

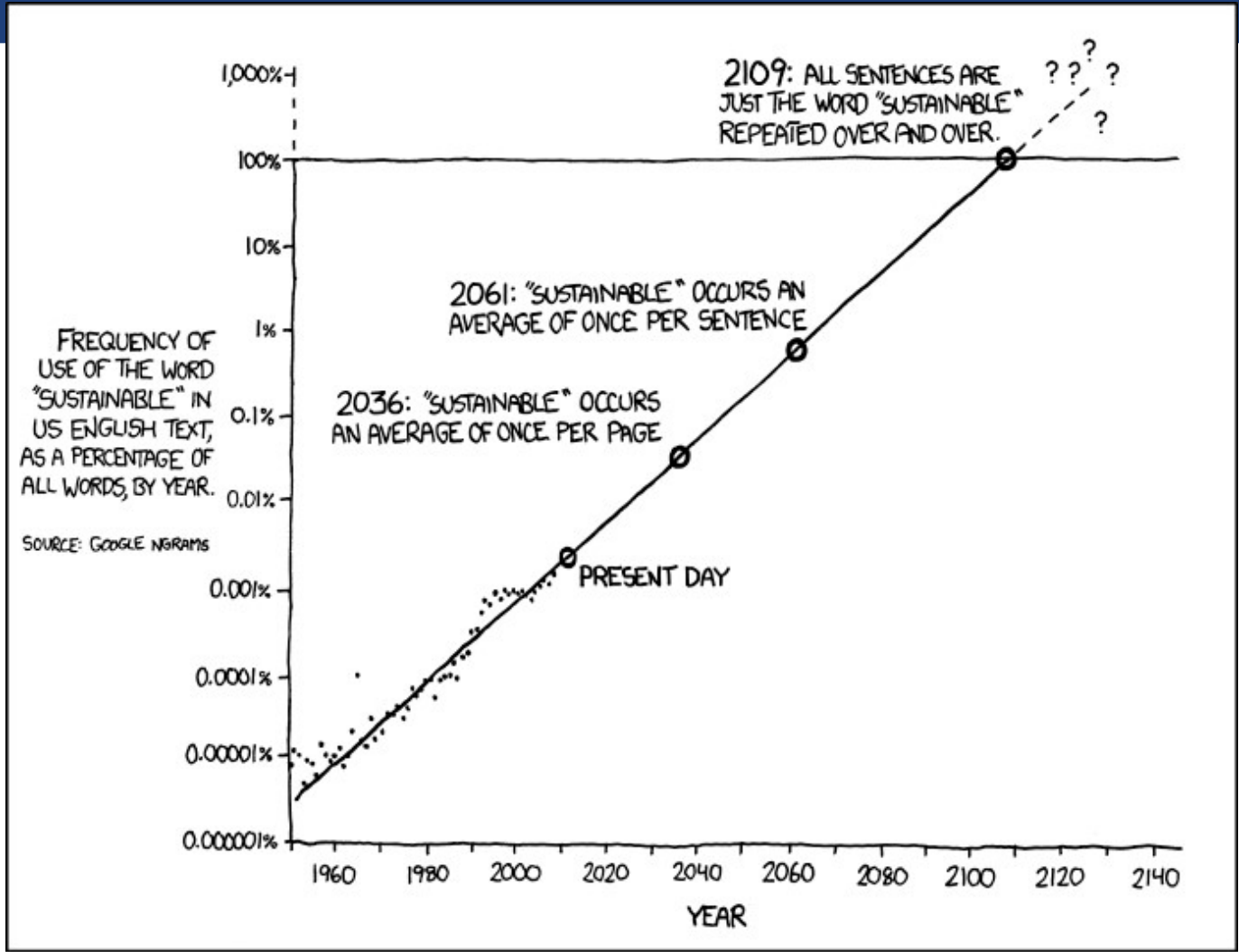


Environmental Savings Potential From the Use of Bamboo in Construction

Dr. Edwin Zea Escamilla

Chair for Sustainable Construction – ETH Zürich

Bamboo Construction Task Force - INBAR



THE WORD "SUSTAINABLE" IS UNSUSTAINABLE.

Munroe, R. 2014. XKCD <https://xkcd.com/1007/>

ETH zürich Bamboo in modern architecture



www.studiocardenas.it



INBAR GARDEN PAVILION - 2019 - www.studiocardenas.it



BASE-Bahay Foundation - <http://www.base-builds.com/>

Quantitative methodology to assess environmental impact of products and services through their service life

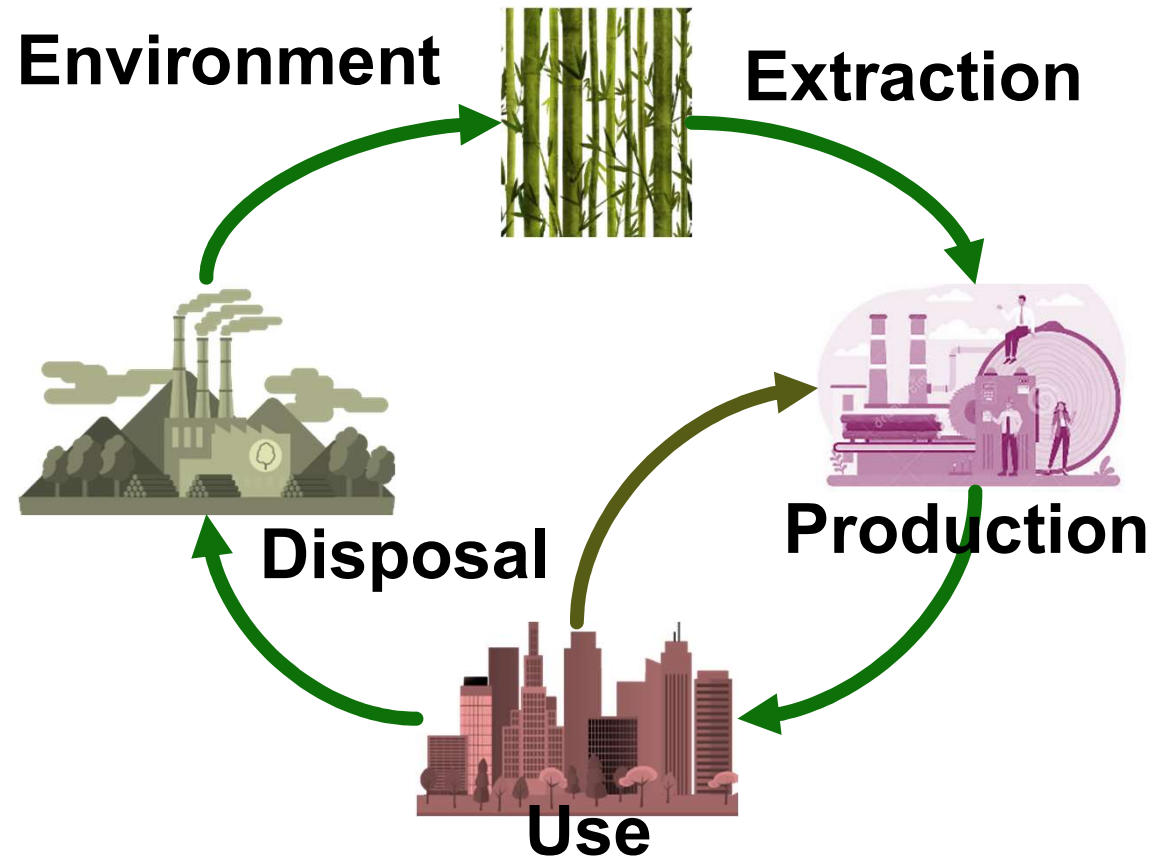
Serves as basis for many reporting and environmental declaration schemes (GRI, PEF, EPD)

Holistic approach considering: land-use, energy, materials, infrastructures and transport

Proposes an input-output relationship between human activity and the environment (Hellweg, 2014)

Produces information to support decision making processes

Defined in the ISO 14040 standards (1997)



To produce high quality life cycle inventory data representing:

- Diverse production processes
- Medium to small producers
- Global and local representativeness
- With very limited financial support



BASE-Bahay Foundation - <http://www.base-builds.com/>

Collaboration withecoinvent
association, INBAR,
CCRS@UZH, CSC-ETHZ

Framework for future datasets
development

Can be adapted for context
specific applications

Four Bamboo Species

- Bambusa Blumenana
- Guadua Angustifolia Kunt
- Phyllostachys edulis
- Dendrocalamus Asper

Global and Country datasets

- Brazil
- China
- Colombia
- The Philippines





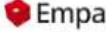
Bamboo-based construction Materials


- Bamboo Forestry Sust.
Managed
- Bamboo Poles
- Flattened Bamboo
- Woven bamboo mats

Under revision & development

- Glue laminated Bamboo
- Scrimber bamboo

Development of Life Cycle Inventories

an association formed by  Agroscope  PSI  EPFL  ETH  Empa
Modern Science and Technology



Filter:

| # | <input type="checkbox"/> | Name | Reference Product | Loc. | Time Period | Synonyms | View |
|----|--------------------------|--|-------------------|------|-----------------------|----------|--|
| 1 | <input type="checkbox"/> | bamboo forestry, sustainable forest management | bamboo culm [kg] | BR | 1/1/2010 - 12/31/2020 | | PDF UPR |
| 2 | <input type="checkbox"/> | bamboo forestry, sustainable forest management | bamboo culm [kg] | CN | 1/1/2010 - 12/31/2020 | | PDF UPR |
| 3 | <input type="checkbox"/> | bamboo forestry, sustainable forest management | bamboo culm [kg] | CO | 1/1/2010 - 12/31/2020 | | PDF UPR |
| 4 | <input type="checkbox"/> | bamboo forestry, sustainable forest management | bamboo culm [kg] | GLO | 1/1/2010 - 12/31/2020 | | PDF UPR |
| 5 | <input type="checkbox"/> | bamboo forestry, sustainable forest management | bamboo culm [kg] | PH | 1/1/2010 - 12/31/2020 | | PDF UPR |
| 6 | <input type="checkbox"/> | bamboo pole production | bamboo pole [kg] | BR | 1/1/2010 - 12/31/2020 | | PDF UPR |
| 7 | <input type="checkbox"/> | bamboo pole production | bamboo pole [kg] | CN | 1/1/2010 - 12/31/2020 | | PDF UPR |
| 8 | <input type="checkbox"/> | bamboo pole production | bamboo pole [kg] | CO | 1/1/2010 - 12/31/2020 | | PDF UPR |
| 9 | <input type="checkbox"/> | bamboo pole production | bamboo pole [kg] | GLO | 1/1/2010 - 12/31/2020 | | PDF UPR |
| 10 | <input type="checkbox"/> | bamboo pole production | bamboo pole [kg] | PH | 1/1/2010 - 12/31/2020 | | PDF UPR |

Show entries Showing 1 to 10 of 42 entries



Industrial or Traditional Bamboo Construction?

Zea Escamilla, E.; Habert, G.; Correal Daza, J.F.; Archilla, H.F.; Echeverry Fernández, J.S.; Trujillo, D. Industrial or Traditional Bamboo Construction? Comparative Life Cycle Assessment (LCA) of Bamboo-Based Buildings. *Sustainability* **2018**, *10*, 3096.

Low industrialized Materials



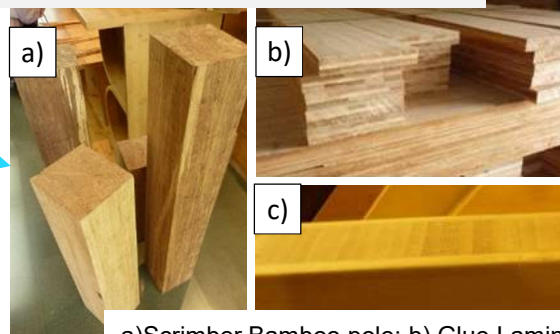
a) Bamboo pole; b) Flattened Bamboo; c) woven bamboo

Single-Storey House (SSH)



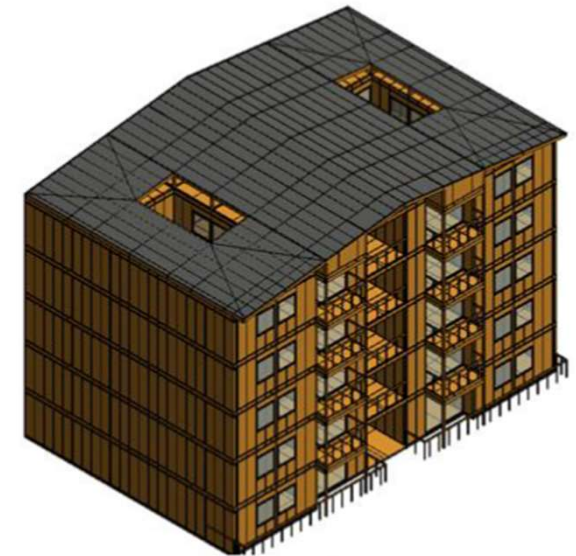
BASE BAHAY – Project @Silay (PH)

Engineered Materials



a) Scrimber Bamboo pole; b) Glue Laminated bamboo; c) cross laminated bamboo

Multi-Storey Building (SSB)



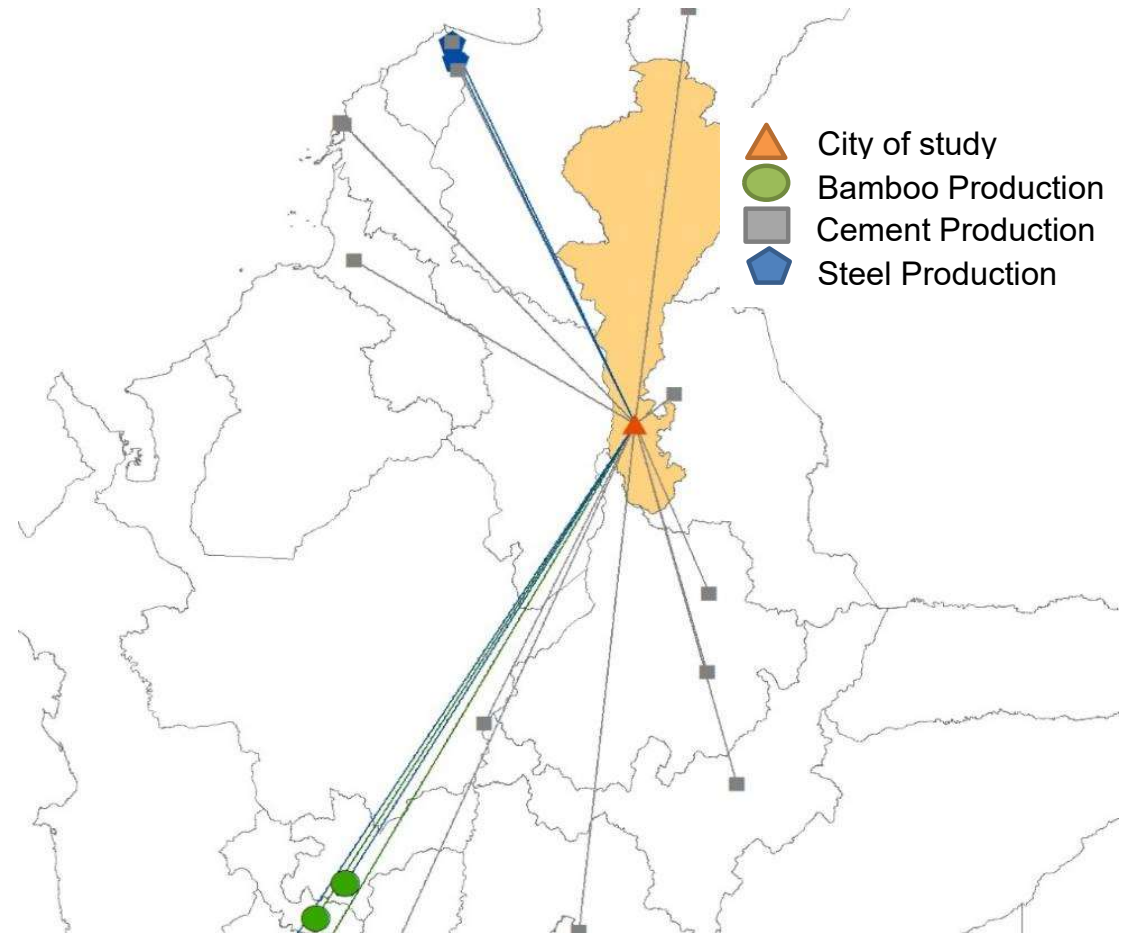
The LCIs of the materials were characterized by integrating LCI data and georeferenced data in a geographic information system (GIS)

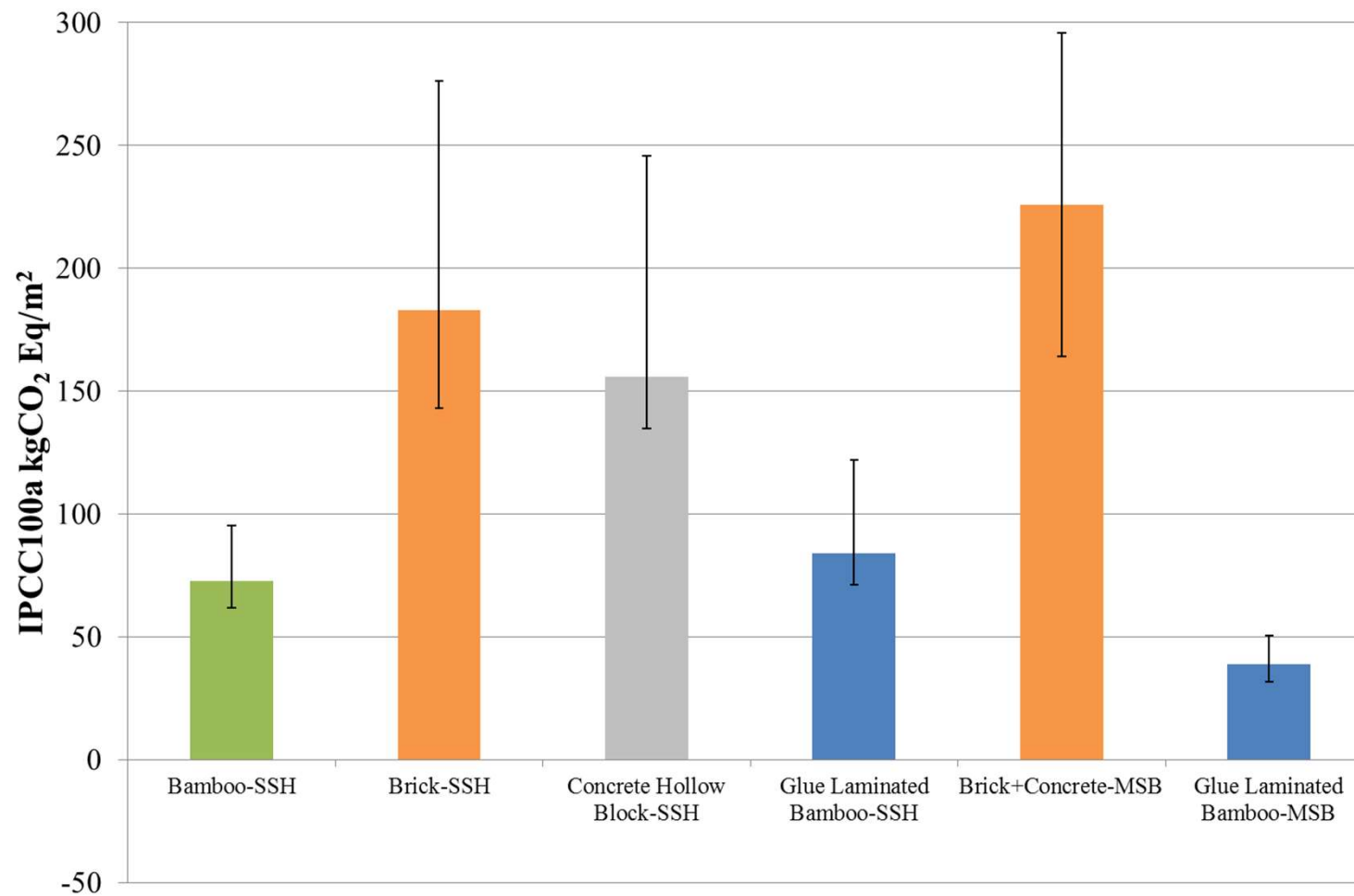
- Three scenarios for material production efficiency: high, medium and low performance
- Specific electricity for Colombia
- Three transport regimes for construction materials

Software: OpenLCA

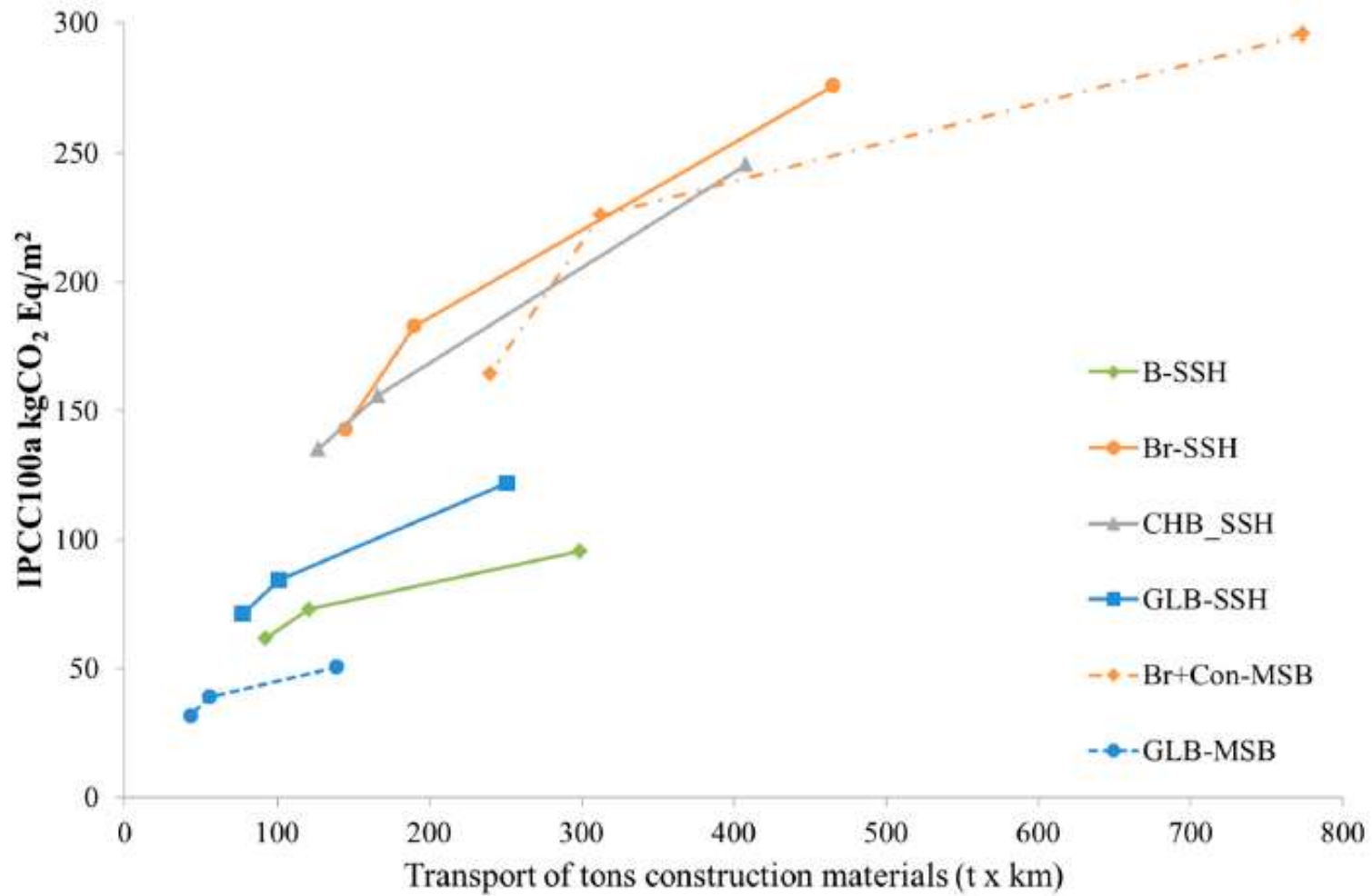
Database: Ecoinvent 3.7

Evaluation Method: IPCC2013





Software: OpenLCA, EcoInvent 3.1, IPCC2013



Software: OpenLCA, Ecolnvent 3.1, IPCC2013



Investing in alternative construction materials

Zea Escamilla, E.; Habert, G.; Celentano, G.; Archila Santos, H.; Cancio Diaz, Y. Investing in alternative construction materials as a sustainable path towards the reduction of global CO2 emissions. In Proceedings of the II Bamboo in the Built Environment, Bogor, Indonesia, 2017.

The Paris Agreement sets out 29 Articles that cover:

- Climate change mitigation and adaptation
- Financing
- Technology development and transfer,
- Capacity building
- Transparency of action and support,
- Facilitating implementation and compliance. Insight

Climate change mitigation – Article 5:

“Parties should take action to conserve and enhance...sinks and reservoirs of greenhouse gases...as referred to in Article 4, paragraph 1(d), of the Convention, including forests.”

Engineered Bamboo for Sustainable Construction Conference



PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

Journal of Cleaner Production 124 (2016) 361–369



Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

Assessing the environmental and economic potential of Limestone Calcined Clay Cement in Cuba



S. Sánchez Berriel ^a, A. Favier ^{b,*}, E. Rosa Domínguez ^a, I.R. Sánchez Machado ^a, U. Heierli ^c,
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Building and Environment 103 (2016) 44–53



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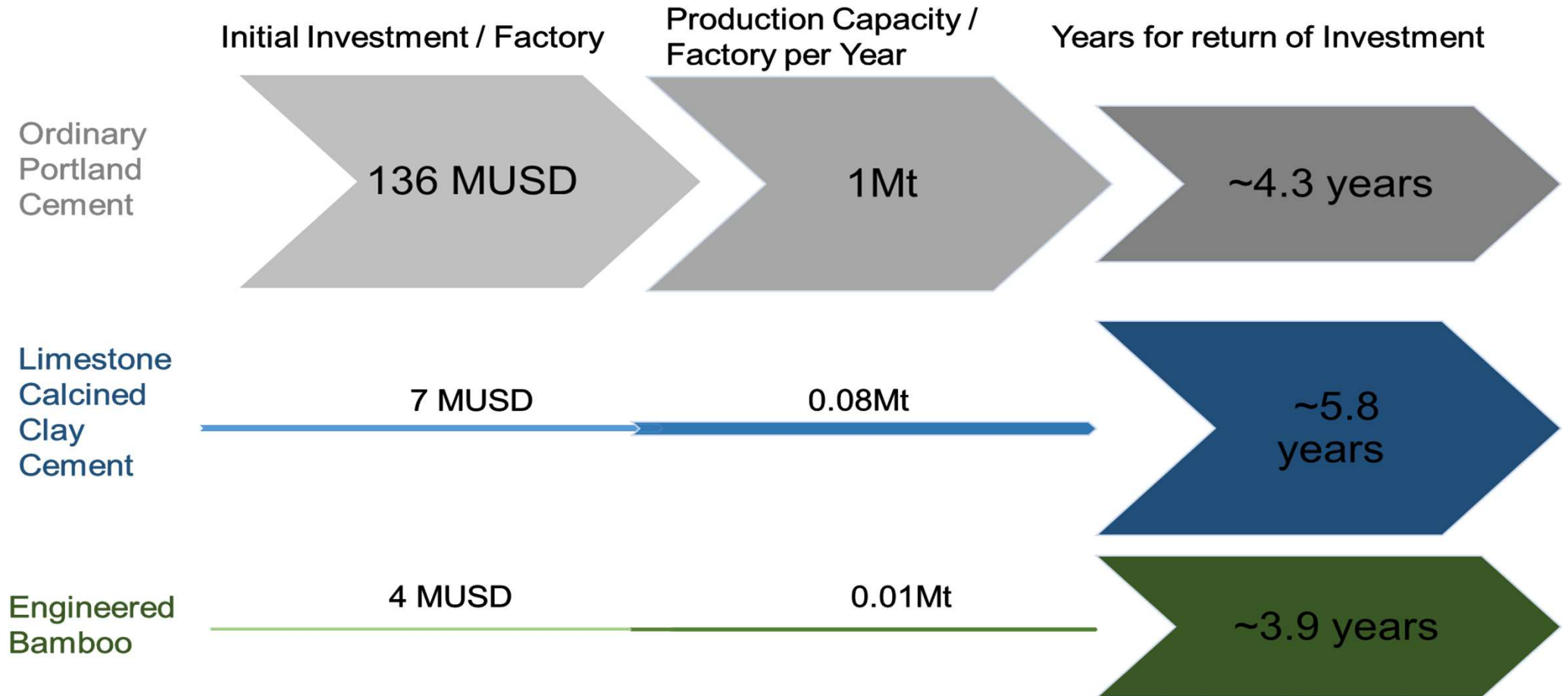
journal homepage: www.elsevier.com/locate/buildenv

When CO₂ counts: Sustainability assessment of industrialized bamboo as an alternative for social housing programs in the Philippines

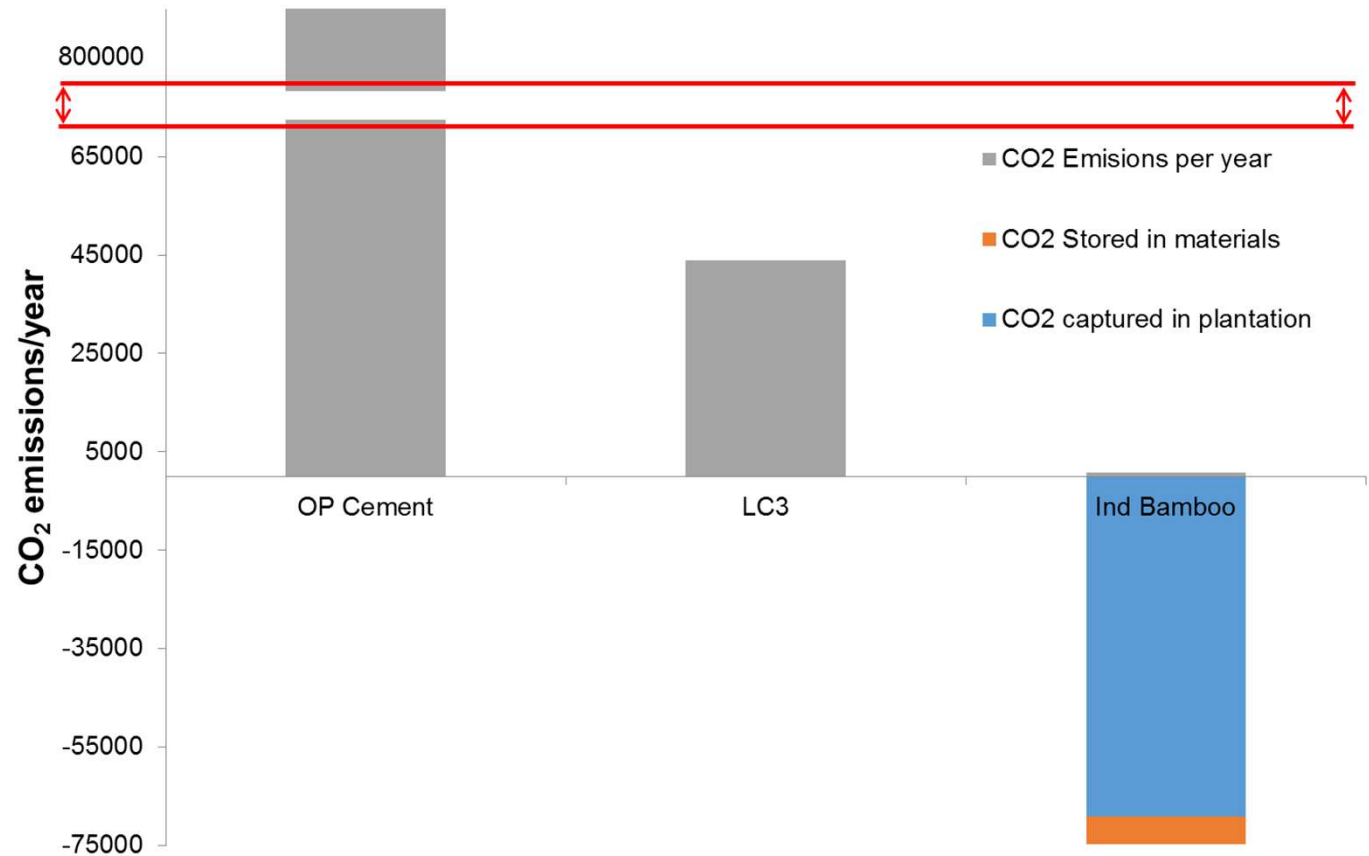


E. Zea Escamilla ^{*}, G. Habert, E. Wohlmuth

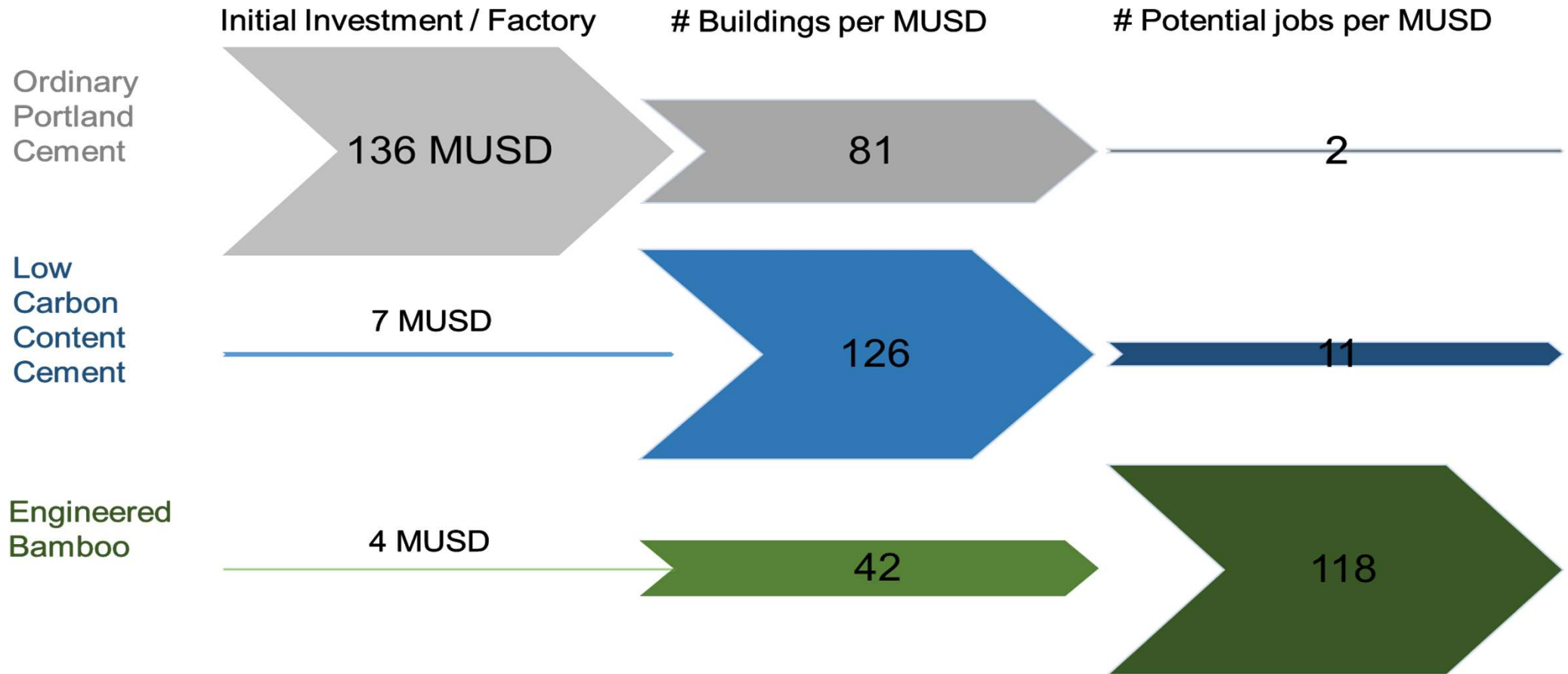
Institute of Construction and Infrastructure Management, Chair of Sustainable Construction, Federal Institute of Technology (ETHZ), 8093 Zürich, Switzerland



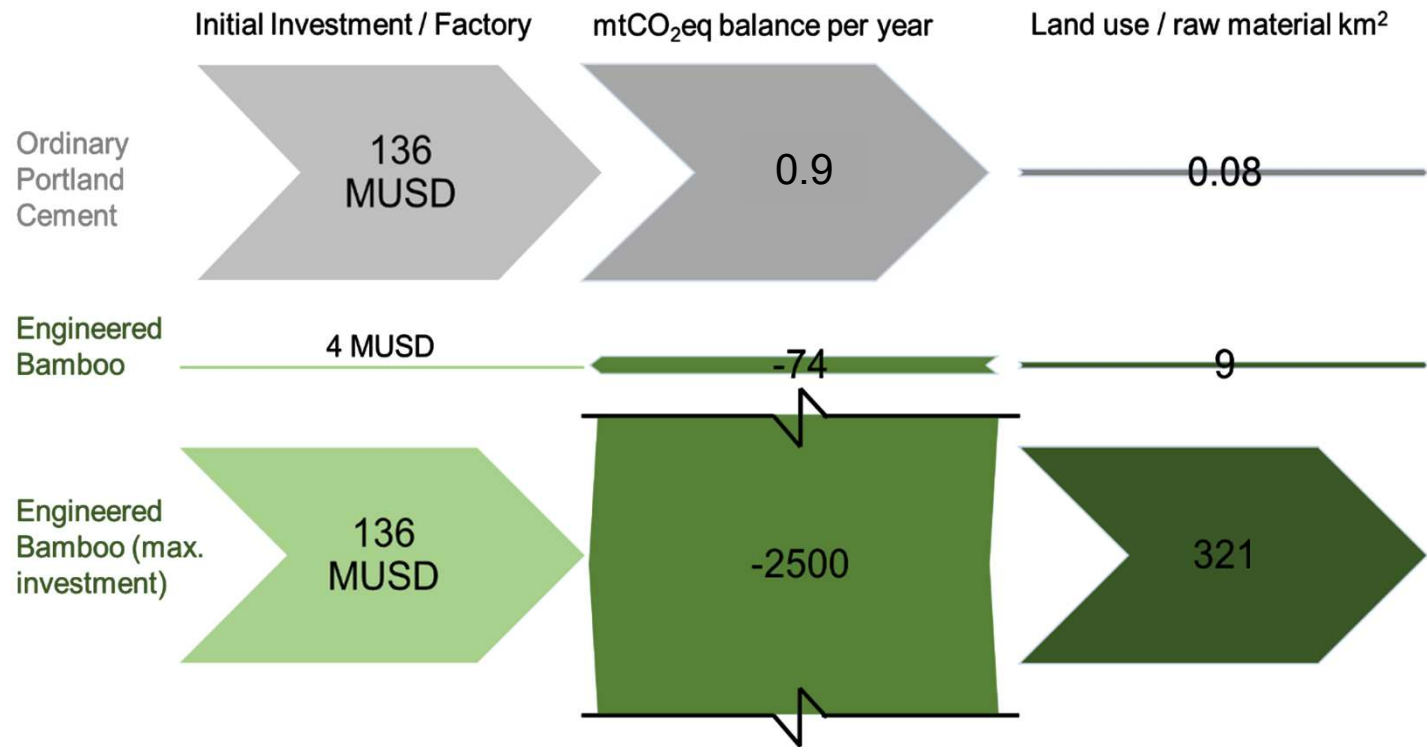
CO₂ stored in plantation is significantly larger than the storage that can be achieved in the built environment



Riaño, N.M., et al., *Plant growth and biomass distribution on Guadua angustifolia Kunth in relation to ageing in the Valle del Cauca – Colombia*. *Bamboo Science and Culture*, 2002. **16**(1): p. 43-51.



Investments should be aimed to support the development of sustainable value chains connecting the bamboo forest to the built environment



Bamboo is a regenerative construction material

Developing sustainable value chains for bamboo based construction materials should be the focus

Bamboo is the material that can spearhead a sustainable transition towards NET-ZERO built environment NOW!!!

A watercolor painting of green bamboo stalks and leaves. The painting is done in various shades of green, from light to dark, with visible brushstrokes and some darker, more saturated areas. The bamboo stalks are vertical and have a segmented appearance. The leaves are long and narrow, some pointing upwards and some downwards. The background is a light, neutral color.

Thank you for your Attention

