"The Trunk & Beyond"

Typically, trees are valued by their logs, due to its strength and aesthetic appeal. By analyzing the **trees beyond their trunks**, a whole host of **new material expressions can be derived from parts that are commonly ignored** or seen as less valuable.

These residual materials which includes **bark, leaves, wood fibers, wood shavings, sawdust, pine needles, pine cones, raw resin** and **off-cuts** are regarded as the protagonist rather than waste products. They therefore becomes the catalysts and the base parameters that defines new alternative tree-based architectural components.

The initial investigation was undertaken by visiting several sources involved in various stages of the wood manufacturing process, including plantations **(Tulstrup, Eldrup)** sawmills in varying sizes **(Ry-, Grønagergård- & Roldskov Sawmill)** and a glue laminated timber factory **(Vinderup Træindustri)**. The objective was to document the procedures, while simultaneously gaining insight into the specific stages within the process where the various residual wood products were generated.

1. Leaves 2. Wood Fibers 3. Wood Shavings
4. Bark 5. Pine Cones 6. Sawdust
7. Off-Cuts 8. Raw Pine Resin 9. Pine Needles

A Wasteful Production Line

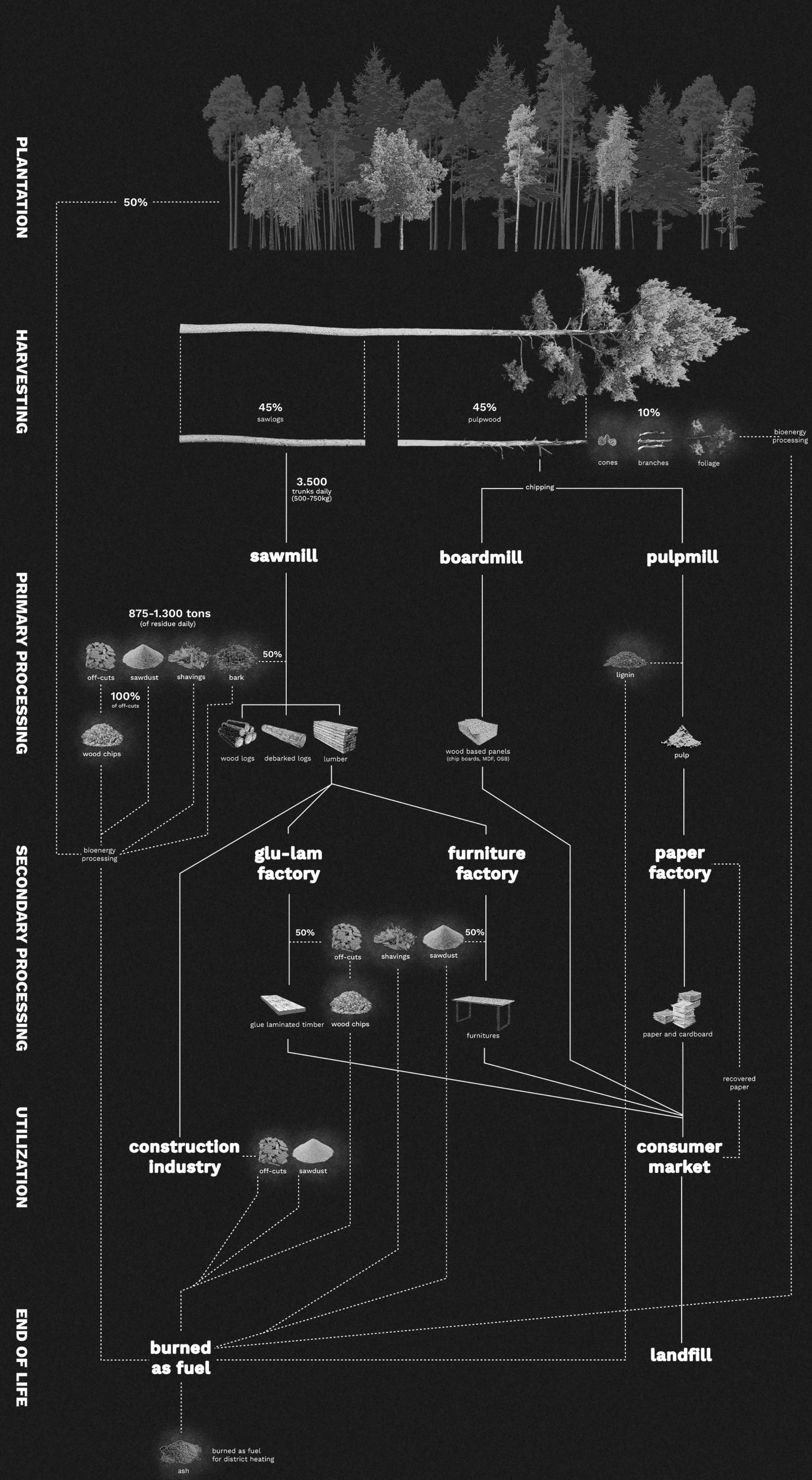
The category of **'wood residues'** contains various processed resources in the many stages of the industry. – from the raw harvesting in the **plantations** to the **sawmills** and onto the **factories**. This chain is often characterized by its high levels of waste and inefficiency in waste management. In the plantation the foliage which includes; leaves, needles, branches and twigs makes up for the majority of this. At the sawmills, there are mainly off-cuts, sawdust, shavings and bark, but also usable wood being discarded due to "low-grade" quality, knots or other imperfections. In the last stage the residual wood are also off-cuts, but from the surplus of the fabrication.

Only a small portion of the wood residues generated is repurposed for various uses. The predominate fate of these residues is to serve as fuelwood for the district heating plant. With very little practical utilization, much of these residues are therefore burned resulting in further exacerbation of the climatic issues. This lack of utilization of logging byproducts therefore highlights the need for more efficient practices throughout the industries. Each stage of the chain of production therefore contains many resources with much potential for exploitation.

From Residue To Architecture

By incorporating these residual wood products into the design process, not only does it reduce waste, but it also provides an opportunity for the logging industry to create value from what would otherwise be considered waste materials. With the right technology and processes in place, **these "low quality" wood residues can potentially be transformed into high-quality architectural components**, providing an alternative to conventional building materials.

By embracing this new approach to building design, we can also challenge the traditional perception of architectural aesthetics. So, the question is how can we highlight the qualities of these residual materials?



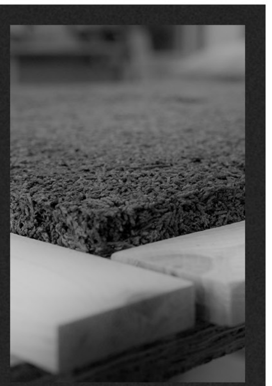
wood composite panels

The procedure begins by taking raw materials, specifically pine cones, bark, and pine needles, and breaking them down into smaller particles using a compost grinder. This step is crucial for ensuring that the materials are of a uniform size, which aids in the next step of the process.

After grinding, the materials are then thoroughly combined with pine resin, a natural adhesive that helps in binding the particles together. This mixture is subsequently transferred into a mold, where it is subjected to a significant amount of pressure. This compression not only shapes the mixture into panels but also ensures that the pine resin adequately permeates the mixture, acting as a binding agent to solidify the composite materials. As a result of this pressure, the mixture solidifies, forming durable and composite panels.





off-cut wall structure

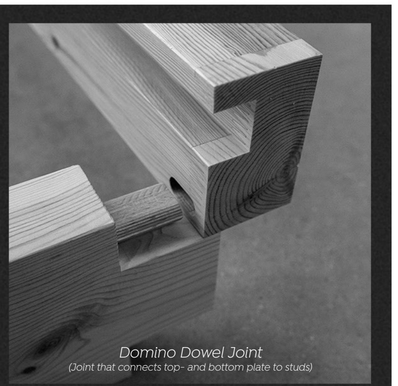
The construction of the wall frame incorporates components crafted from the surplus wood pieces sourced from Vinderup Træindustri. These pieces are joined together through the use of finger joints, a woodworking technique that interlocks two pieces of wood by cutting complementary sets of cuts into them, and securing them with pine resin. Thus creating the: studs, struts. top- and bottom plates.

Following the creation of these individual elements, they are assembled into the complete wall frame. This assembly process utilizes dowels. These grooves are designed to accommodate the insertion of the composite panels, ensuring a snug and secure fit.


Studs
(With grooves for insertion of composite panels and struts)


Struts
(With notch to slide into grooves of studs)


Top- & Bottom Plate
(Made to fit perpendicular to studs)

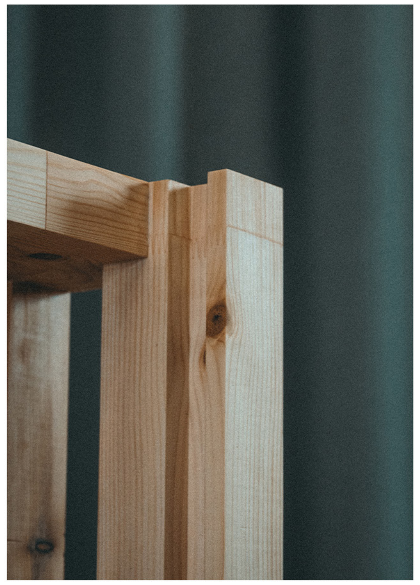

Domino Dowel Joint
(Joint that connects top- and bottom plate to studs)

leaf insulation blocks

The manufacturing process of the insulation blocks involves a blend of leaves and pine resin, combined to form a cohesive mixture. This mixture is then introduced into a mold where it undergoes compression, a critical step that not only shapes the blocks but also embeds them with precise notches. These notches are designed to fit together, much like puzzle pieces in between the studs of the wall frame, when the blocks are assembled.

The primary purpose of these notches is to facilitate the interlocking of the blocks upon installation, a feature that plays a pivotal role in enhancing the overall insulation efficiency of the structure. By fitting snugly together, the blocks form a continuous barrier that significantly reduces the incidence of thermal bridging





Grooves in the studs where the composite panels can be inserted into.


Inbetween the composite panels, struts are placed in the grooves to further stabilize the structure.

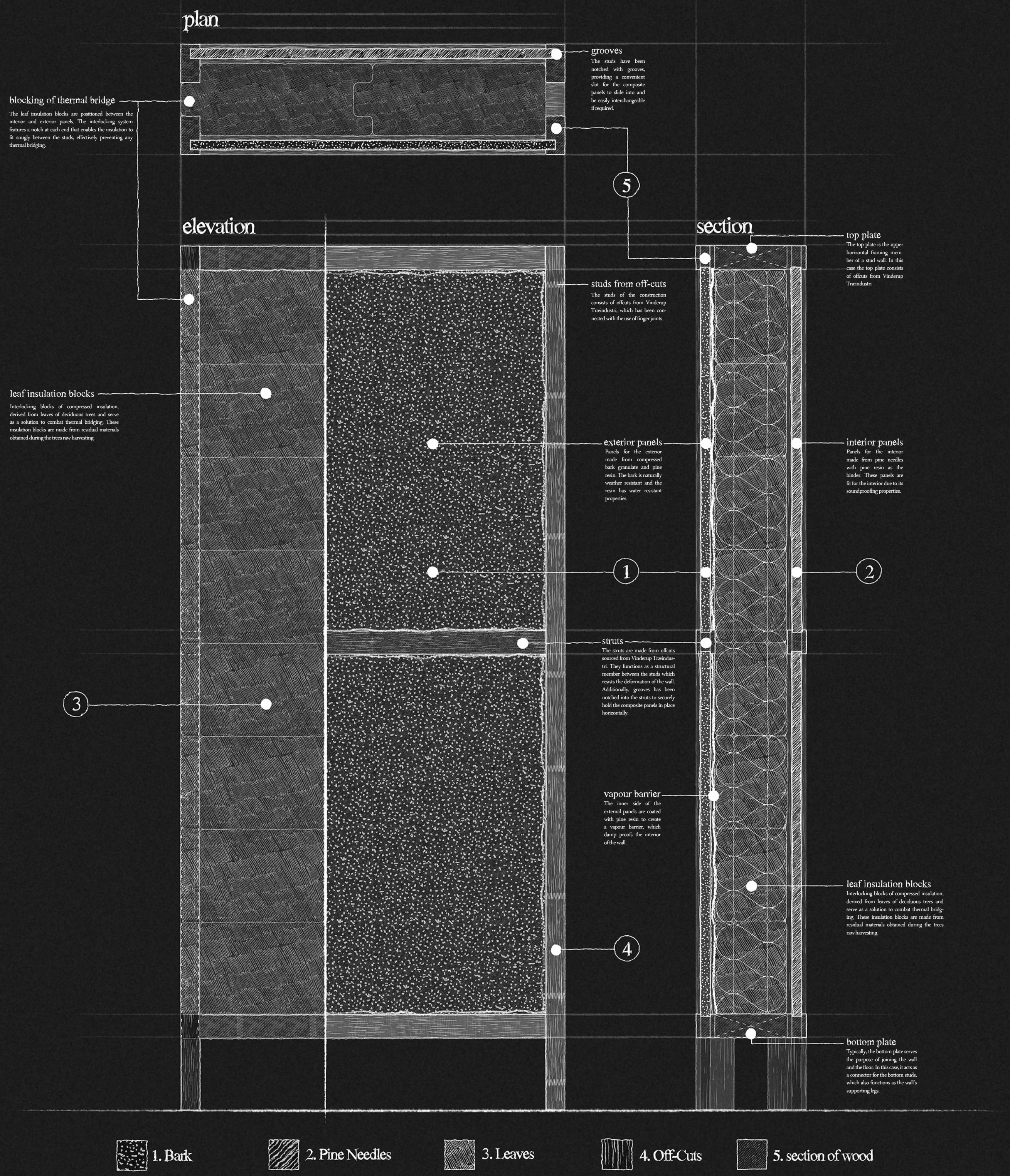

A view of the exterior panel (bark & pine cones) and leaf insulation. (Top exterior panel removed for view)


Interlocking insulation blocks made from leaves and resin. The notch allows the block to fit inbetween the studs.


A view of the bottom interior composite panel (pine needles) It rests on top of a strut and inbetween the studs.


A close up, showingcasing the fit of the panel and insulation block in the wall frame.


View of the exterior panel (Top panel is removed for view into leaf insulation)


plan
blocking of thermal bridge
The leaf insulation blocks are positioned between the interior and exterior panels. The interlocking system features a notch at each end that enables the insulation to fit snugly between the studs, effectively preventing any thermal bridging.
grooves
The studs have been notched with grooves, providing a convenient slot for the composite panels to slide into and be easily interchangeable if required.
5
elevation
section
top plate
The top plate is the upper horizontal framing member of a stud wall. In this case the top plate consists of offcuts from Vinderup Træindustri
studs from off-cuts
The studs of the construction consists of offcuts from Vinderup Træindustri, which has been connected with the use of finger joints.
leaf insulation blocks
Interlocking blocks of compressed insulation, derived from leaves of deciduous trees and serve as a solution to combat thermal bridging. These insulation blocks are made from residual materials obtained during the trees raw harvesting.
exterior panels
Panels for the exterior made from compressed bark granulate and pine resin. The bark is naturally weather resistant and the resin has water resistant properties.
interior panels
Panels for the interior made from pine needles with pine resin as the binder. These panels are fit for the interior due to its soundproofing properties.
1
2
struts
The struts are made from offcuts sourced from Vinderup Træindustri. They functions as a structural member between the studs which resists the deformation of the wall. Additionally, grooves has been notched into the struts to securely hold the composite panels in place horizontally.
3
vapour barrier
The inner side of the external panels are coated with pine resin to create a vapour barrier, which damp proofs the interior of the wall.
leaf insulation blocks
Interlocking blocks of compressed insulation, derived from leaves of deciduous trees and serve as a solution to combat thermal bridging. These insulation blocks are made from residual materials obtained during the trees raw harvesting.
4
bottom plate
Typically, the bottom plate serves the purpose of joining the wall and the floor. In this case, it acts as a connector for the bottom studs, which also functions as the wall's supporting legs.
1. Bark
2. Pine Needles
3. Leaves
4. Off-Cuts
5. section of wood