CHALMERS
UNIVERSITY OF TECHNOLOGY

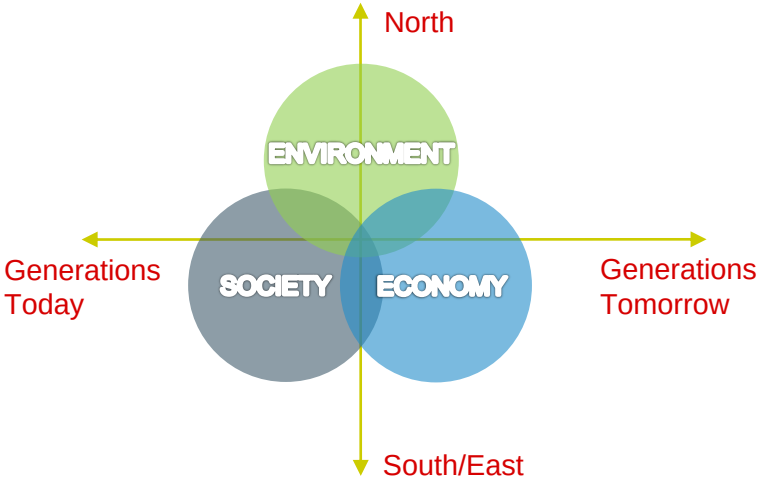
THE SUSTAINABILITY PERFORMANCE OF WOODEN CONSTRUCTION PRODUCTS IN A NUTSHELL

HOLGER WALLBAUM, PROF. DR.-ING.

Helsinki, 2019-09-27

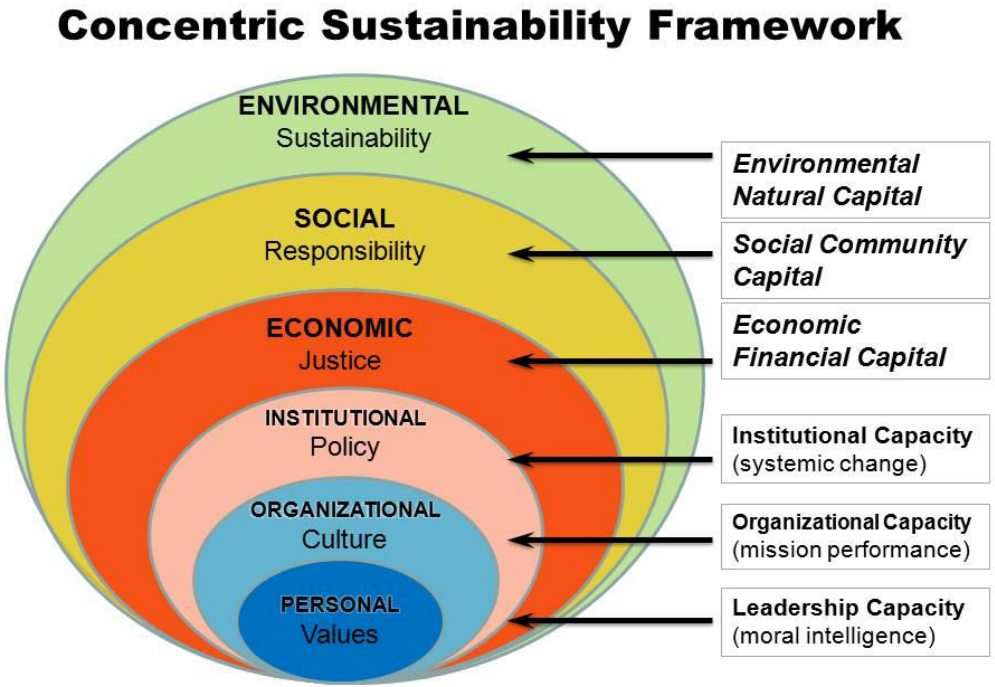
FORUM WOOD BUILDING NORDIC

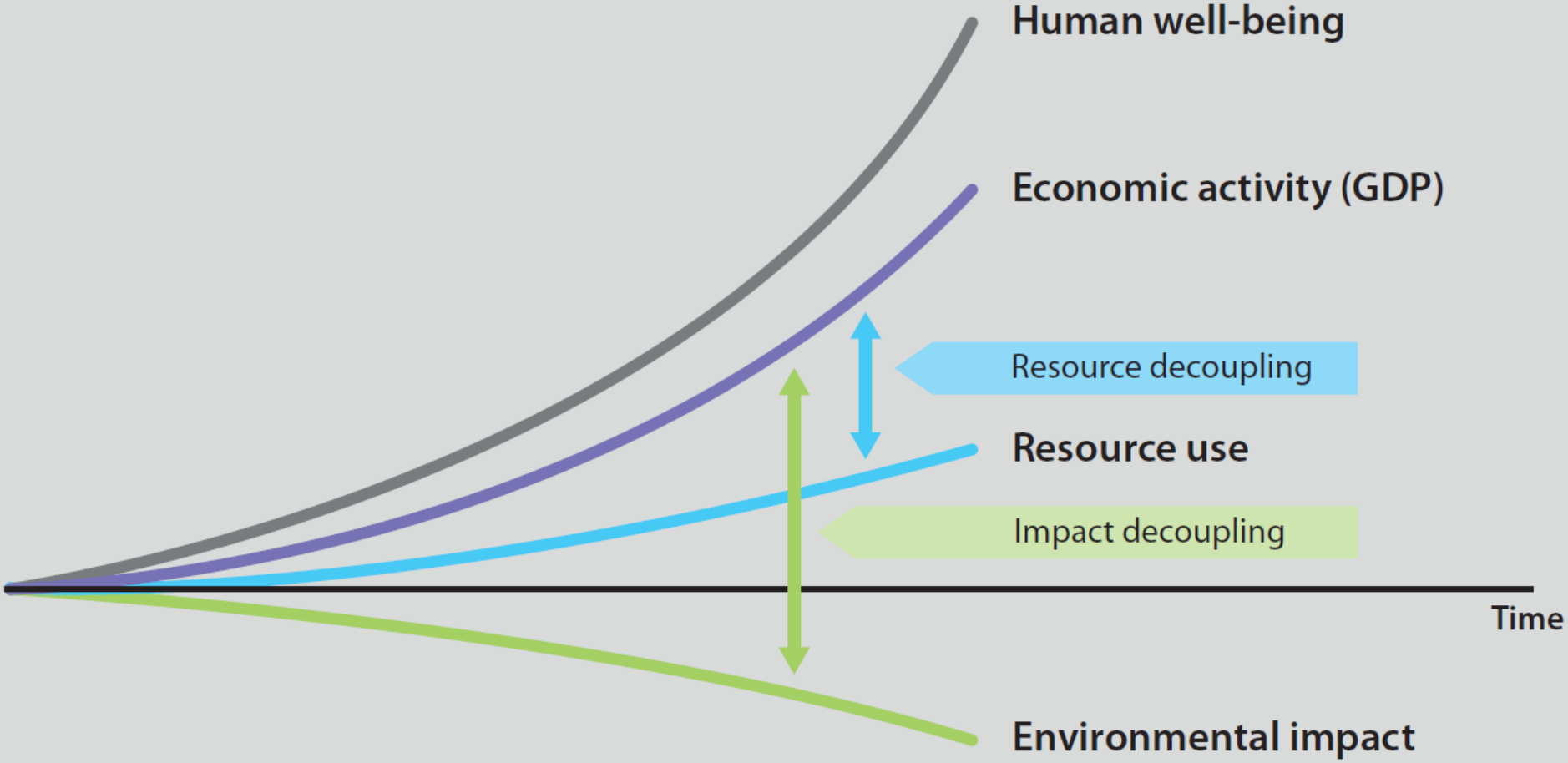
THREE PILLAR CONCEPT



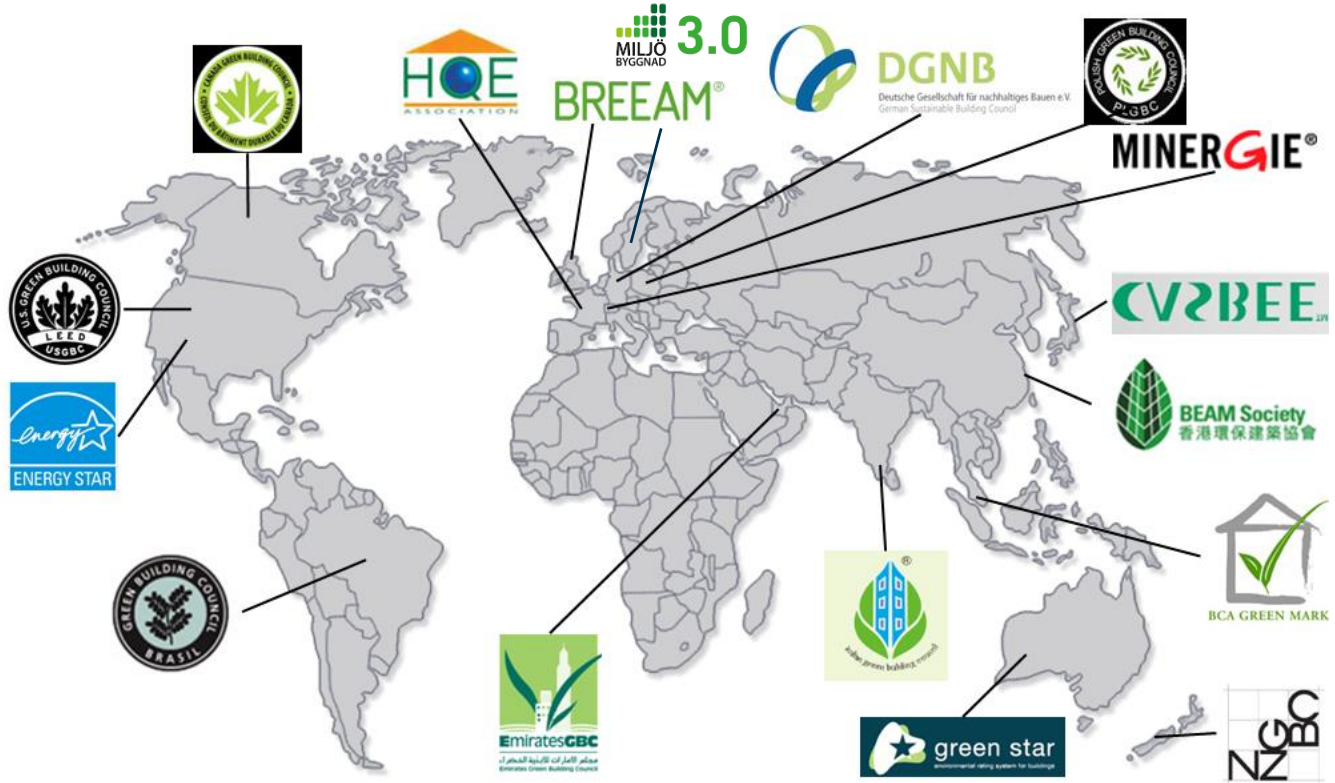
- **Target dimensions**
  - Environment
  - Society
  - Economy
- **Dimension of time**
- **North-South/East-Dimension**

MANY OTHER INTERPRETATIONS EXISTS




Human well-being
Economic activity (GDP)
Resource decoupling
Resource use
Impact decoupling
Time
Environmental impact

CERTIFICATION SYSTEMS - MAP



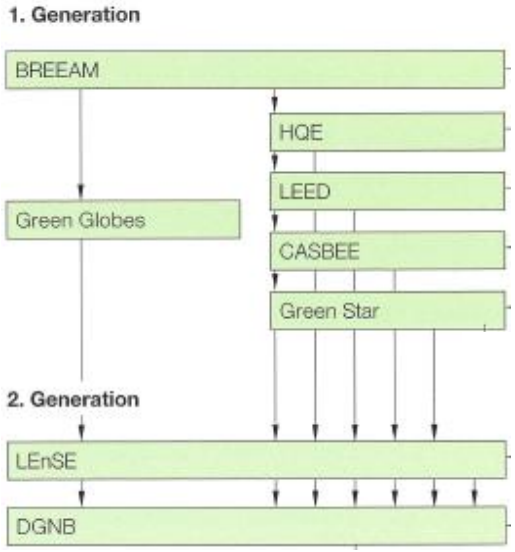
„GREEN BUILDINGS“ VS „SUSTAINABLE BUILDINGS“

1st Generation „Green Buildings“

- Assessment of the „green“ performance
- Building certification mainly based on 1 pillar (ecology)

2nd Generation „Sustainable Buildings“

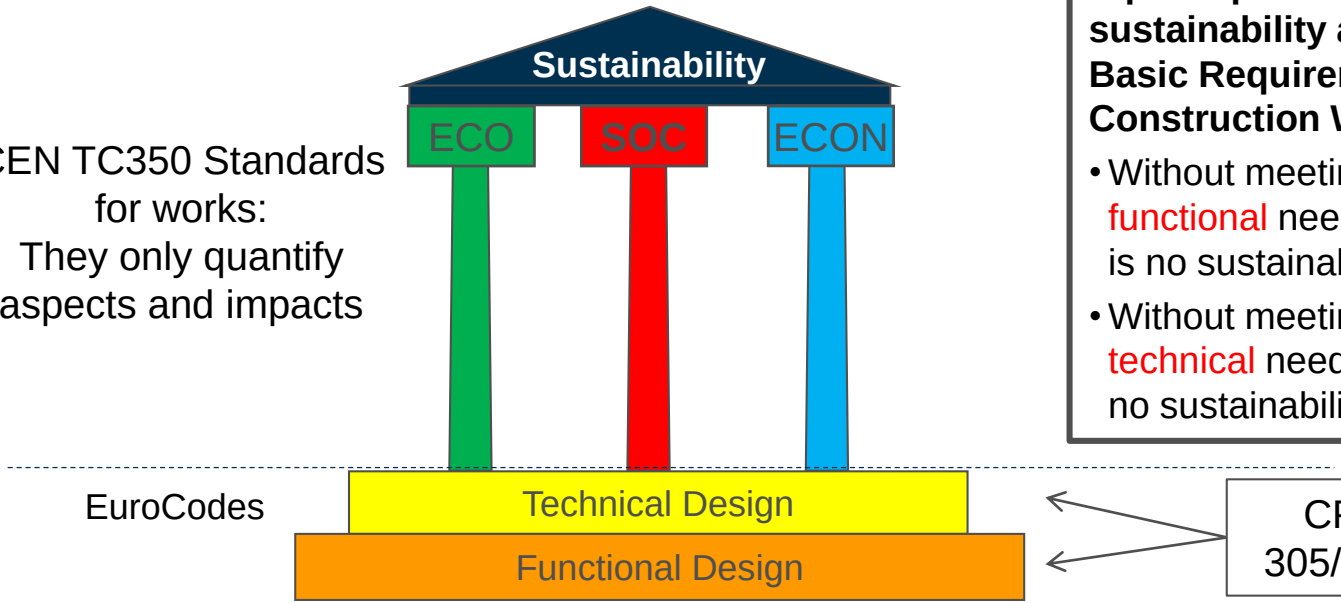
- Holistic assessment
- Focus on all 3 sustainability pillars (ecology, economy, society)



Source: Abb. 1.30 aus „Zertifizierungssysteme für Gebäude“, Detail Green Books, 2010

SUSTAINABILITY OF CONSTRUCTION WORKS

CEN TC350 Standards for works:
They only quantify aspects and impacts



A prerequisite for sustainability are the 6 Basic Requirements for Construction Works:

- Without meeting the functional needs there is no sustainability
- Without meeting the technical needs there is no sustainability

Source: Chris Hamans (ESC)

CONSTRUCTION PRODUCTS REGULATION (CPR)

CPR: (Essential) Basic Requirements

1. Mechanical resistance and stability
2. Safety in case of fire
3. Hygiene, health and environment
4. Safety in use and accessibility
5. Protection against noise
6. Energy economy and heat retention
7. Sustainable use of natural resources

4.4.2011 EN Official Journal of the European Union L 88/5

REGULATION (EU) No 305/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 9 March 2011

laying down harmonised conditions for the marketing of construction products and repealing Council Directive 89/106/EEC

(Text with EEA relevance)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

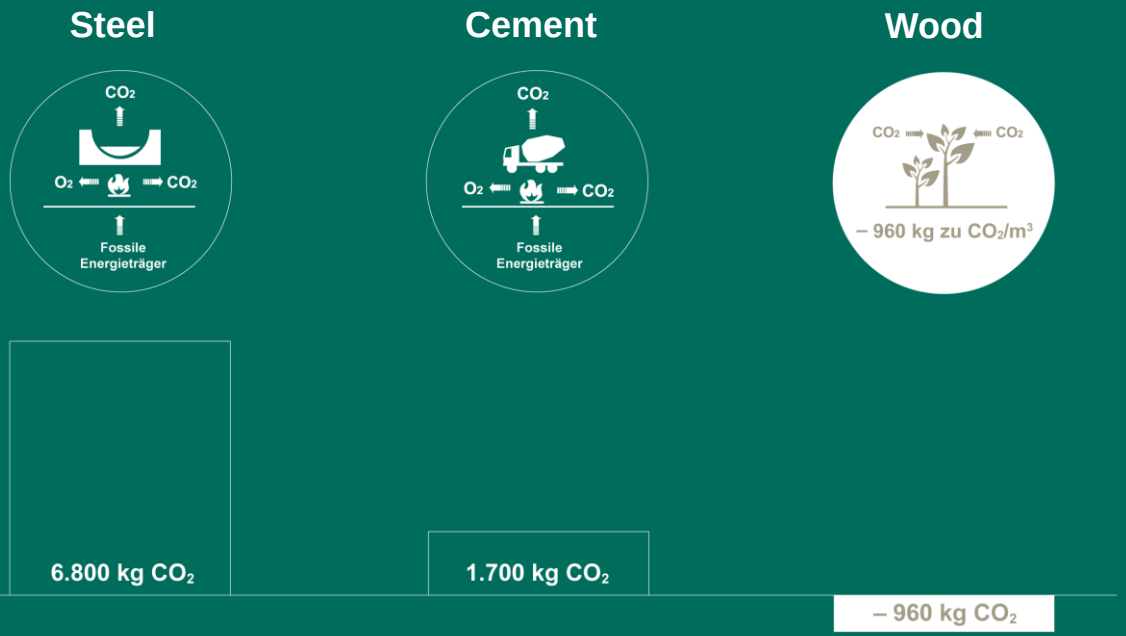
Having regard to the Treaty on the Functioning of the European Union, and in particular Article 114 thereof,

(4) Member States have introduced provisions, including requirements, relating not only to safety of buildings and other construction works but also to health, durability, energy economy, protection of the environment, economic aspects, and other important aspects in the public interest. Laws, regulations, administrative measures or case-law, established either at Union or Member State level, concerning construction works may have an impact on the requirements of construction

STUDENT EXERCISE

What is the most sustainable construction material?

RELEASE OF CO_2 PER 1M³ OF CONSTRUCTION MATERIAL



Source: Ökobau.dat

DATABASES

CPM the Swedish life cycle center

INSULATION CONCRETE FORMS MAGAZINE

Characterization of Life Cycle Inventory Data using the EDIP/UMIP 96 Method of Characterization (Output from SimaPro)

Impact category	Unit	Wood frame house			ICF house					
Resources (all)	kg	28.5	33.7	42.5	41.9	47.3	28.2	32.7	40.4	40.2	45.1

*An x means there are no data.

"Studies show that very little of a building's total environmental impact is related to construction. Rather, heating, cooling, and operating the building add up to more than 90% of a structure's total environmental impact over its lifespan.

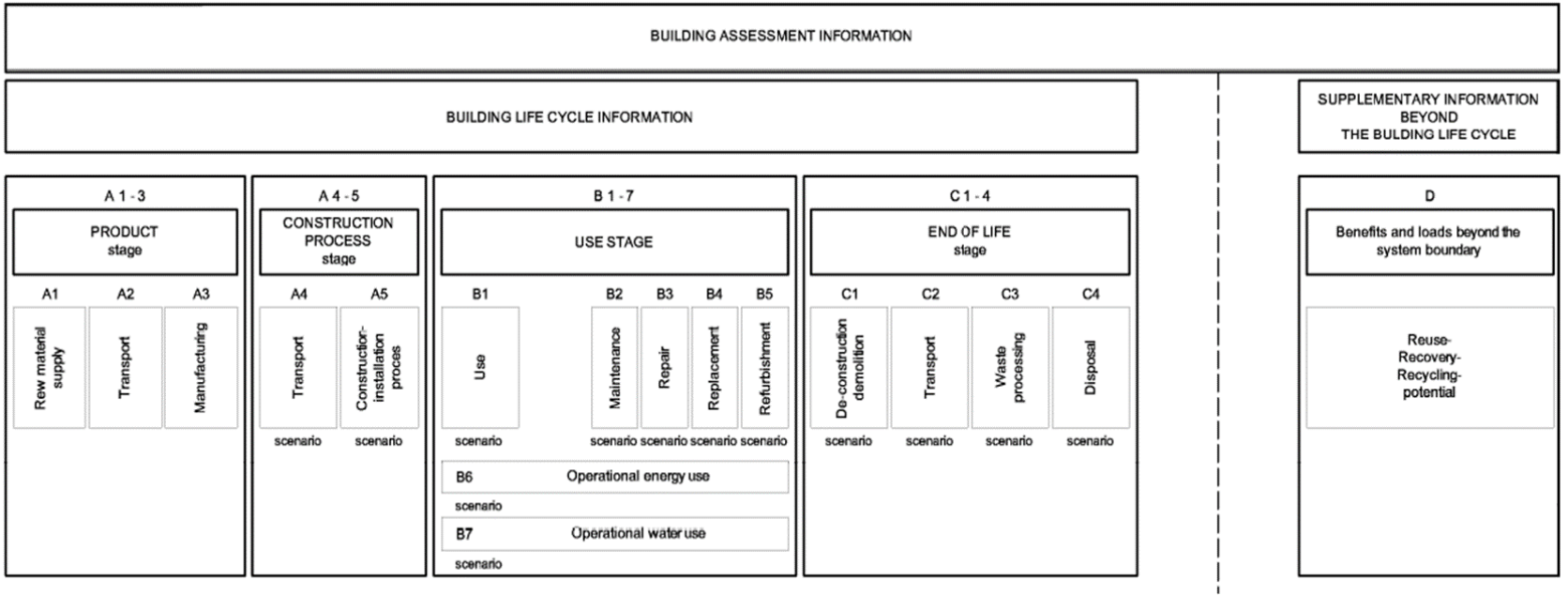
Concrete's thermal mass, combined with a continuous layer of EPS insulation, saves energy over the life of a building, thus reducing overall environmental impact.

. . .

The executive summary summarizes, "The results show that in almost all cases, for any given climate, the environmental impact in each category is greater (worse) for the wood house than for the ICF house. The largest impacts are in the form of depletion of fossil fuel reserves (categorized as damage to natural resources) and release to the air of respiratory inorganics (categorized as damage to human health). Among the construction products used in the house, wood products and copper tubing have the largest environmental load, followed by cement-based materials."

Source: https://www.icfmag.com/2015/05/icfs-and-the-life-cycle-assessment/

SUSTAINABILITY OF CONSTRUCTION WORKS – BUILDINGS (EN 15978:2011)



LCA FINDINGS – WOODEN PRODUCTS

- High consumption of (fossil) energy associated with the production of fibers, particles/chips, resins, and additives, etc.
- Wood products tend to have a favorable environmental profile compared to functionally equivalent products out of other materials (nr-e, CED, GWP, solid waste) but higher ren-en (by nature).
- Potentially more critical reg. impregnation of wooden products (toxicological effects and/or photo smog (depending on the type of preservative).
- Incineration of wood products can cause higher impacts of acidification and eutrophication than other products, thermal energy can be recovered.
- Comparative LCA's are very sensitive to methodological decisions (allocation procedure) or assumptions related end-of-life scenarios (e.g. methane emissions from landfilled wood, thermal energy recovery, etc.).
- LCA does not assess (sufficiently) toxicological effects of chemical components of preservatives
- Neglected additional pos/neg impacts of forests, such as land occupation, impacts on biodiversity, purification of air, etc.

Sources: Werner, Richter, JoLCA 2007; Sathre, O'Conner TR-19R 2010; Sathre, González-García, Ecoeff Con and Build Mat 2014

Climate-KIC is supported by the EIT, a body of the European Union

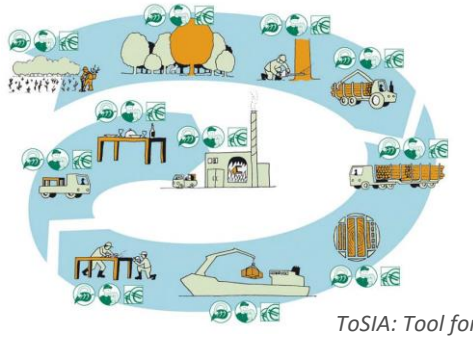
SMARTA WOOD

Göteborgs Stad · CHALMERS · Aalto University · ETH zürich

Development of decision making support tool on construction materials with holistic sustainability impact assessment.

With the considerations of;
1) increase of use of wood,
2) quantification of material flow
3) various use of wood (material, energy etc.)
4) environmental, economic and social sustainability indicators.

For; **City planners** **Building owners**



Life Cycle Assessment
+
Material Flow Analysis

Indicators
- Environmental
- Social
- Economic

E F I

ToSIA: Tool for Sustainable Impact Assessment

Case studies to compare same construction in different materials

https://www.swedishwood.com/

(Source: Jonas Wüst Architekten GmbH)

Projects in Finland, Sweden and Switzerland

Foto: Cree GmbH

Foto: Norman A. Müller

Ingredients

- ✓ Renovation before new construction
- ✓ Choose environmental friendly energy sources (A1-A3/B1-B6)
- ✓ Use materials in an intelligent way
- ✓ Use more bio based materials
- ✓ Build light
- ✓ Reduce material varieties
- ✓ Avoid gluing
- ✓ Design for disassembly

BEYOND 2020

JUNE 9 - 11

WORLD SUSTAINABLE BUILT ENVIRONMENT CONFERENCE

THE MISSION OF THE CONFERENCE

The mission of the conference is to link the **global building sector** to the **UN Sustainable Development Goals** and to define its role towards the achievement and implementation of 2030 objectives.

THE THEME OF THE CONFERENCE

The main theme of the conference is SDG 11, Sustainable Cities and Communities.

Grand Challenge

Mission

Areas of interest & cross-sector

R&I Projects

CLIMATE CHANGE

100 CARBON NEUTRAL CITIES BY 2030

Reach net zero greenhouse gas emissions balance of 100 European cities by 2030

Real Estate | Energy | Mobility | Social Sector

Construction materials | Environment | Food | Behavioural econ

- Buildings with carbon-absorbing components
- Clean urban electric mobility
- Carbon neutral urban food industry connecting city and agriculture
- Citizen carbon-ID: e-government streamlining of carbon footprint


THANK YOU!
SEE YOU IN GÖTEBORG
Tack! Vi ses i Göteborg