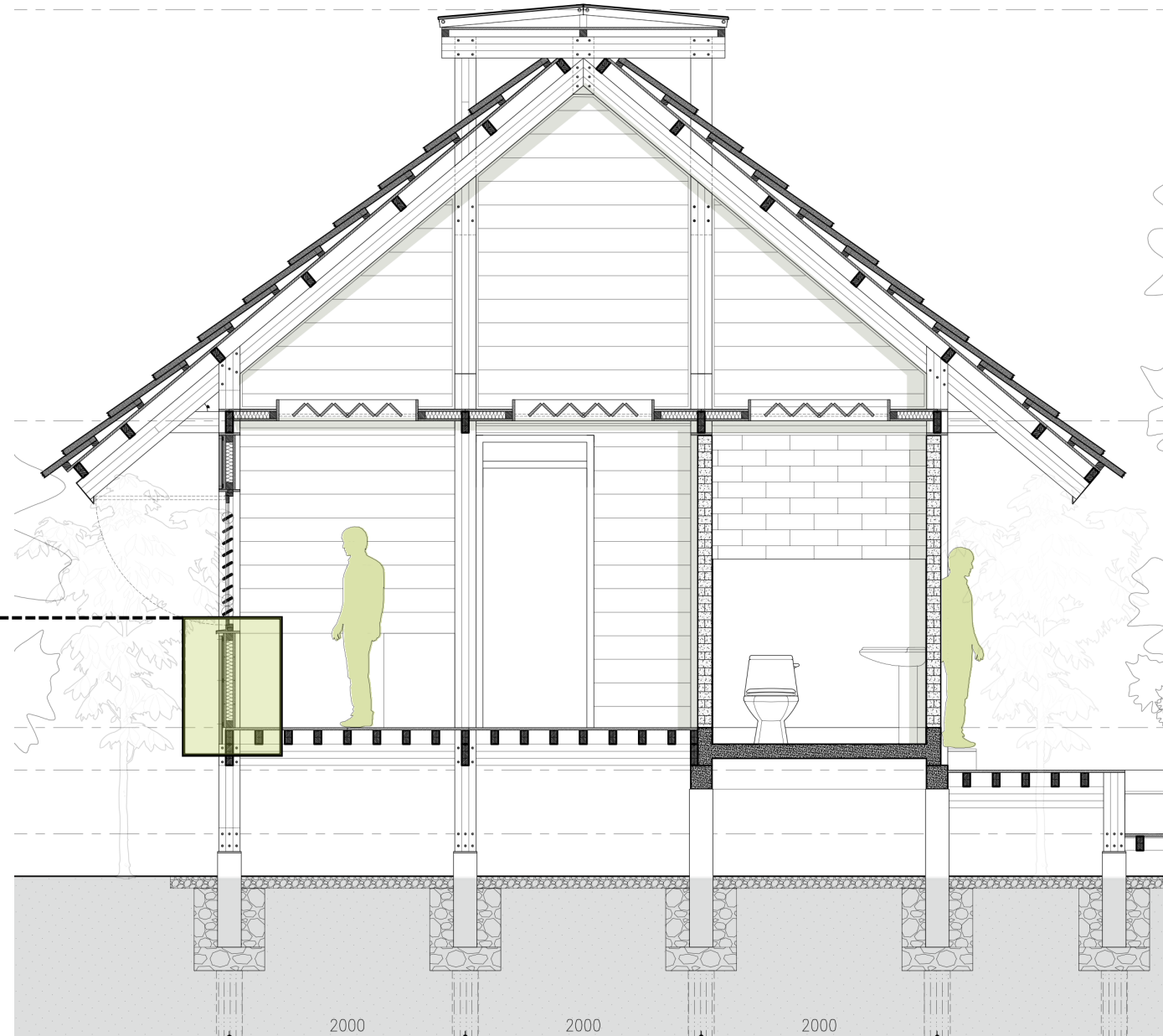
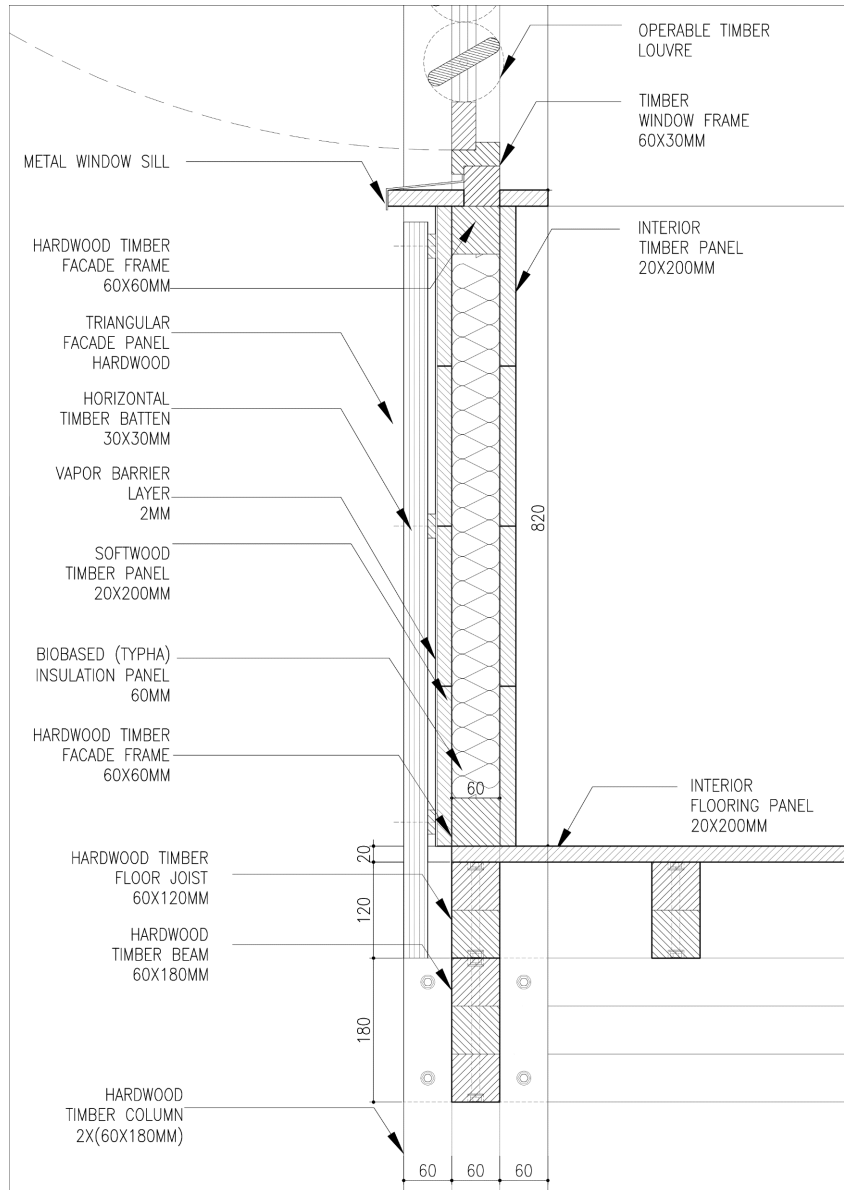
HOUSING

Section & Climate Strategy



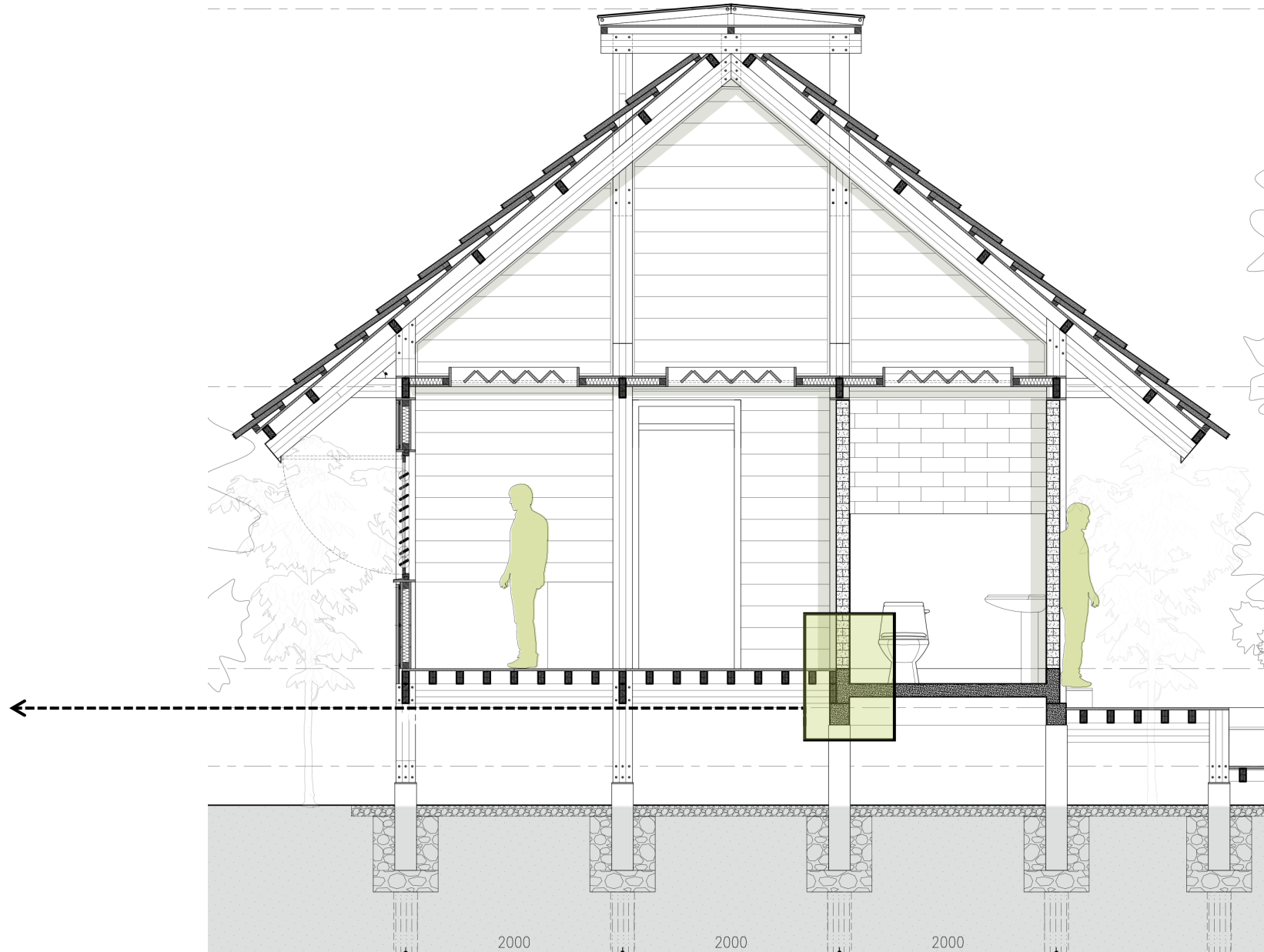
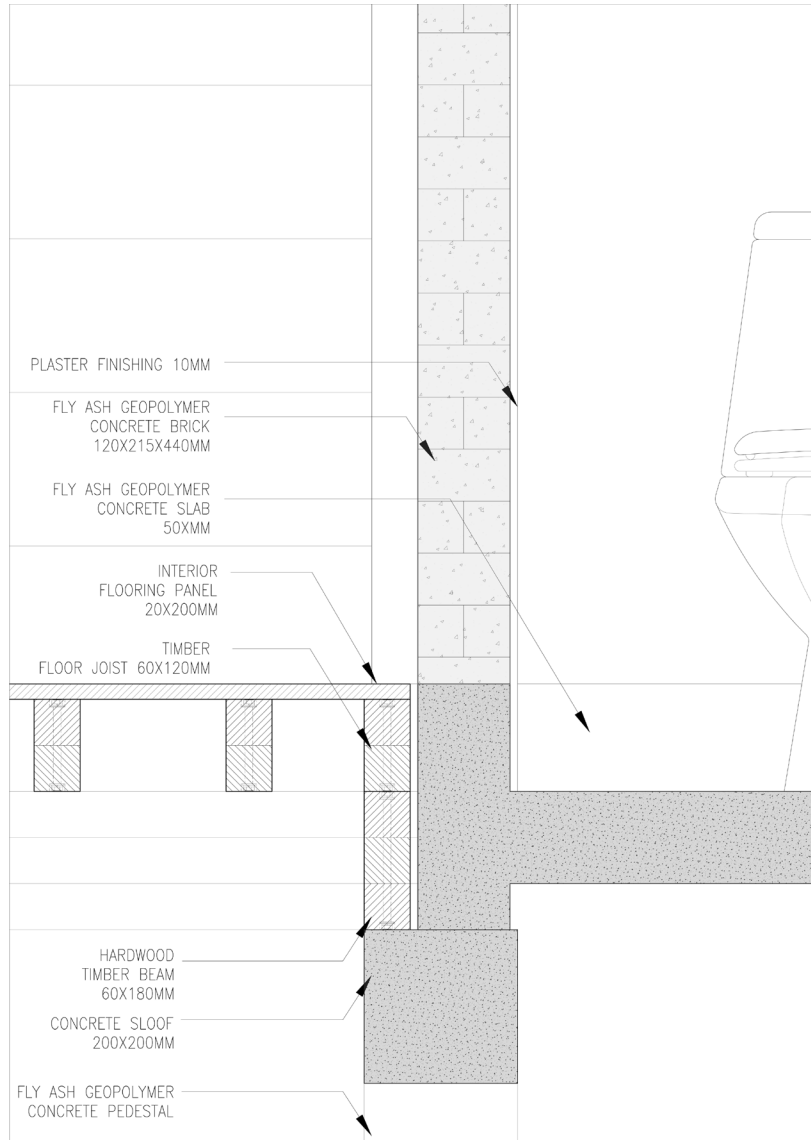
HOUSING

Section & Climate Strategy



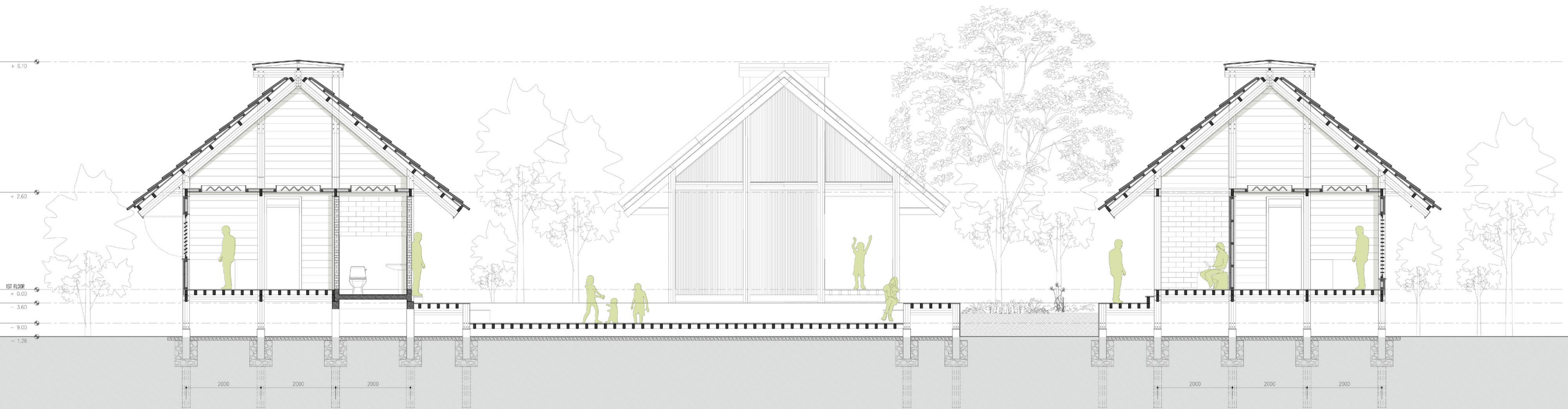
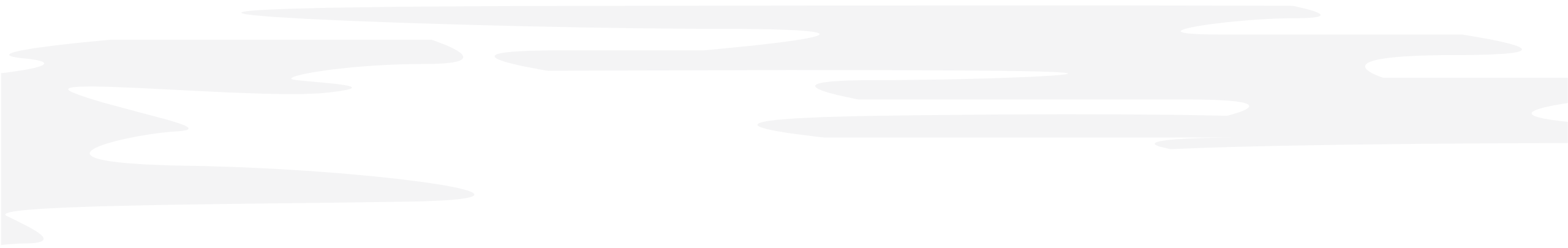
HOUSING

Section & Climate Strategy



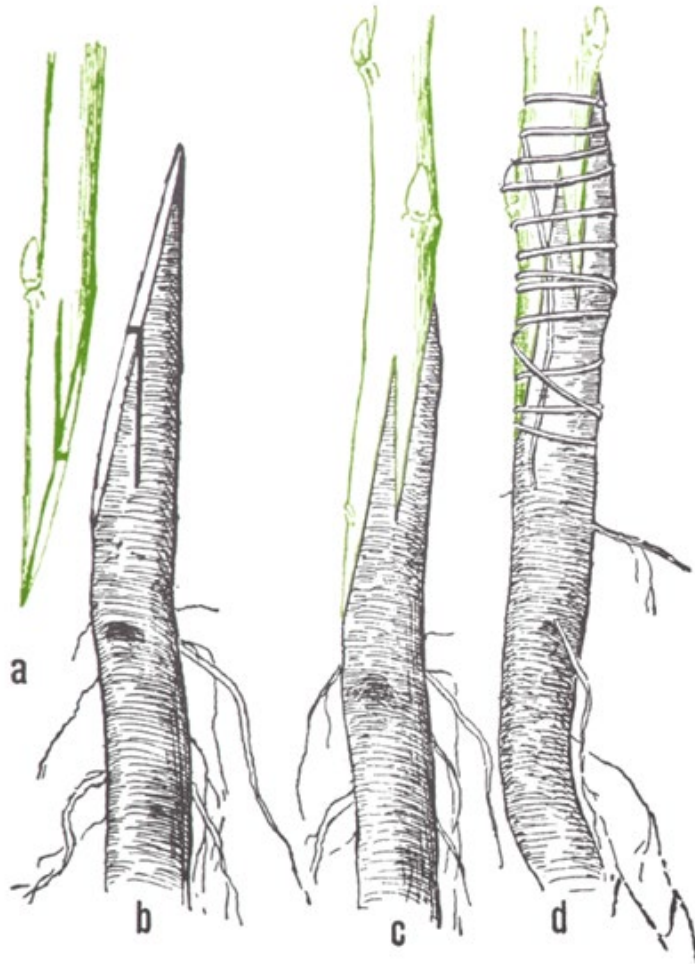
HOUSING

Section & Climate Strategy

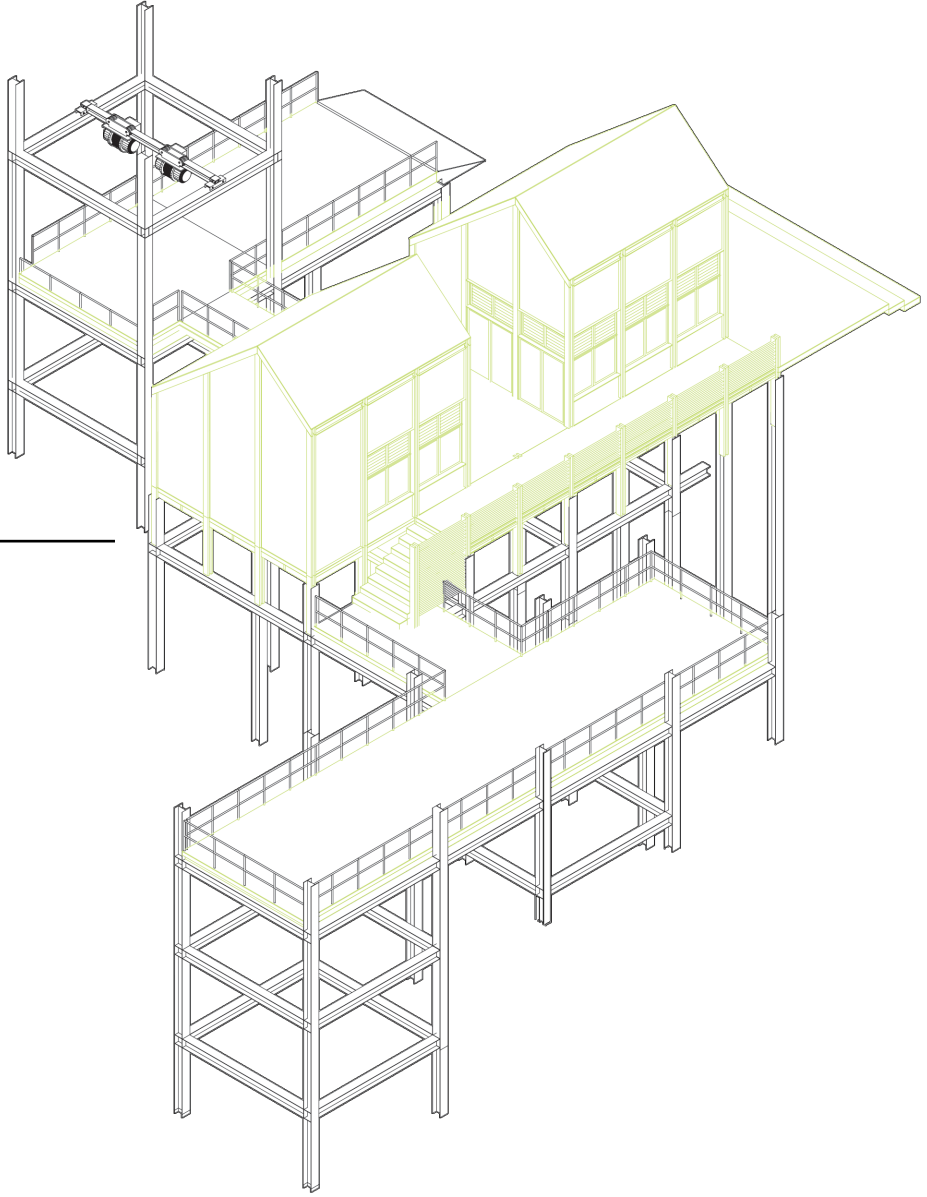
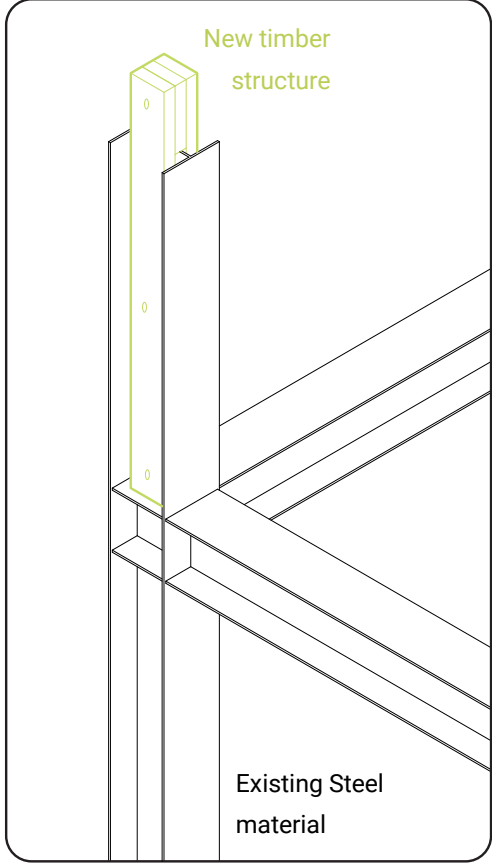


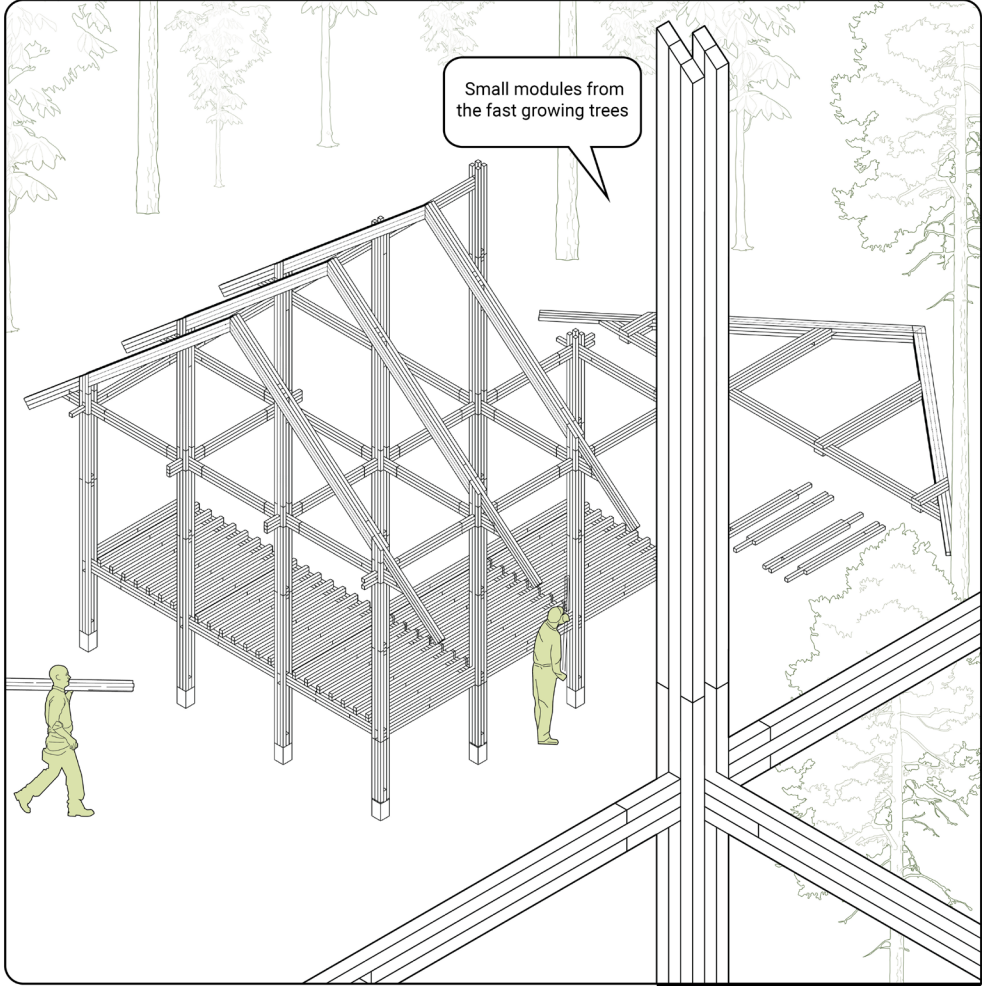






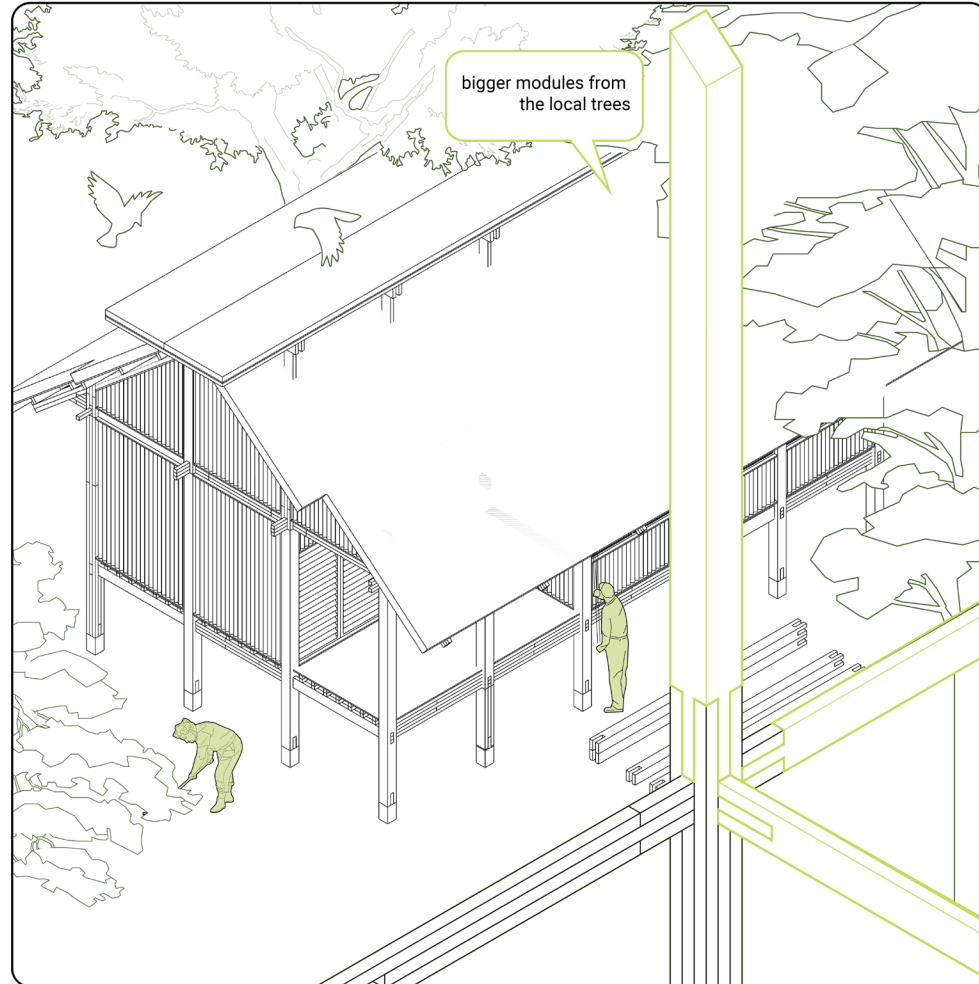
Stages of Root Grafting
Charles Stuart Gager - *Fundamentals Of Botany* (1916)





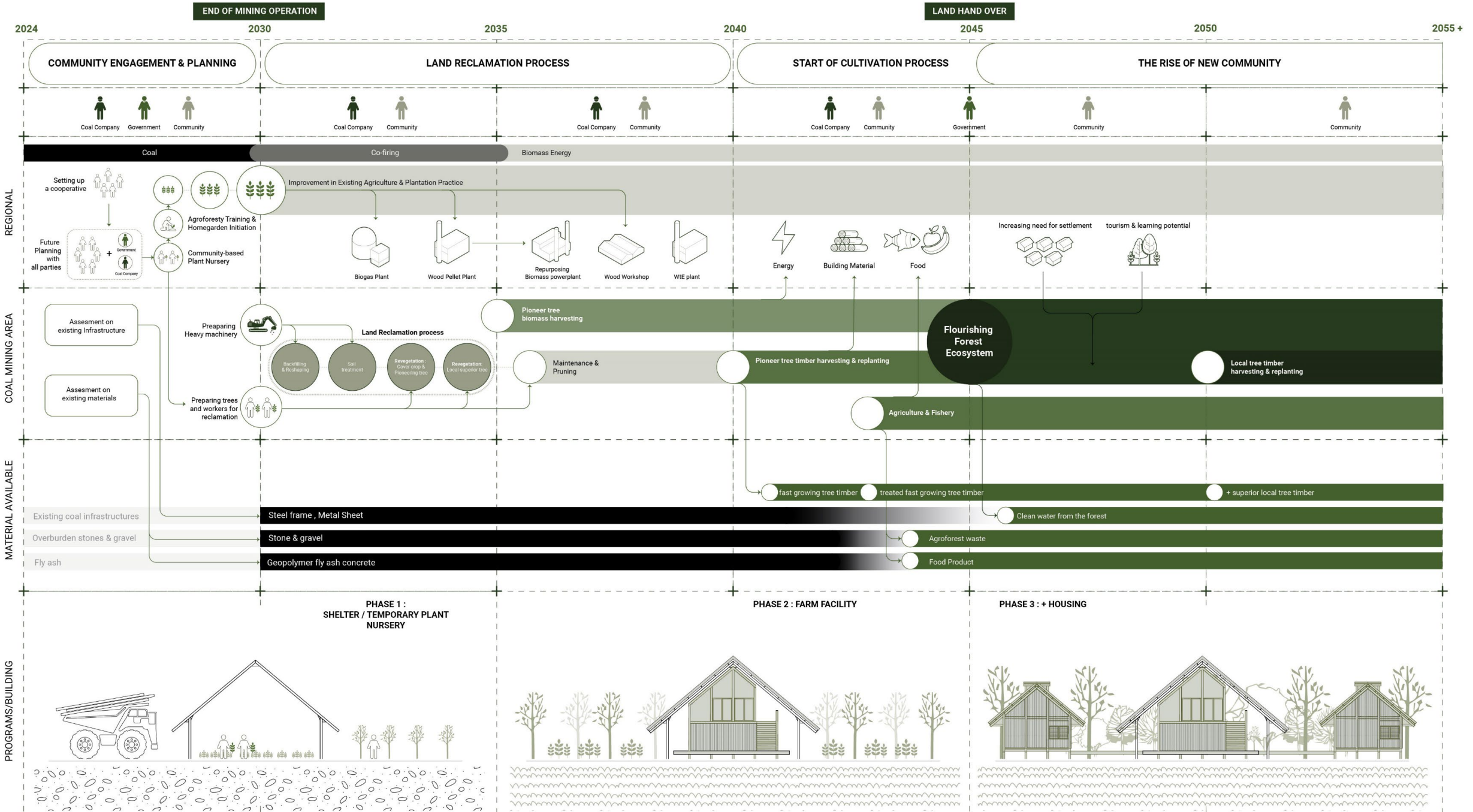
Small modules from the fast growing trees

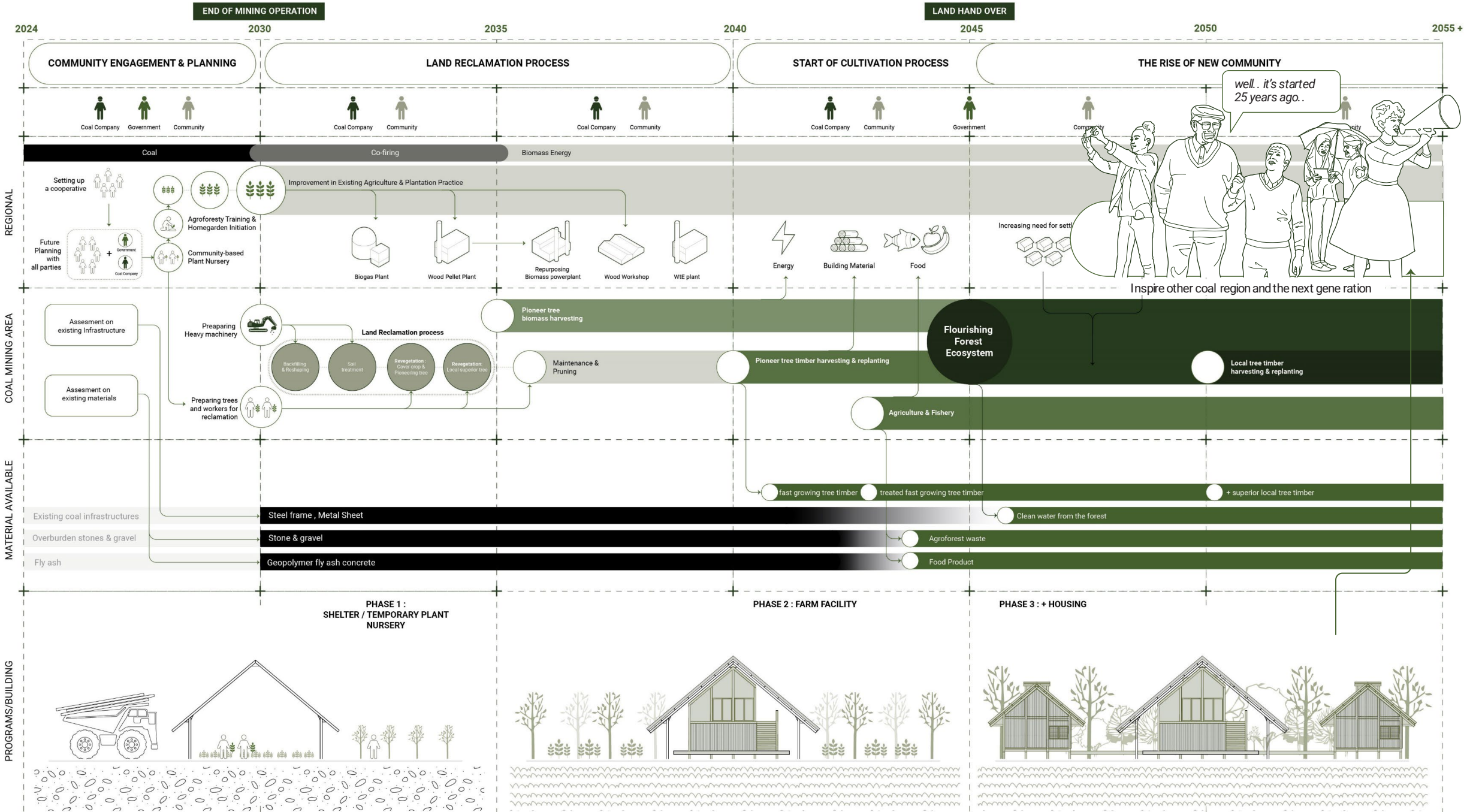
Early Building Process



bigger modules from
the local trees

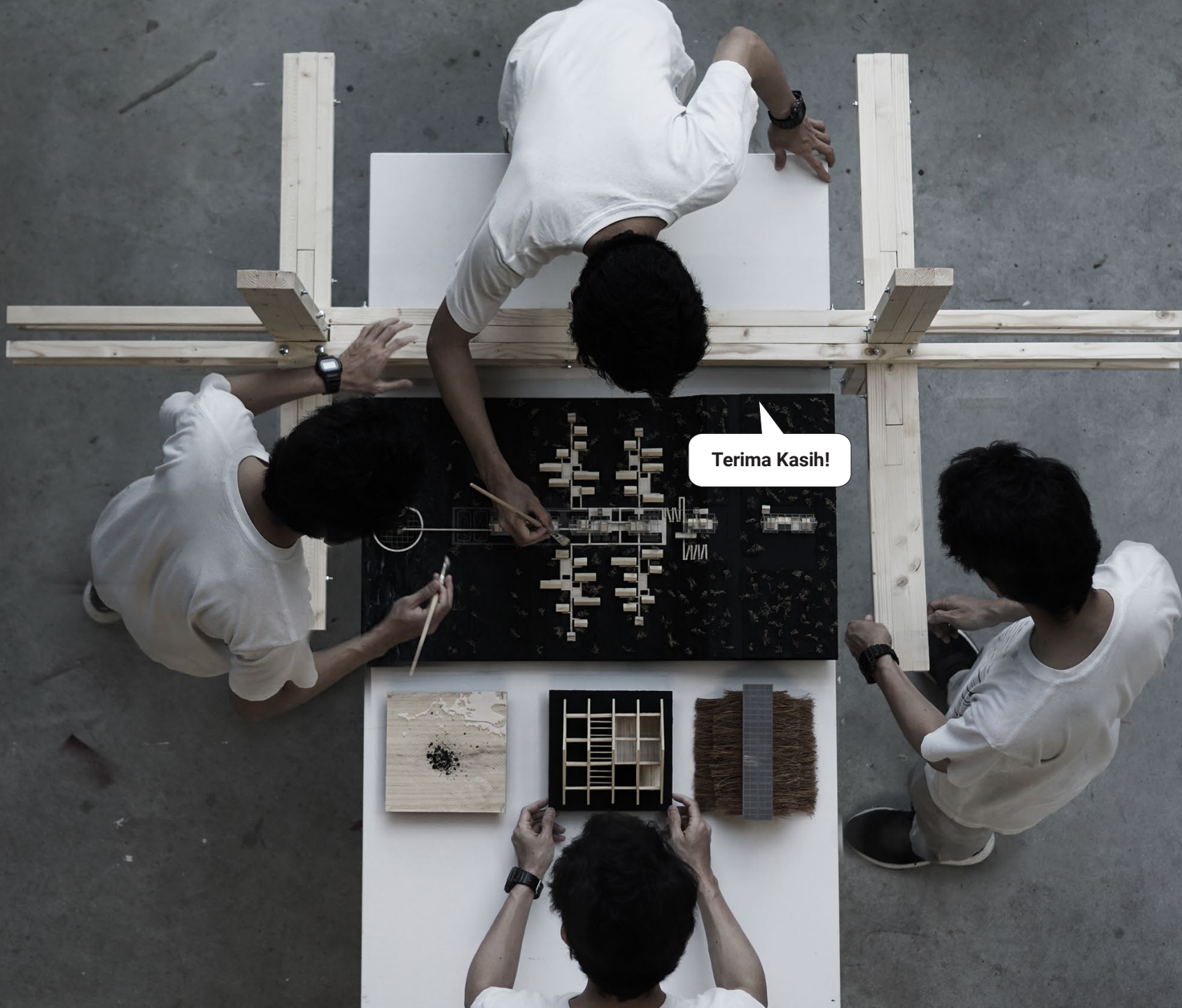
Future Maintenance / Renovation





Rising from the [Coal] Ashes: Envisioning a Circular Post-Coal Community in Muara Enim





Terima Kasih!