



BEYOND FOOD

DE PORRE - MATERIAL & WASTE

Climate Design &
Sustainability

KULeuven - Departement Architecture
2021

William Wery, Liadan Long, Benoît Freymann, Sander Bahnmuller, Sara Dimech

TEAM & CONTENT

1. TEAM

- William Wery
- Liadan Long
- Benoît Freymann
- Sander Bahnmuller
- Sara Dimech

2. FUNCTION

- Manufacturing
- Housing
- Education
- Recreation

Total Project Area: 3,9 Hectares
 Production: 15 438 m²
 Education: 4458 m²

Food Production: 8236 m²
 Housing: 1303 m²
 Recreational: 15 157 m²



Material Max Production: 1 600 000 m³
 Water treatment: 1303 m²
 Electricity production: 227 000 kWh/year
 Jobs: 110
 Housing: 39 units
 149 Inhabitants
 9x50m² (1 bed)
 5x100m² (2 bed)
 14x125m² (3 bed)
 4x150m² (4 bed)
 7x250m² (co-h. 6 bed)
 150 bike parkings

INDEX

3-4. GENERAL OVERVIEW - SECTION A

5. MISSION STATEMENT

6. GHENT CONTEXT

7. VILLAGE SITE PLAN

8. GROUND PLAN

9-10. FACTORY SECTION B

11. BOARD PRODUCTION

12. EXPLODED HOUSING AXONOMETRIC

13-16. MATERIALS CATALOGUE

17. BLOCK A

18. BLOCK B

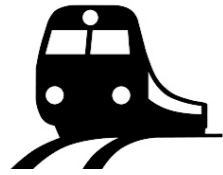
19. BLOCK C

20. LANDSCAPE CONCEPT

21. TEAM RULES

GENERAL OVERVIEW - SECTION A

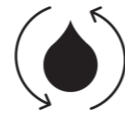
Transportation by train



Community greenhouse roof



Lagooning



Cohousing



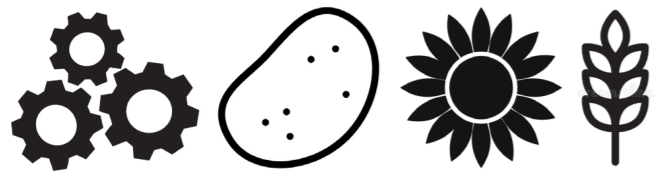
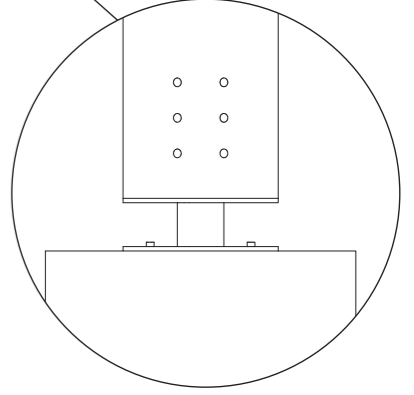
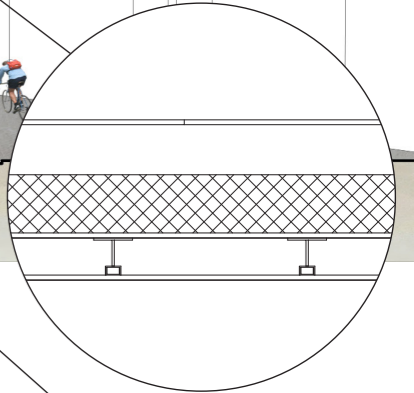
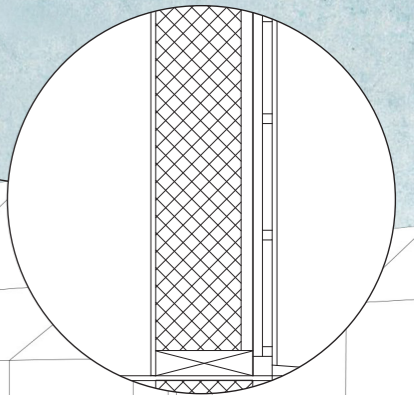
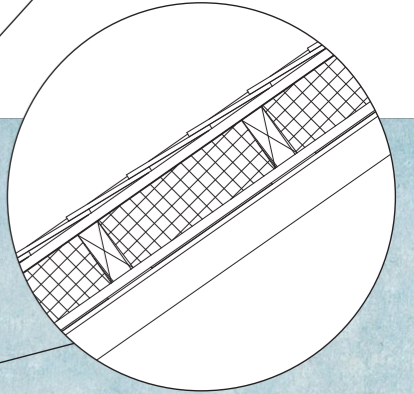
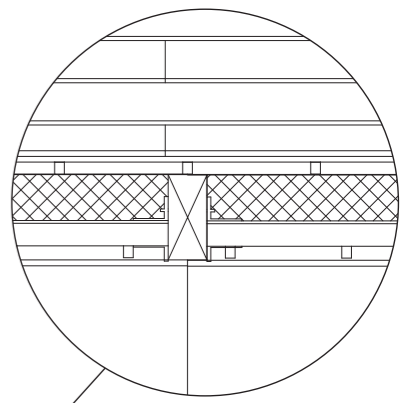
Housing block



Solar energy



Project Overview



2040 Production of panels



Production of panels for De Porre Workshops & Education



Recreational Park

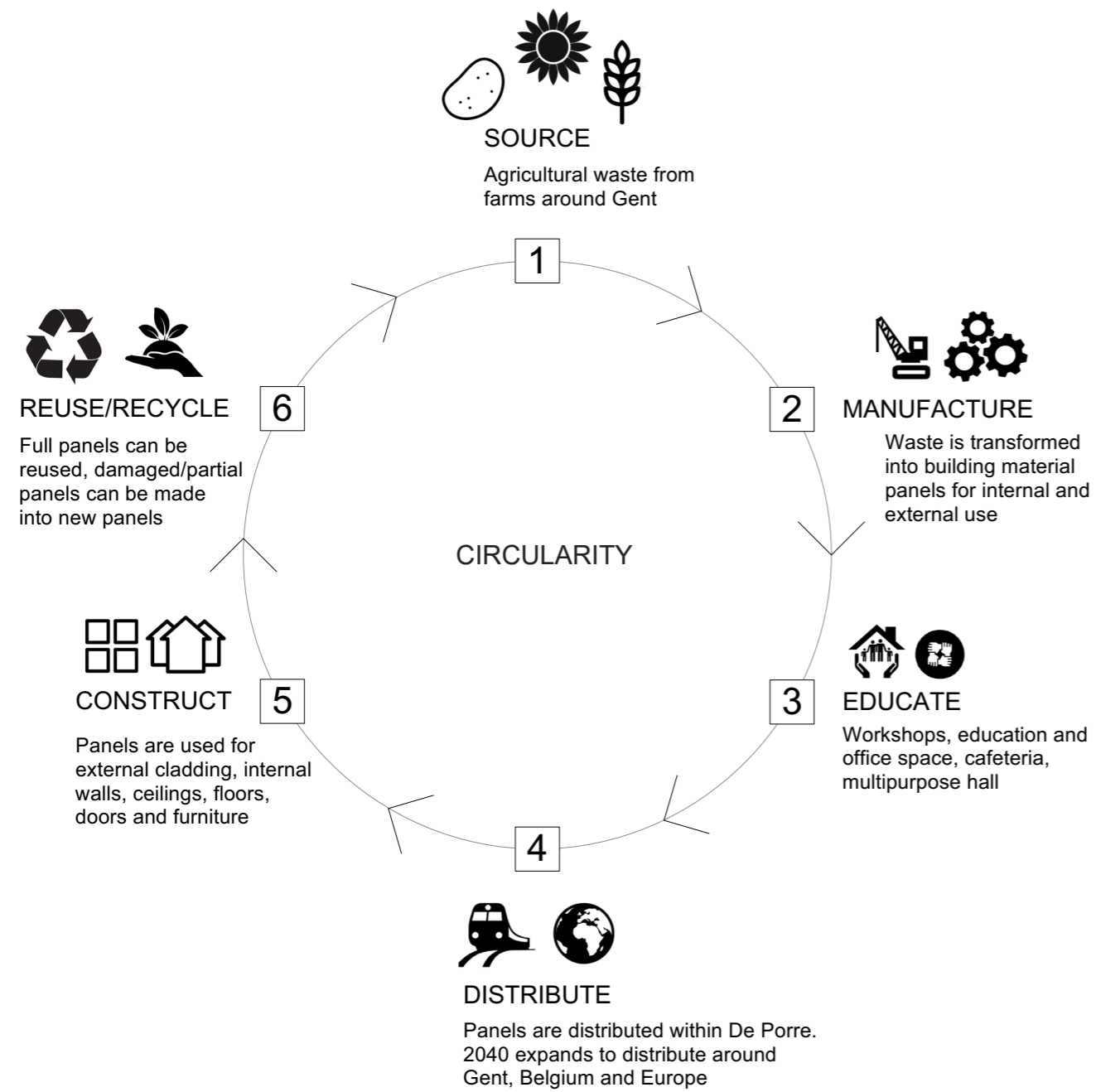


Product of the factory

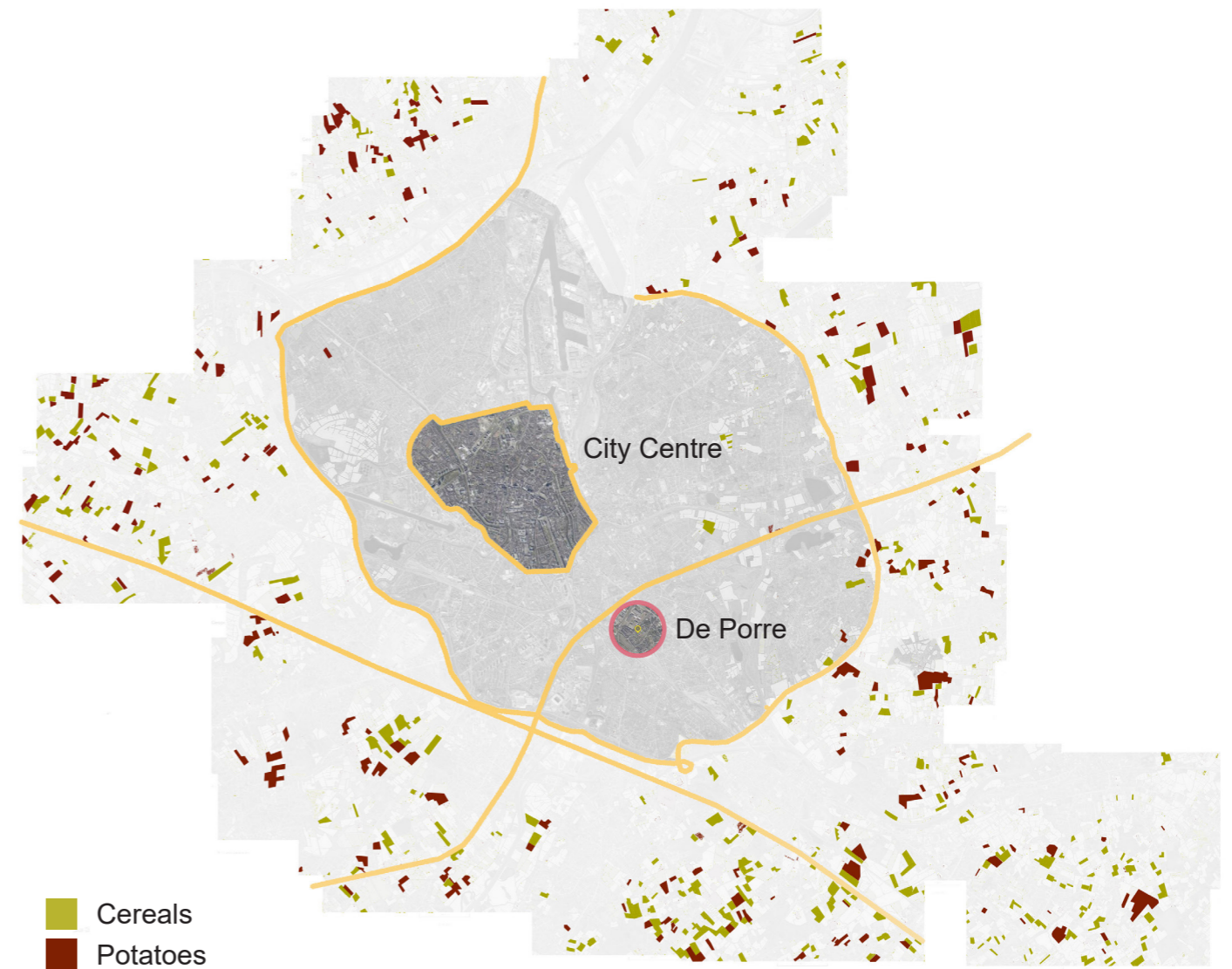


Jules de Saint-Genoisstraat

MISSION STATEMENT



GHENT CONTEXT



This map shows raw material sources (potato, sunflower and wheat) around Ghent. Only 40% of agricultural waste is used by farmers for cattle grazing, the rest is left unused. We intend to use this waste for material production. Thanks to the mobility team the agricultural waste can be easily brought to our manufacturing site.

VILLAGE SITE PLAN



Our project is located on the Arsenaal site next to De Porre. The site has a post industrial setting with abandoned warehouses as well as a railway system within the site, which we will respectively reuse for production (in red) and transport. The site benefits from easy access thanks to the nearby E17 motorway, the N9 and the railway. The housing units (in beige) are implemented on a vacant section of the site. They present themselves as the product of the factory and complete the residential street Jules de Saint-Genoisstraat which connects directly to the De Porre (in grey) site itself. A park (in green) inserts itself between the housing and the production facility acting as a connecting element and landscape buffer for the village. The park is also used for part of the food production to satisfy the Food team's requirements. Included in the park is a water basin for natural water purification as part of the Water team's initiatives. In order to preserve the site's heritage and limit our built footprint we focused on renovating the existing warehouses and keeping our intervention for housing to a minimum. The resulting open space provides for slow mobility and recreation resulting in a positive impact for the community.

The ground floor is intended as a porous and flexible space between the street and the project, which invites locals to enter the site. It also serves as a space for collective amenities (laundry, bike storage, workspace, food hub, recreation) for the neighbourhood.

GROUND PLAN



FACTORY SECTION B



Factory Section

The factory includes several public functions alongside the production itself. Starting on the left, the start-up production lines take up most of the ground floor. Next is the cafeteria (in beige) which gives on the production thanks to a sound proof glazed wall. That area also includes workshops on the ground floor and the offices necessary for production on the first floor. To the right, is the main entrance (in white) which is accessed from the park ensures the connection between both existing buildings and provides vertical circulation. On the far right is a multipurpose hall and auditorium for various educational and social events. A newly added steel structure on the factory floor allows for the use of the roof for food production, in the form of a green house and rooftop garden. In the background are the housing blocks of which the cohousing tower serves as a landmark for the village of De Porre.



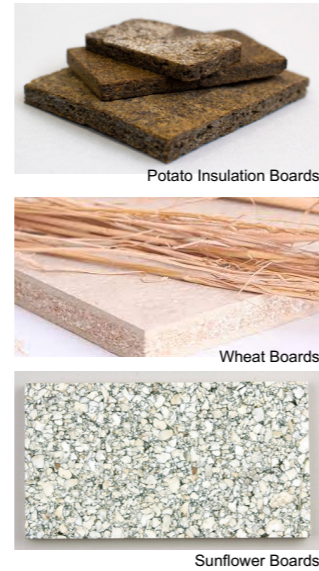
BOARD PRODUCTION

Materials

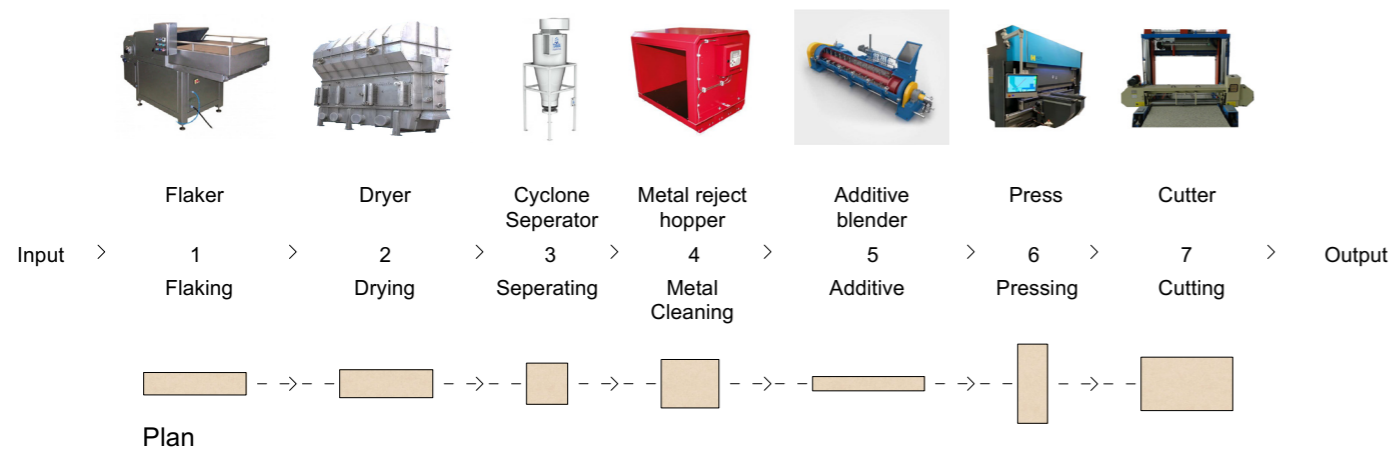
Input - Raw Materials



Output - Product



Manufacturing Process



Data

Input/output per material

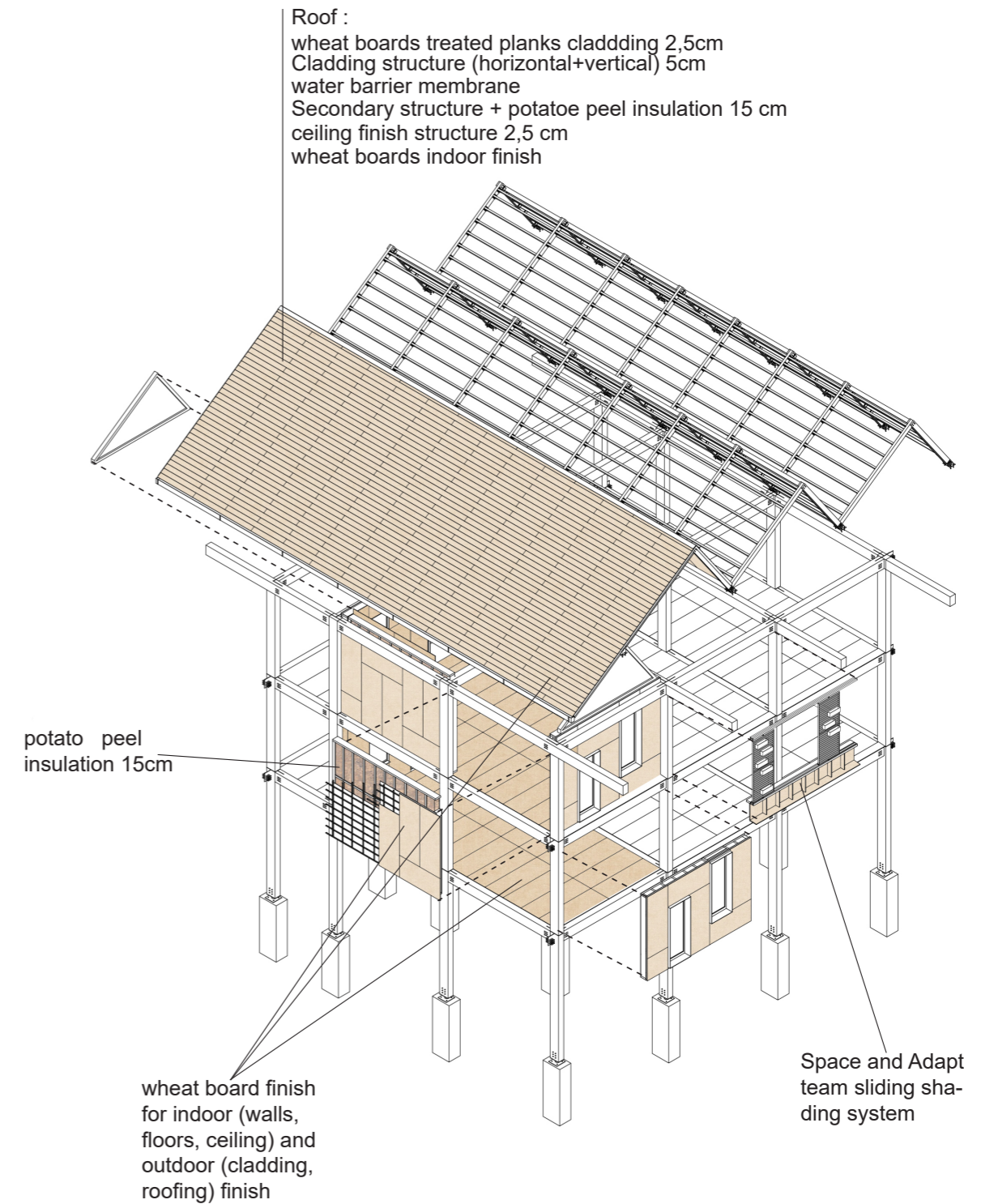
- Wheat - 630kg/m³
- Potato - 5000kg/T
- Sunflower - 700kg/m³

Yearly Production - 200,000m³ per production line
 Start up - 400,000m³ annually
 2040 - 1,600,000m³ annually

Energy Consumption - 1040 kWh per production line

Water Consumption - 24.5m³/h per production line

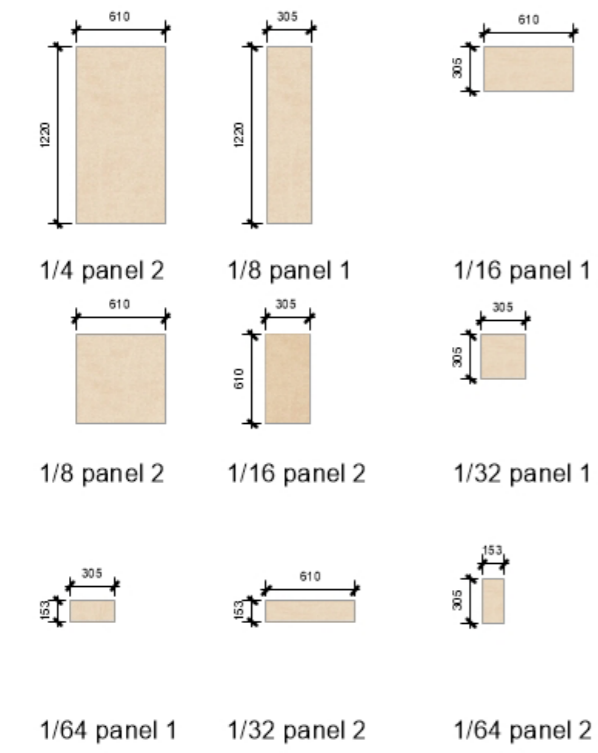
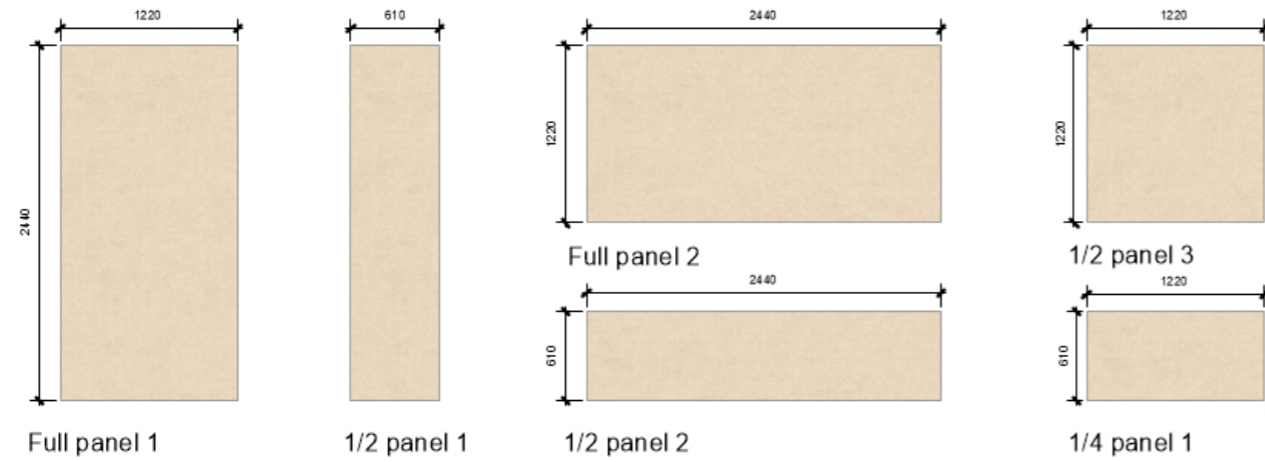
EXPLODED HOUSING AXONOMETRIC



The housing blocks are based on the Space and Adapt team's grid of a 6mx6m for which we chose to use glulam, visible from the outside. The entire construction intends to be fully demountable. All the internal components are products of the factory. The roof extends on all sides to protect the structure from weathering as well as providing shading. In addition, the Space and Adapt team's shading panel system are integrated on the facade. The roof serves as a reminder of the site's industrial heritage. Its southern inclination of 35 degrees makes it ideal for the use of solar panels as required by the Energy team.

CATALOGUE

Wheat Board
Panel cut sizes
Sizes in mm



USES

Internal
External

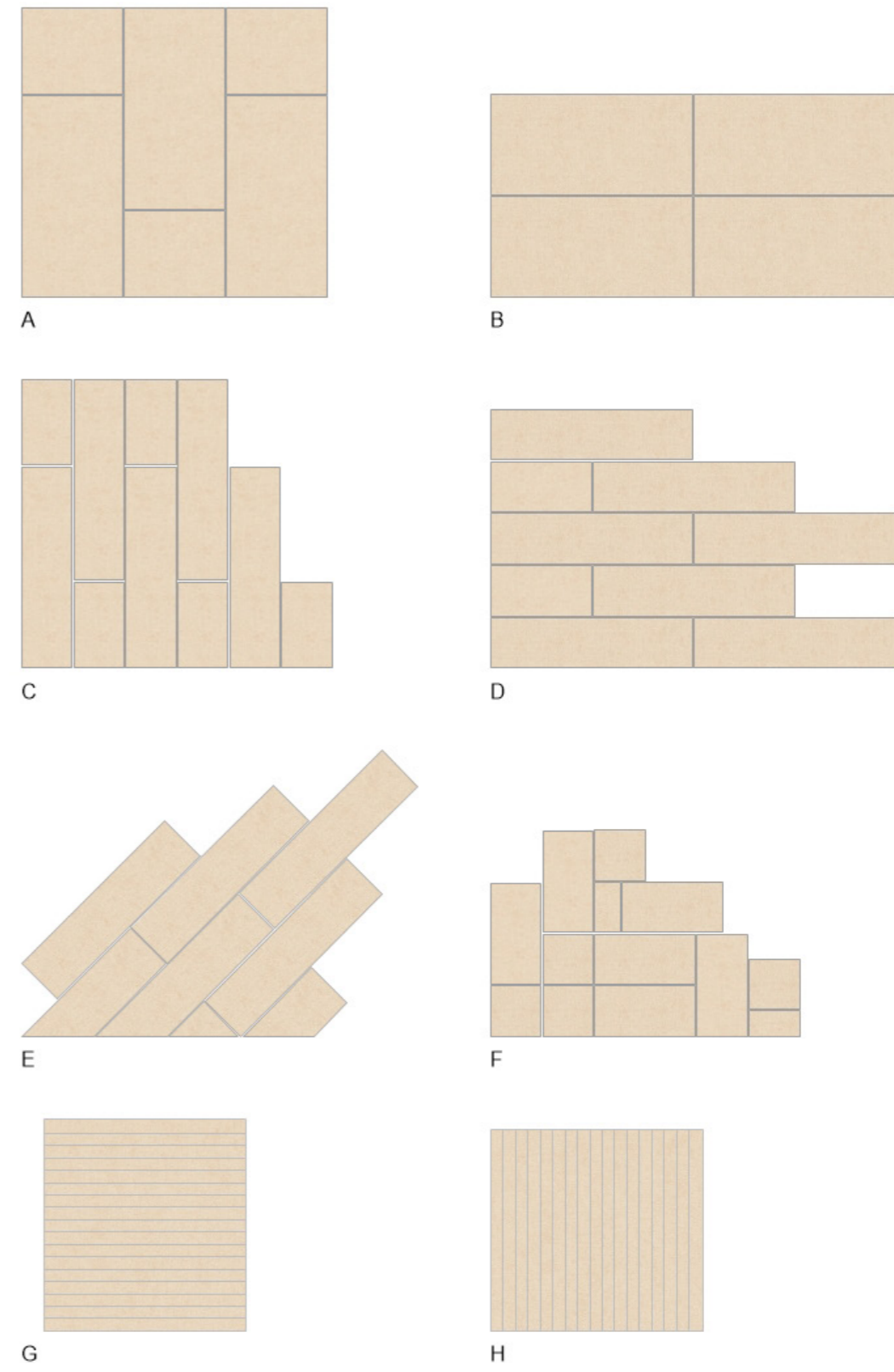
Floors
Ceilings
Walls
Cladding
Roofing
Furniture

PROPERTIES

- More resistant than any wood-based MDF board
- formaldehyde-free adhesive (P-MDI): eco friendly and healthy
- much better fire resistance: B2 vs C for normal boards
- good water resistance thanks to MDI and outside layer of pure wax
- water swelling rate : 6%/2h
- High stiffness
- Good acoustic properties
- Biodegradable and fertilizer

CATALOGUE - CLADDING

Wheat Board
Patterns using larger cuts



CATALOGUE - CLADDING

Wheat Board

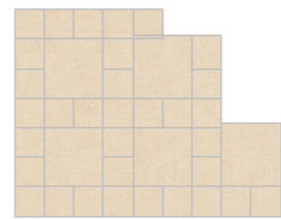
Patterns using smaller cuts or offcuts



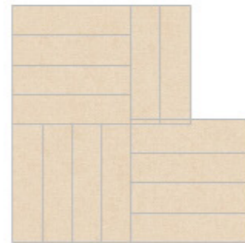
I



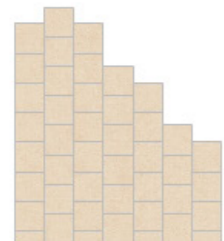
J



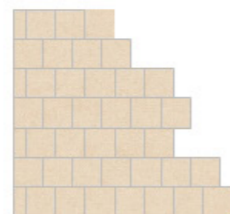
K



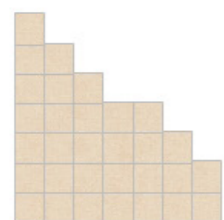
L



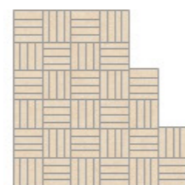
M



N



O



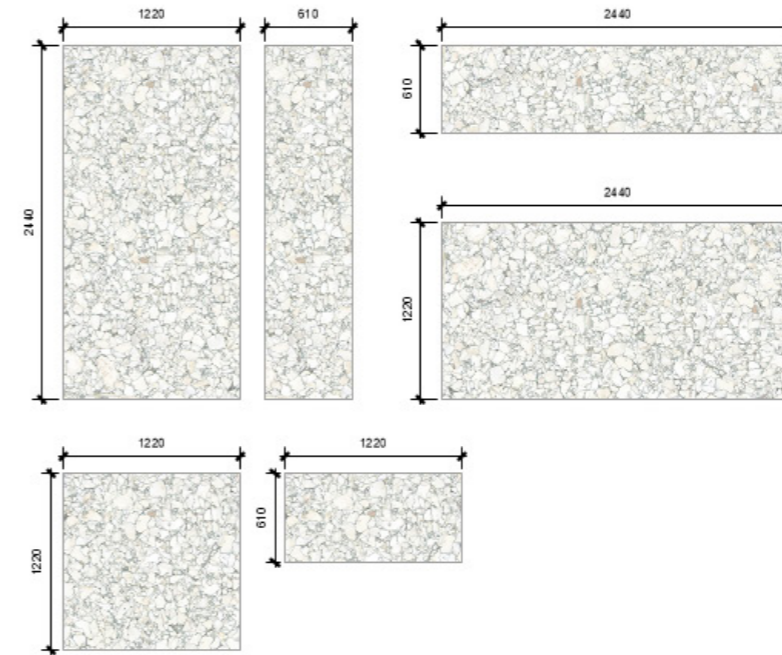
P



Q

CATALOGUE

Sunflower Board



USES

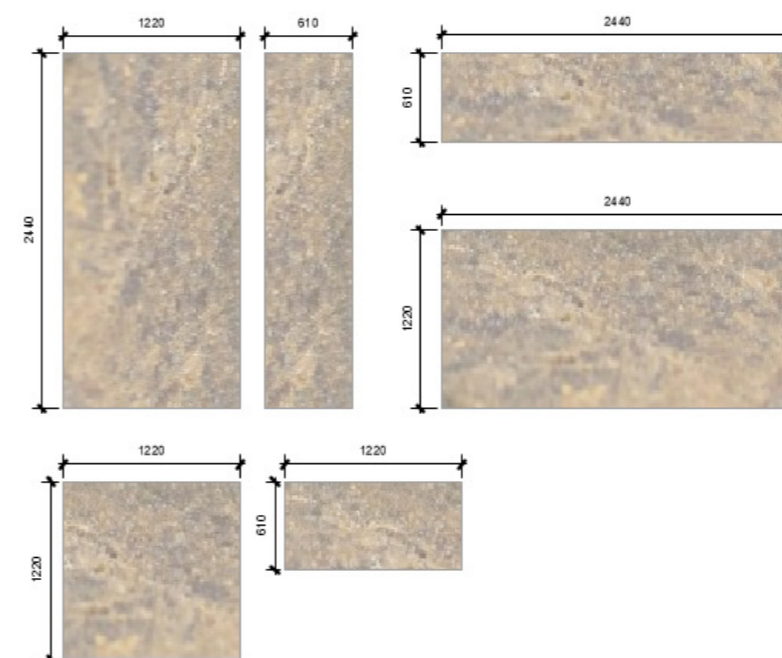
Internal

Ceilings
Walls
Furniture

PROPERTIES

- Formaldehyde-free adhesive (P-MDI): eco friendly and healthy
- Light weight
- Fire resistance
- Water repellent
- Biodegradable and compostable
- Good acoustic properties

Potato Insulation Board



USES

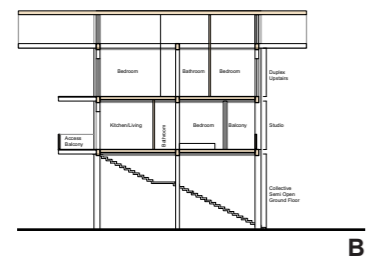
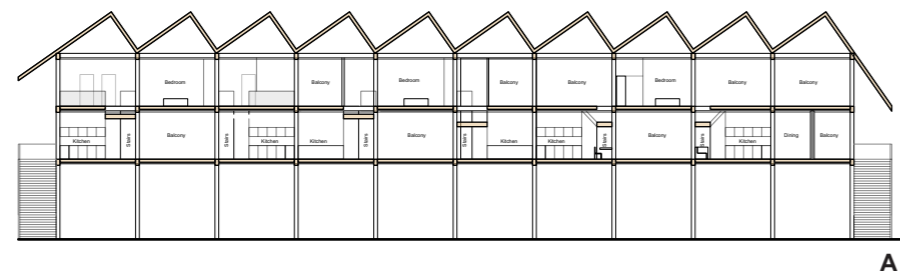
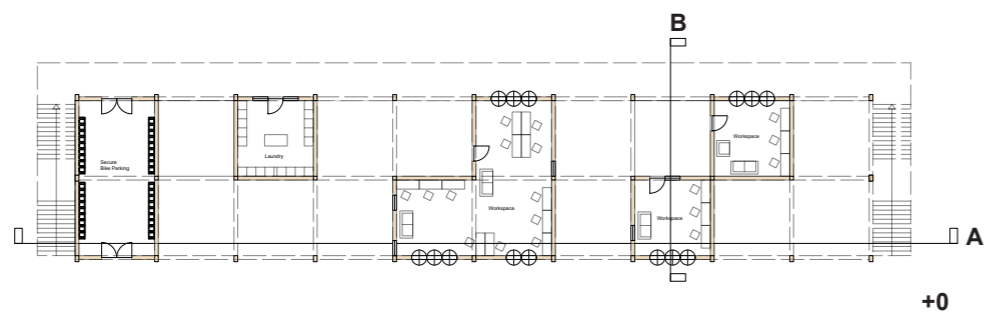
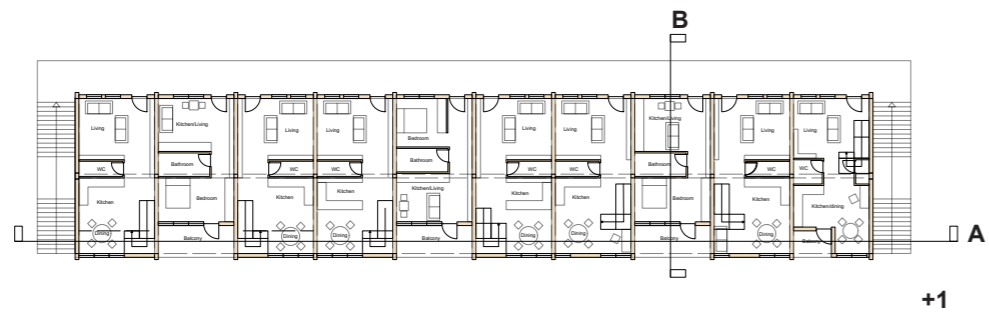
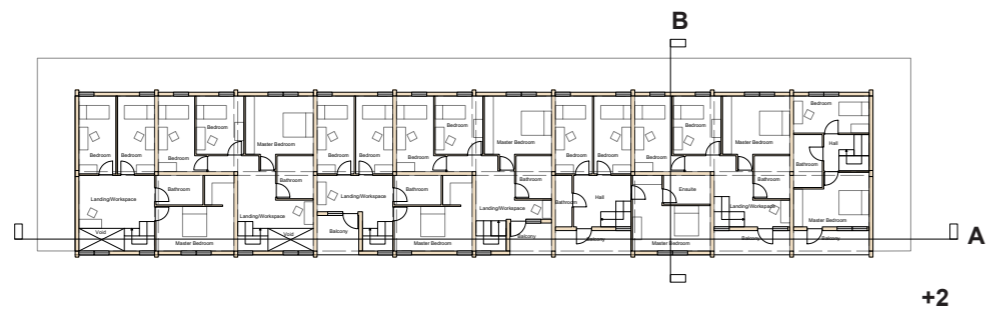
Internal

Insulation
- Walls
- Floors
- Ceilings

PROPERTIES

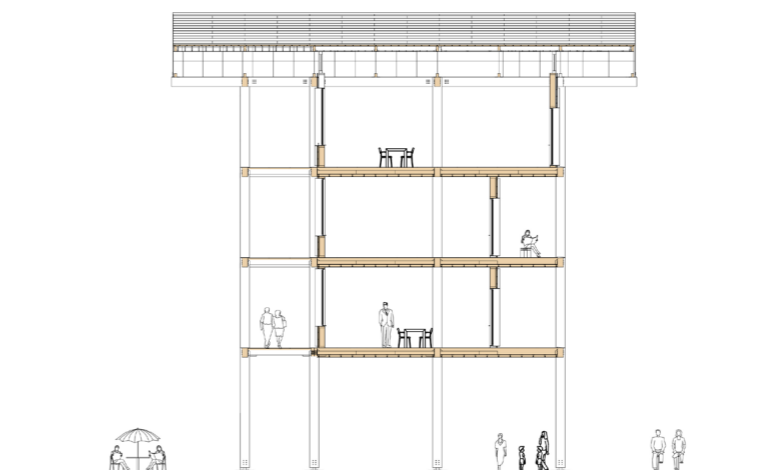
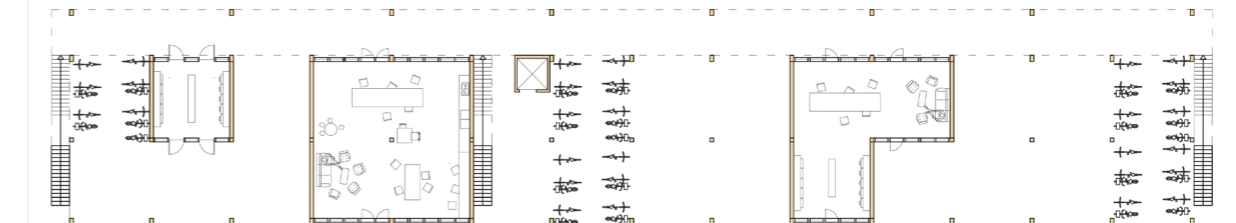
- Thermal Conductivity Coefficient = $0,0478 \text{ W}^*(\text{m}^*\text{K})^{-1}$
- Water repellent
- Fire resistant
- Low weight
- Acoustic absorbent
- Doesn't use the toxic material found in other thermal insulation
- High strength

BLOCK A



We have a mix of traditional duplex, simplex and studio units as well as some collective units. Balconies serve as private outdoor space and shading on the southern side. According to the Space and Adapt team's rules the first floor is raised by 5 metres.

BLOCK B

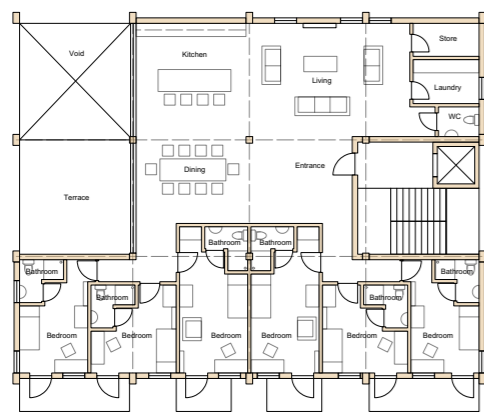


The grid structure facilitates flexibility in the plan layout and can be filled in in a variety of ways over time.

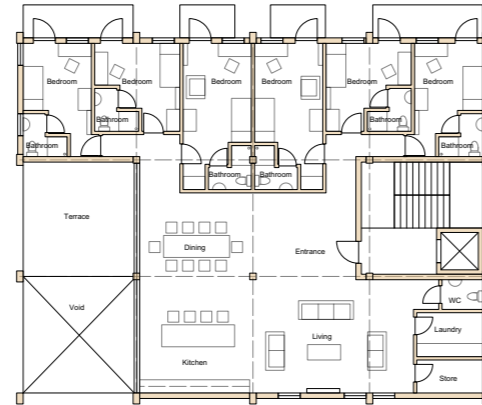
BLOCK C



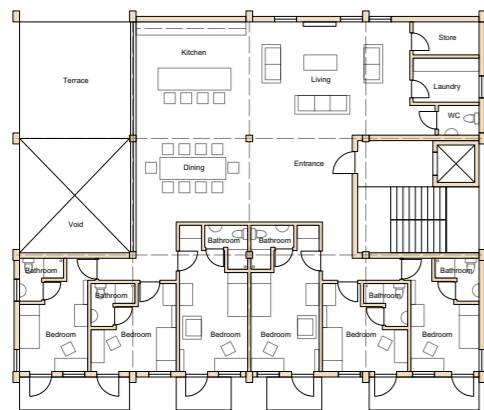
LANDSCAPE CONCEPT



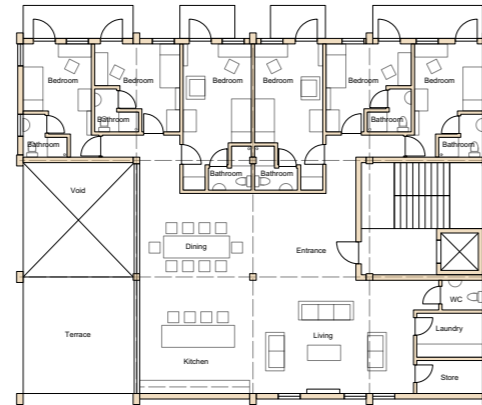
+2/+6



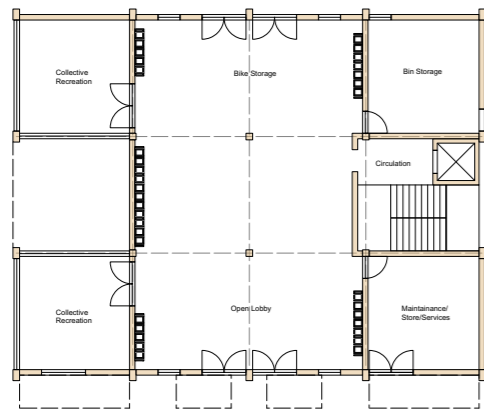
+4



+1/+5



+3/+7



+0

The tower accommodates co-housing meant for students or young professionals. Each floor is composed of a generous open plan collective space, including a terrace and has six bedrooms. Double heights between the terraces creates communication and visual connection to the different levels.



The landscape park is at the centre of the scheme. It connects the housing on the street side to the public activities happening in the factory building. The idea is to create a natural buffer to ease the relationship between two different functions (housing and manufacturing). The park is a mixture of more or less maintained landscaping, food production and water. A primary path travels across the park and is surrounded by grass partially left to grow and partially cut to create new soft finish paths and connections.

MATERIAL AND WASTE TEAM RULES

1. Insulation using potato peel panels
2. Internal wall to be made using wheat board or sunflower boards (replaces OSB but looks better, can also have a finish if wanted)
3. Floor also to be made using wheat boards
4. Ceiling panels, to use wheat boards or sunflower boards
5. Exterior cladding may be made using wheat boards or reclaimed materials from other nearby sites (around Gent)
6. Furniture can be made using either wheat boards or sunflower boards
7. Primary Structure - Steel (bolted) or Wood (dry connections) or other - has to be dismantlable and reusable, can be combination of different materials
8. Secondary Structure - wood - also dismantlable

NOTE: All panels are produced at our facility and are to be used within De Porre.

PROJECT SUMMARY



Located on the Arsenaal site next to De Porre, our project provides the village not only with sustainable alternative building materials but also with a variety of other functions. They include education, food production, housing and recreation. The project reuses existing buildings to house our production and educational facilities. The housing, the product of the factory, participates in answering the growing needs of a changing demographic of the city. It also tries to work with climate. The park creates a new urban landscape within the village. Beyond Food is a centre for education and learning about building for the future and puts these principles into practice. First and foremost, our positive impact on the village is found in the production of panels, using a waste product, which have a circular life span. We create the energy required to meet the needs of our inhabitants, the running of the factory and a surplus for the village (Energy). Food is grown within the landscape in the form fruit trees and a greenhouse rooftop on the factory (Food). We collect grey water for purification and its reuse (Water). All spaces created are adaptable, flexible and demountable (Space and Adapt). The factory itself not only produces the panels for construction but also creates jobs and provides education in relation to the manufacturing as well as the impact of sustainable materials on our climate. The public amenities give a sense of community within De Porre and are a means of sharing the knowledge needed to work towards a more sustainable future together. And finally, looking to 2040 our factory will provide panels beyond the village around Gent, Belgium and Europe using the railway transport system in place at our site (Mobility). Beyond Food serves as a model for sustainable building practices going forward.