

# enabling a biofiber low carbon platform for sustainable performance materials

A case study  
with African Bamboo B.V.

Research carried out with Top Sector Energy Subsidy from  
the Ministry of Economic Affairs and Climate





*CO<sub>2</sub> emissions from buildings and construction hit a new high, leaving the sector off track to decarbonize by 2050. Materials used in the construction of buildings already account for around 9% of overall energy-related CO<sub>2</sub> emissions, which makes the sector an area for immediate action, investment and policies to promote short and long-term energy security.*

- *2022 Global Status Report for Buildings and Construction, Egypt COP27*



# We need to move towards more sustainable building materials and processes...

Tackling emissions associated with materials and construction processes, requires looking at renewable materials, and decarbonizing conventional building applications.

- Pressure on the sector comes from global stakeholders setting targets and strategies towards a sustainable, **zero-carbon and resilient buildings and construction sector**
- The construction industry is likely to face increasing **regulatory pressure to promote sustainability** in the coming years, as governments around the world seek to address the urgent challenges of climate change and resource depletion.

## Saint-Gobain needs to actively address more and more upcoming regulatory requirements:



### **Net Zero Emissions Buildings:**

Many countries have set ambitious targets to reduce greenhouse gas emissions, and this will lead to regulations mandating that all new buildings be designed to produce zero carbon emissions.



### **Building Material Standards:**

Regulations will likely be introduced to reduce the carbon footprint of construction materials. This includes requirements for the use of low-carbon concrete, timber, and other materials that have a lower environmental impact than traditional building materials.



### **Circular Economy Principles:**

Regulations may encourage the use of circular economy principles in the construction sector, promoting the reuse and recycling of materials and reducing waste.



# ... while creating opportunities to increase resilience and competitive advantage

### New market opportunities



est. CAGR of bio-based materials market

Rising demand for sustainable building materials and growing market for bio-based composites in the building sector

### More resilient supply chain



of organizations deal on an ongoing basis with disruptions

Diversification of the supply chain increases resilience against political and climate-related disruptions, as well as rising costs for fossil based resources.

### Reduced carbon footprint

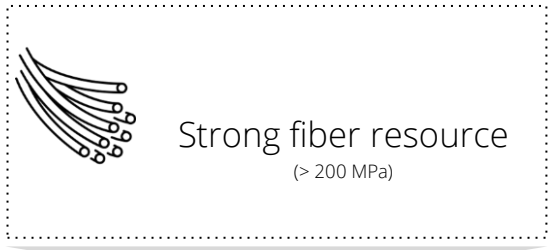


of CO2 emissions can be reduced by bio-based materials

Investing into carbon-negative building material technologies contributes to Saint-Gobain's decarbonization goals.

Transitioning to bio-based, low-cost material alternatives that are capable of reducing the environmental impact through the use of renewable and locally available resources, offers a technology base to address the recyclability, biodegradability and circularity of current building applications and make these substantially more sustainable.

# ...by developing a sustainable material platform with bamboo and other natural fibers as a resource and creating true synergies.



**GHG emission reduction**  
(Access to carbon credit markets)



**Establishment of a bamboo supply chain**

**Versatile application platform**  
(African Bamboo patented Key Enabling Technologies)



**High-Performance Panel**  
Manufacturing, 90% to 190% stronger than wood-based panels



**Dry Biofiber Valorization**  
enhances durability and strength of bio-based fibers, saving 37% energy



**Advanced Compression Molding**  
doubles productivity and recycles heat, saving 28% energy

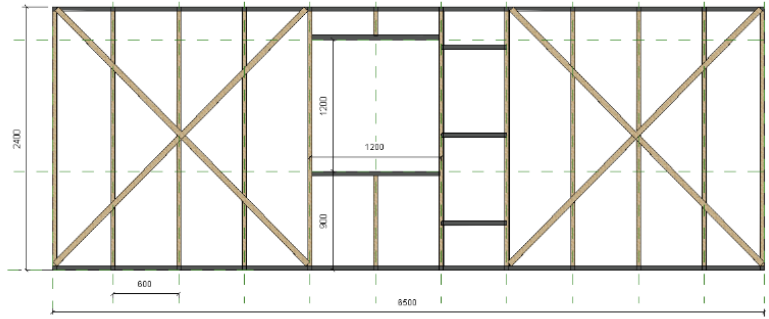
Complementing timber & steel supply chain for timber-based panel and steel products

Serving as an entry point for different divisions within Saint-Gobain, e.g. paneling, cladding, profiles, etc.



# Promising carbon-neutral use case validated thru Saint-Gobain

Bamboo composites for 3d profile applications, e.g. framing elements for modular gypsum drywall construction to replace metal products



Weight savings and more efficient construction processes

Higher design flexibility and streamlined construction with higher accuracy

Easier assembly and disassembly (wood working tools, no heavy machinery)

Higher material efficiency due to minimal production and construction waste

**75% LOWER IMPACT**

than corresponding steel products due to carbon sequestration of bamboo

**90% LOWER FOOTPRINT**

in the application due to 80% lower material consumption

**30% LOWER COSTS**

in the manufacturing due to 50% lower energy consumption





# Readily available partnership that creates value and opportunities along the entire product life cycle



African communities improve their life quality due to bamboo plantations, improving also their Habitats. By working with African Bamboo B.V., it activates the benefits of bamboo as a resource for natural-fiber composite applications.

**COOPERATION**



Bamboo's CO2 sequestration, could reduce the organization's overall carbon footprint.

**AWARENESS**



Develop light weight building material with new technologies, driving competitive innovation, complying with upcoming regulations.

**INNOVATION**



Economic opportunities to position as global leader in sustainable construction material.

**LEADERSHIP**



Enable circularity, reduce environmental impacts. Increase diversity of the company's products.

**OPPORTUNITY**




# Future-proofing the value chain in a growing market

Building product expertise in natural fiber composites including supply chain offers an entry point into the market for further natural-fiber composite applications in building and construction.



**Sustainable alternatives to conventional materials such as concrete, steel or plastics**

Natural fibers have higher strength than flax, hemp or sisal at equal densities.



**Larger product portfolio diversity and more resilient supply chain**

Access to natural fiber processing technologies that enable a wide range of applications.



**Competitive advantages in the growing market for natural fiber applications**

The developed processing technologies can handle a broad range of different natural fibers.



**Strong contribution to net-zero targets and decarbonization strategy**

Activating natural fibers as a resource significantly reduces carbon footprint of products, supply chain and processes.



**Risk mitigation and readiness for upcoming regulations and roadmaps**

Renewable materials actively address regulatory requirements resulting from global sustainability roadmaps

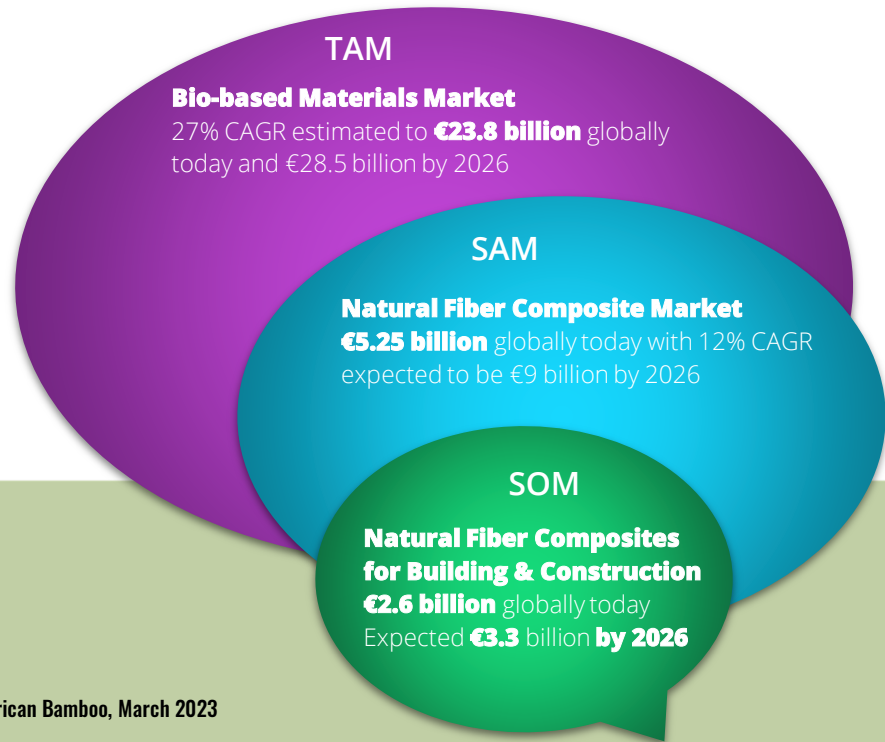




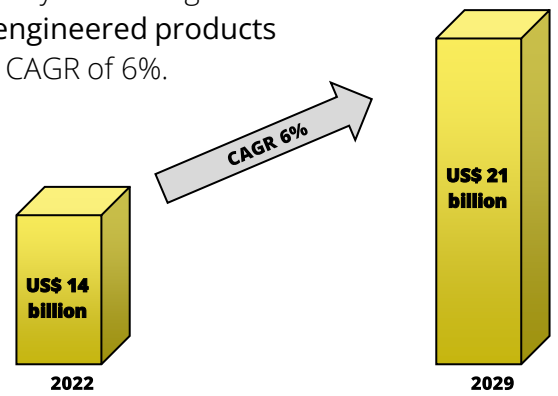


# Addressing a demand for materials globally

The demand for construction materials is about to double by 2060.



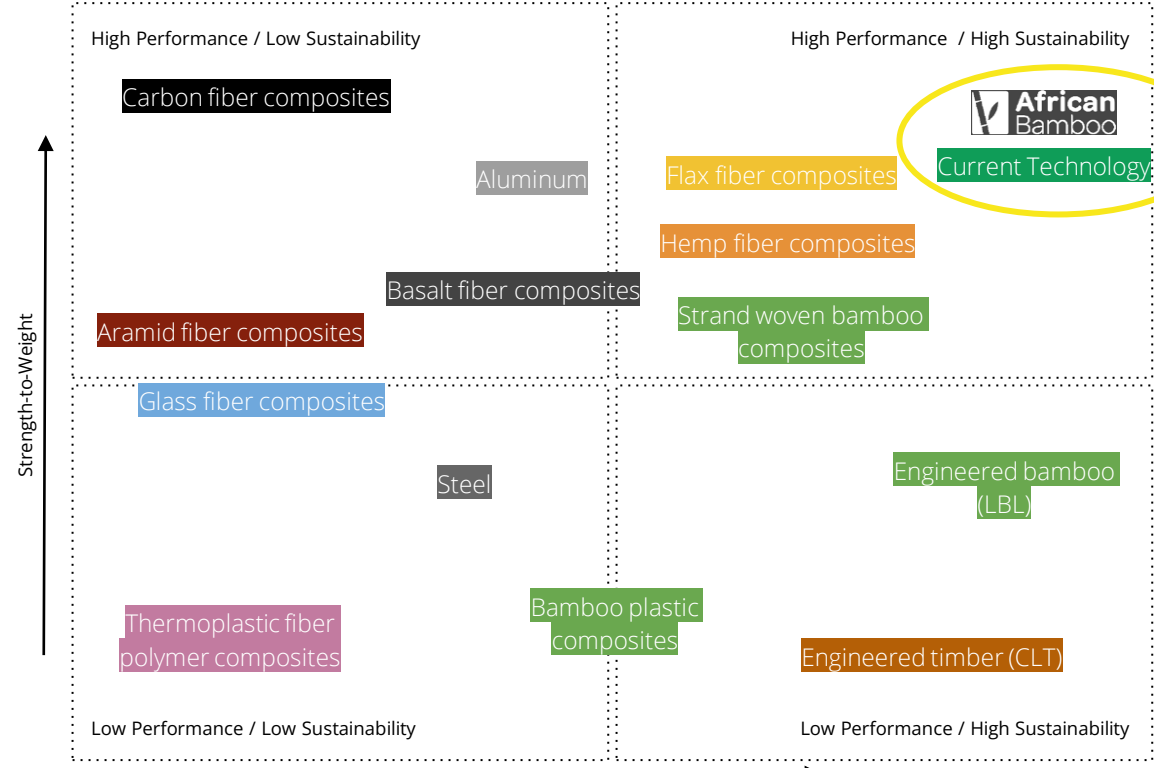
Sustainability roadmaps in the construction industry drive the growth of the market for engineered products to a CAGR of 6%.



The Youth population is expected to reach 2.4 billion people in 2050 and an estimated 70% of the global building stock expected for 2040 has yet to be built. The **construction** market is already estimated to US\$ 13 trillion today.



# Creating a biocomposite manufacturing platform in Netherlands based on competitive advantages to comparable technologies



Competitors in the low performance sector:

- |                                      |  |
|--------------------------------------|--|
| MOSO International B.V.              | Smith & Fong Co. Inc.                  |
| Bamboo Australia Pty. Ltd.           | Anji Tianzhen Bamboo Flooring Co. Ltd. |
| Bamboo Village Company Limited       | Bamboo Bio Composites Sdn Bhd          |
| EcoPlanet Bamboo                     | Shanghai Tenbro                        |
| China Bamboo Textile Company Limited | Bamboo Textile Co. Ltd.                |
| Southern Bamboo Inc.                 | Kerala State Bamboo Corporation Ltd.   |
| Dasso Industrial Group               | Jiangxi Feiyu Industry Co.             |



# Overcoming non-technological factors to adapt in the market

As composite applications constitute a novel field of natural material applications in the construction sector, it is necessary to establish a **certification and regulatory framework** that can be used for the validation of the applications in the market. Existing **building codes** and regulations that apply to building with **engineered timber components** as well as other **natural fiber products** serve as a framework to enter the market.

Some **regulatory compliance parameters** for the application of bamboo composite elements as gypsum drywall frames:

Requirement	Solution
Fire resistance class A1	Implementation of fire retardants through resin technology
Tensile strength incl. safety parameters: min 270 MPa	Profile dimension and application design adaptation
Declaration of toxicity and hazardous substances	Non-hazardous bio-based resin technology without VOC
Chemical resistance and service life-time extension	Coating and fiber treatment in manufacturing

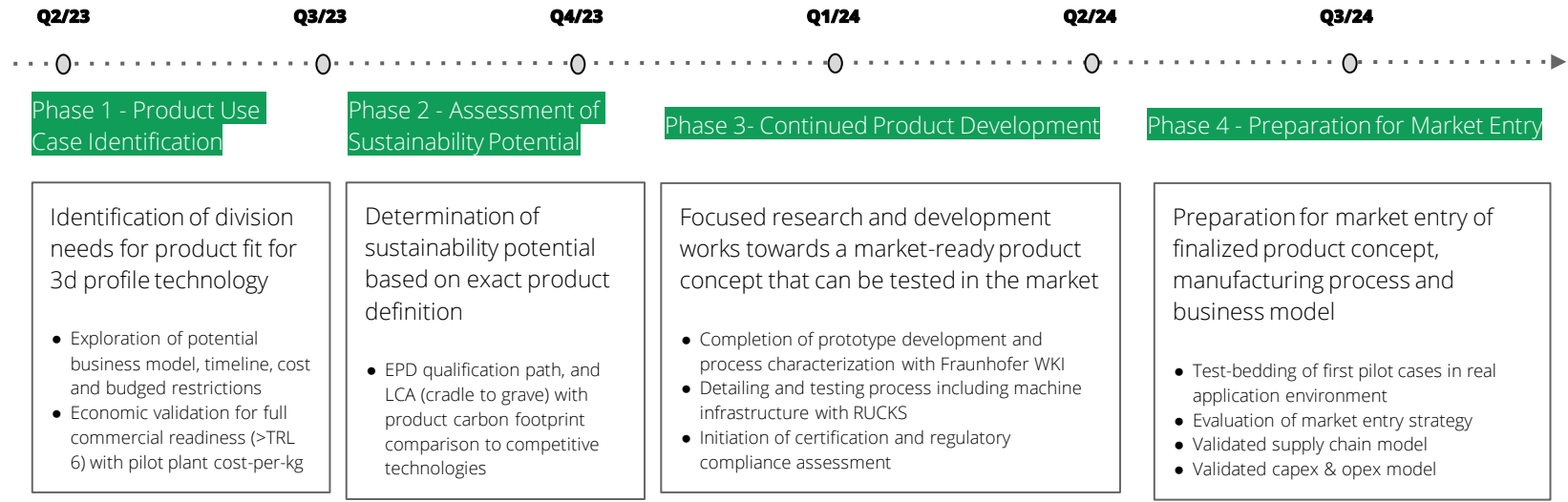
Applicable engineered bamboo- and natural fiber -construction standards as a reference framework:

- ISO 23478:2022:** Bamboo structures — Engineered bamboo products — Test methods for determination of physical and mechanical properties
- ISO/DIS 5257:** Bamboo Structures – Engineered bamboo products – Test methods for determination of mechanical properties using small size specimens
- ASTM D5456:** Standard Specification for the Evaluation of Composite Structural Wood Products
- EN 15228:2009:** Structural timber - Structural timber preservative treated against biological attack

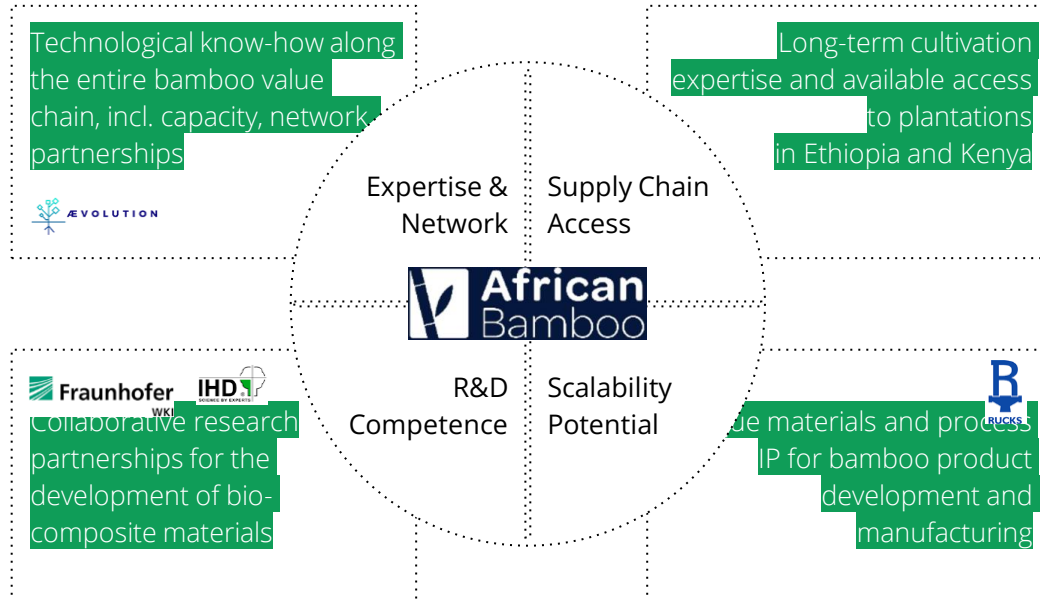


# A phased approach to establish a strong natural fiber competence

The already validated prototype use case with the unique expertise of African Bamboo in product development and supply chain deliver the foundation for the validation of the most efficient commercialization strategy for Saint-Gobain.



# And a team with all necessary competencies for scaling



## Readily Available Service Offering:

- **Product Development**

Provision of customized, cost-effective, applied R&D, rapid and agile product development, and access to R&D infrastructure.

- **Manufacturing Execution**

Hosting and controlling the manufacturing execution systems that are integrated into a licensed smart factory concept.

- **Product Testing & Certification**

Offering product testing, evaluation, quality assurance, and certification for certified bamboo products in Europe.

- **Supply Chain Establishment**

Project support with plantation model design plans, carbon counting models, and basic cost estimation.

# Fully integrated solution provider network along entire value chain

The current project setup offers a strong competitive advantage driven by a unique acquisition of state-of-the-art bamboo expertise, technology partnerships and access to already available supply chains

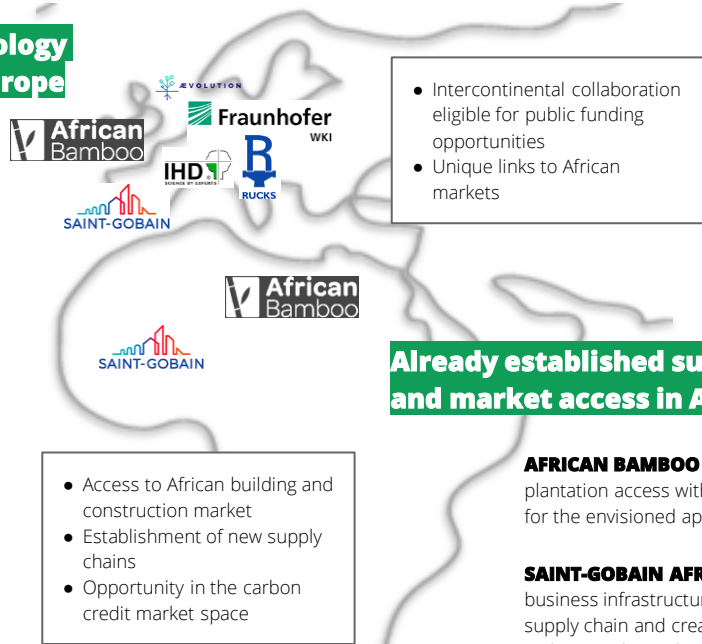
## Proprietary technology development in Europe

**AFRICAN BAMBOO NL:** long-term track-record in the development standardization of high-performance bamboo fiber composite materials

**SAINT-GOBAIN EU:** readily available access to various construction product markets through divisional organizational setup, scaling power

**FRAUNHOFER WKI / RUCKS / IHD:** readily available expertise in bamboo, bamboo technology development and processing technologies, and testing along all phases of the development, i.e. from supply chain to certification

**EVOLUTION:** bamboo product development and circular design; impact assessment



- Intercontinental collaboration eligible for public funding opportunities
- Unique links to African markets

## Already established supply chain and market access in Africa

- Access to African building and construction market
- Establishment of new supply chains
- Opportunity in the carbon credit market space

**AFRICAN BAMBOO ET:** fully integrated bamboo plantation access with validated resource properties for the envisioned application

**SAINT-GOBAIN AFRICA:** already established business infrastructure to build up own bamboo supply chain and create new opportunities in the carbon credit market space

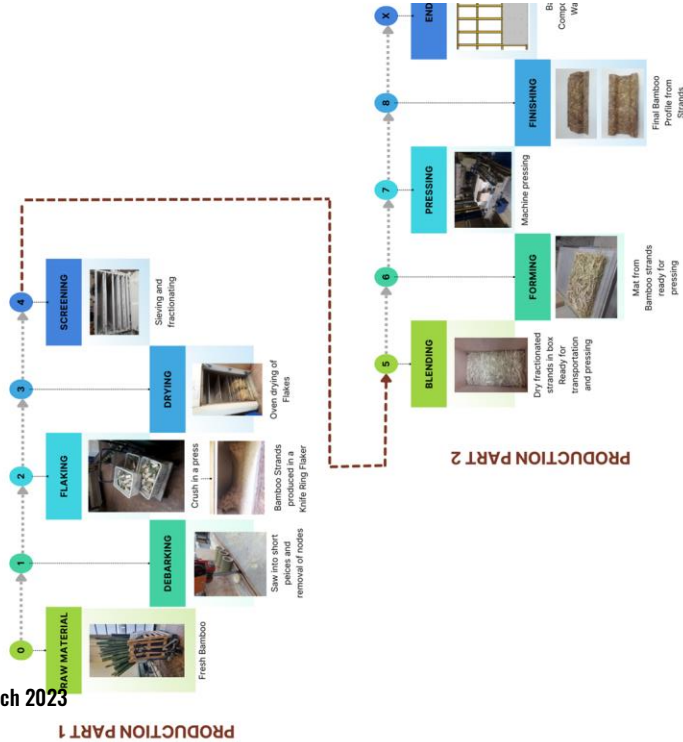
**Annex**



# Validated bamboo composite profile production process

Bamboo composites for 3d profile applications, e.g. framing elements for modular gypsum drywall construction to replace metal products

BAMBOO COMPOSITE PROFILE - PRODUCTION PROCESS



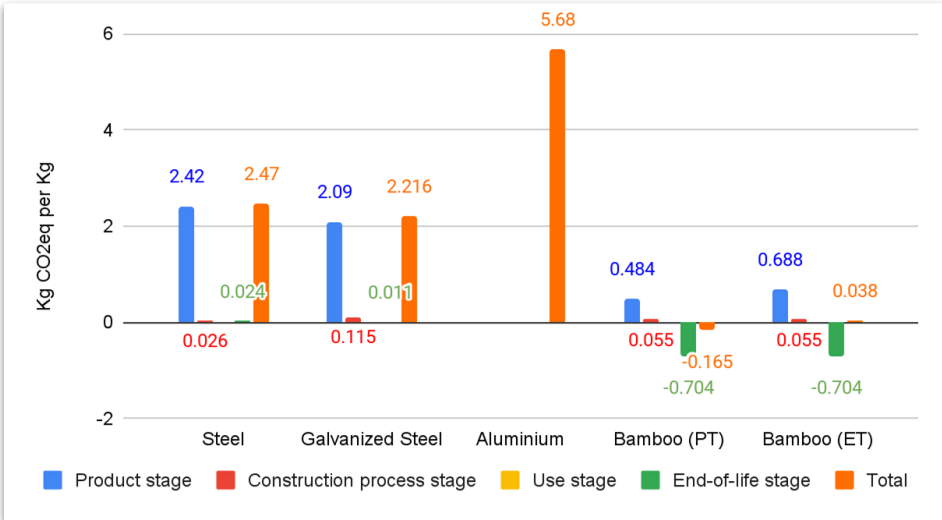
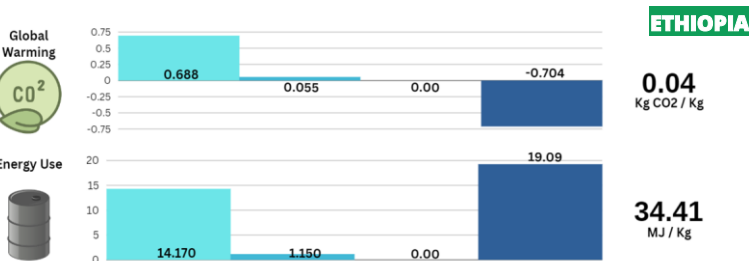
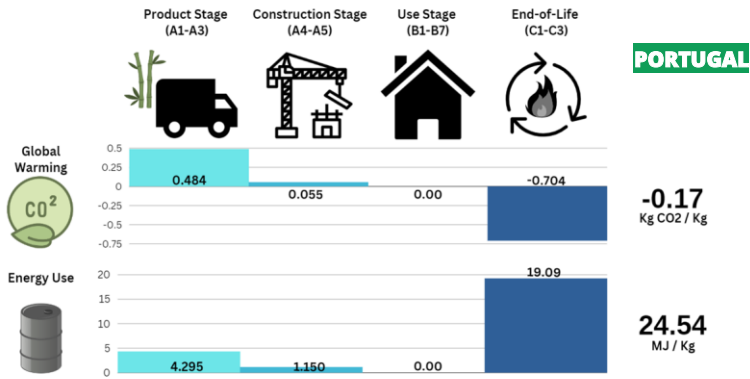
Property	Test Standard	Unit	Result
Bending strength (MOR)	EN 310	N/mm <sup>2</sup>	37.2
Bending MOE	EN 310	N/mm <sup>2</sup>	31,700
Density	EN 323	Kg/m <sup>3</sup>	517
Swelling in thickness (2h)	EN 317	%	3.8
Swelling in thickness (24h)	EN 317	%	8.9
Internal bond	EN 319	N/mm <sup>2</sup>	0.22
Water absorption (2h)		%	42.6
Water absorption (24h)		%	69.7

Physical and mechanical parameters as validated in standardized tests of the prototypes that have been manufactured at the Fraunhofer WKI.



# Sustainability potential as compared with existing products

Impact assessment of all considered phases along the entire lifecycle of the product from cradle to grave and the bamboo supply from Portugal vs. Ethiopia



GWP potential analysis of the bamboo composite product vs. various existing benchmarks out of metal.

# A versatile material platform to create sustainable composite applications for various industries

African Bamboo provides bamboo-fiber material processing technology know-how, expertise, IP and engineering talent to commercialize composite applications for different industries.

