17.5.2022

Ympäristöministeriö
Miljöministeriet
Ministry of the Environment

Ympäristöministeriö
Miljöministeriet
Ministry of the Environment

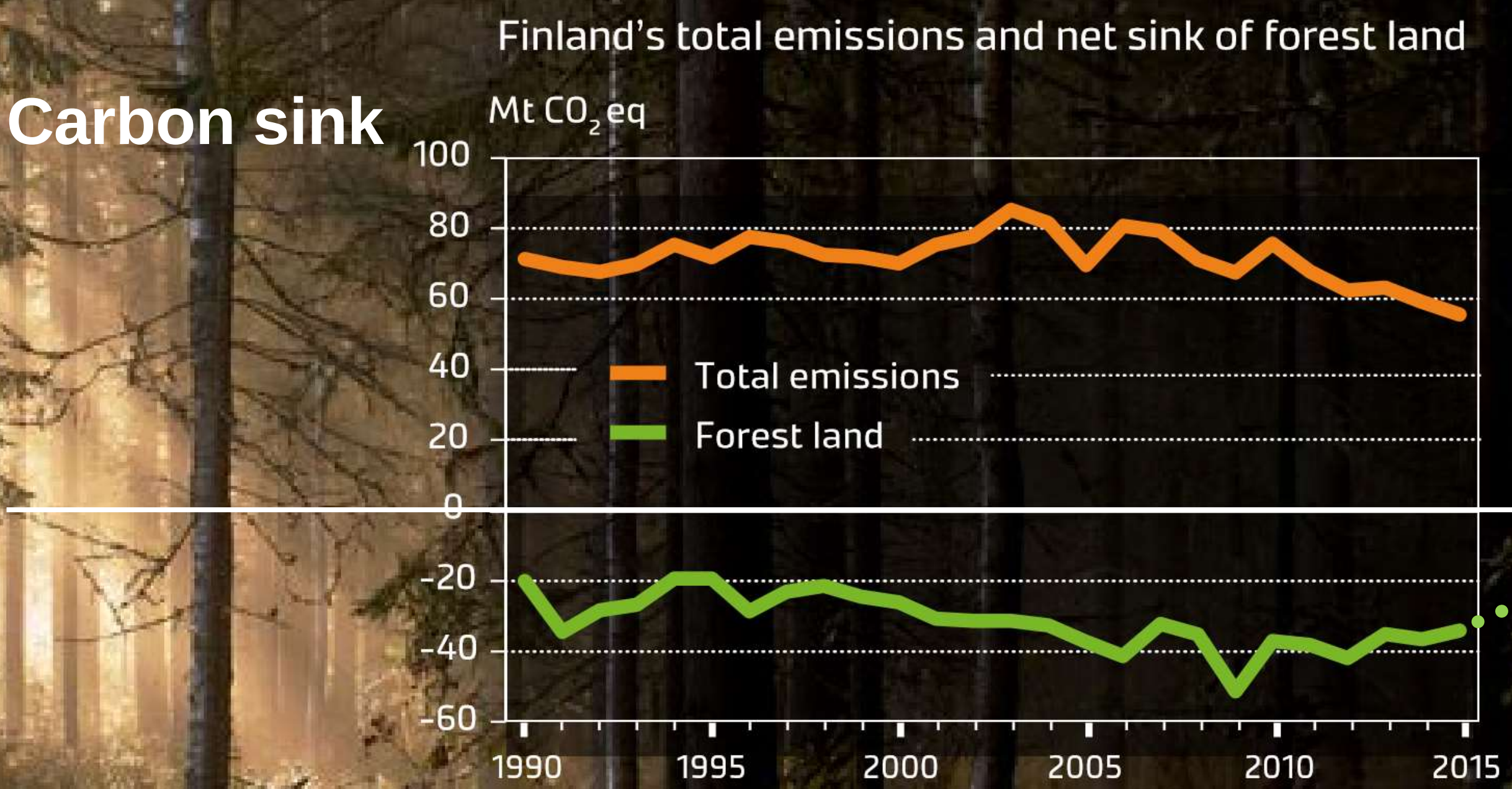
Meeting future needs today – promoting wood building and low-carbon construction in Finland

Simon le Roux, Architect SAFA
Project Specialist, Wood Building Program

Forum Wood Building Baltic, 10.5.2022


Carbon neutrality by 2035
Carbon negativity in 2040´s
Political goals in Finland
Low-carbon roadmaps 2035
Ministry of Economic Affairs and Employment
https://tem.fi/en/low-carbon-roadmaps-2035

Carbon sink



https://www.luke.fi/wp-content/uploads/2017/06/finlands-forests-facts-2017-www.pdf

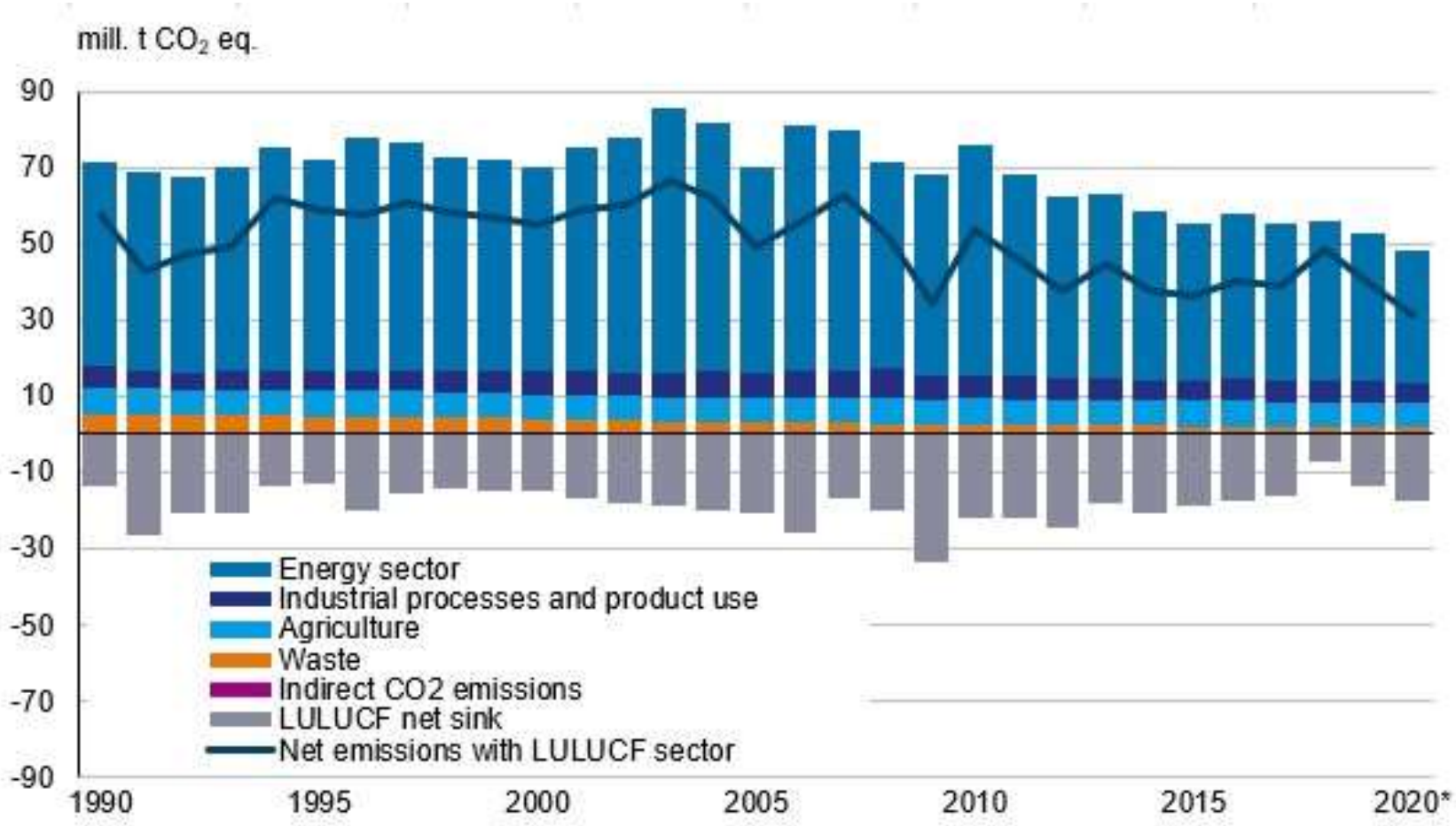
Source: Statistics Finland 2017.

Greenhouse gas emissions are decreasing

Finland is advancing in accordance with its carbon neutrality targets.

Ambitious goals for the future require more investments and successfully implemented measures

The year 2021 marked the 100th anniversary of monitoring the state of forests in Finland



*Preliminary data
LULUCF refers to the land use, land-use change and forestry sector. The estimates of the LULUCF sector for the latest years will be updated in future due to new input data (incl. tree biomass, surface areas)

- https://kestavakehitys.fi/en/-/the-resource-wise-economy-and-carbon-neutral-society-greenhouse-gas-emissions-are-decreasing-and-the-share-of-renewable-energy-was-at-a-record-high-level-in-2020

Promotion of wood construction and wood products in Finland

WOOD CONSTRUCTION

- Increasing the use of wood in urban development, public buildings and large structures
- Strengthening of regional skills bases
- Legislation and best practice in this sector
- Increasing the productivity in wood construction

WOOD PRODUCTS

- Product development and increase in added value
- Communication campaigns to promote the use of wood
- Wood structures for transport infrastructure
- Wood structures in farms and sparsely populated areas

CARBON STRORAGE IN WOOD PRODUCTS AND STRUCTURES

- Carbon storage and carbon footprint calculation and assessment tools
- Tools for calculating and assessing substitution effects
- Circular economy
- Utilization of by-products

UTILIZATION AND DIGITALISATION OF NEW TECHNOLOGIES AND METHODS

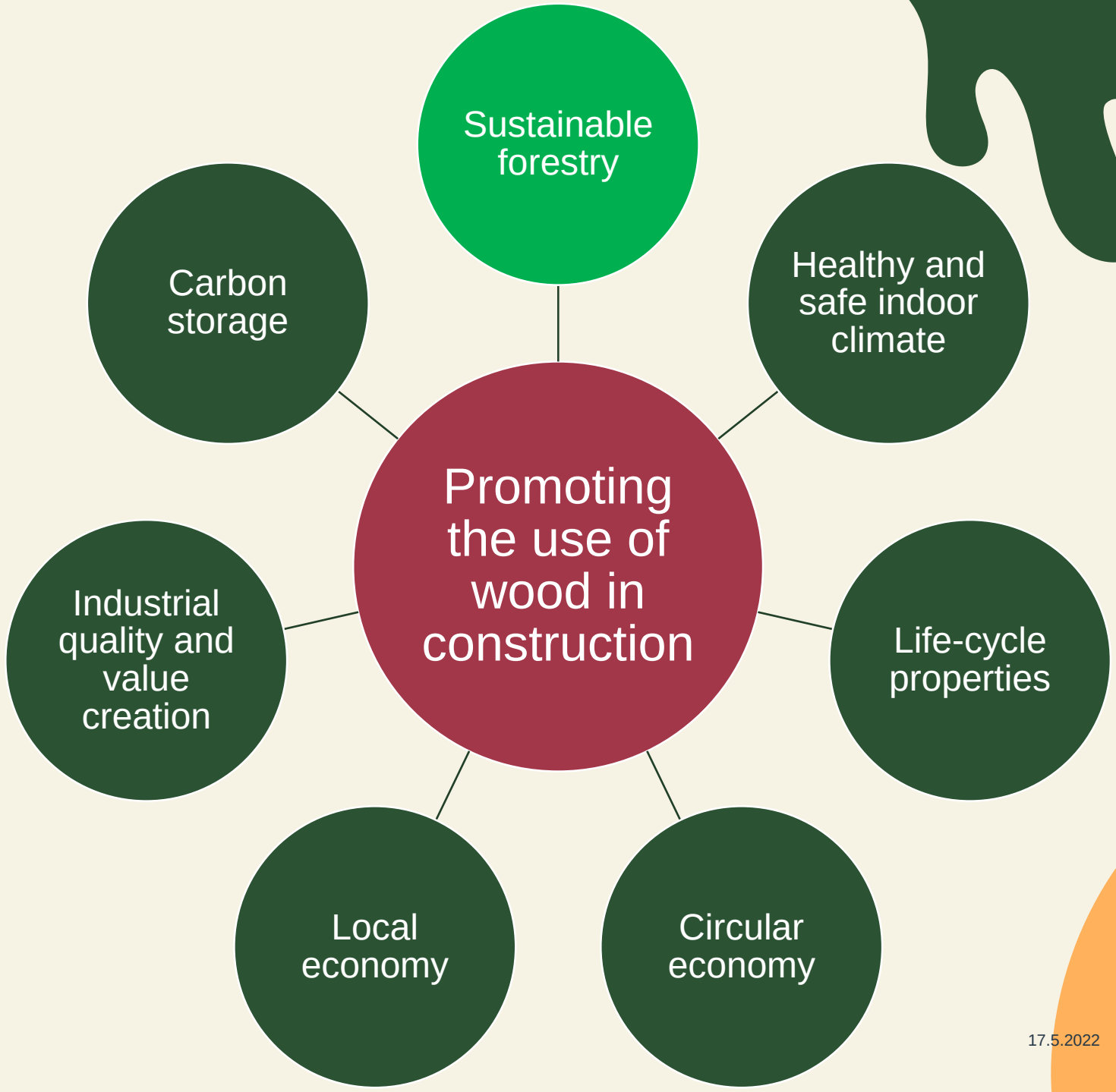
UPSKILLING IN VALUE NETWORKS

PROMOTION OF EXPORTS OF WOOD CONSTRUCTION AND TIMBER PRODUCTS

Ministry of the Environment | Ministry of Economic Affairs and Employment | Ministry of Agriculture and Forestry | Ministry of Transport and Communications

Solutions for balanced sustainable performance

The goal to reduce the life-cycle impacts of the built environment is to achieve climate change mitigation and the sustainable use of natural resources.
At the same time, the benefits of the built environment are to be assessed from **social and economic points of view**: quality, functional performance and value creation.



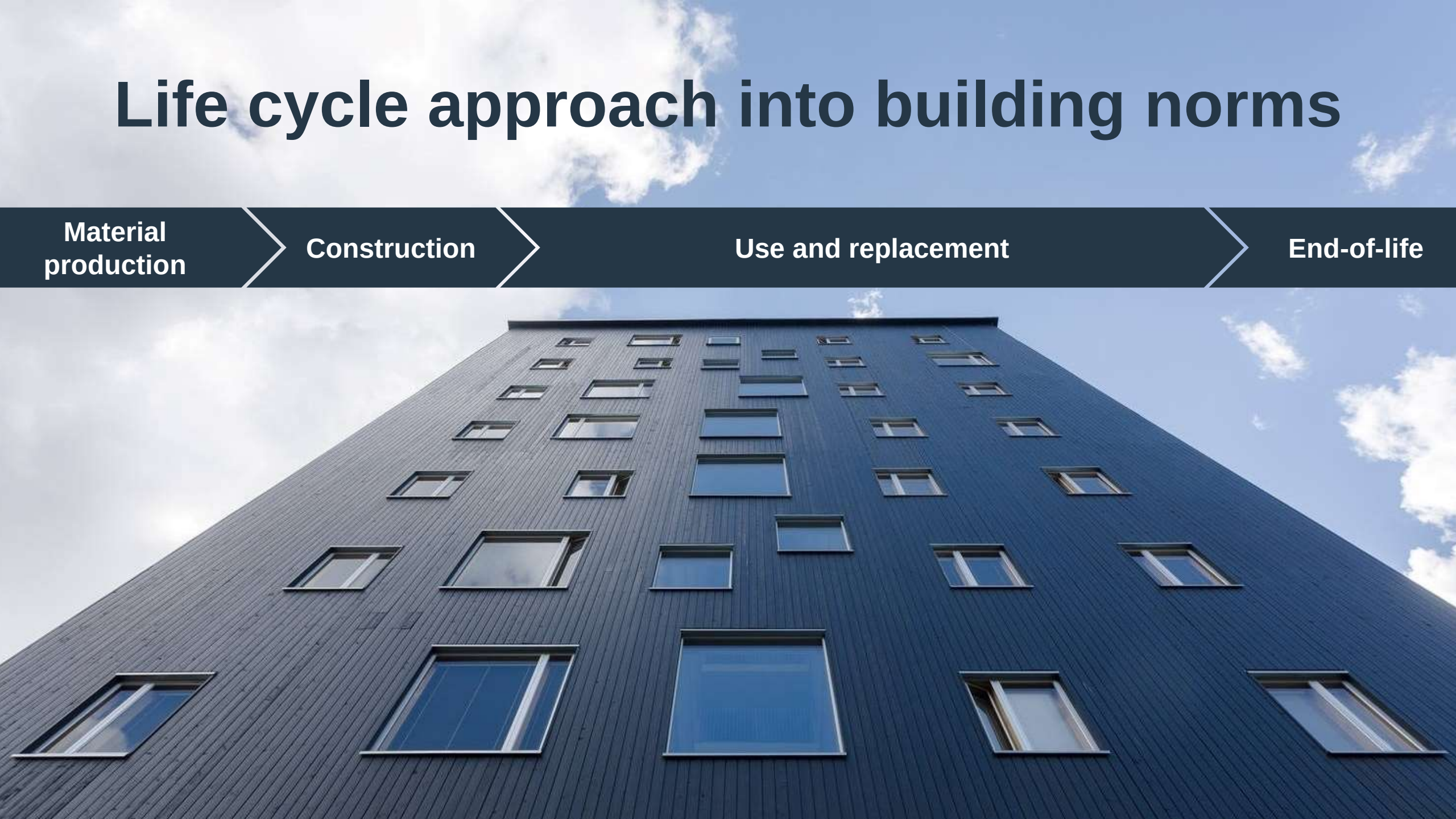
Meeting future needs today: working in synergy with broad strategic goals

Responding to a wide range of market trends and policies with wood building

- **Green Public Procurement** promoting government **Low-carbon roadmaps** and the sustainable use of timber in cooperation with companies
- Implementing the **local governance** perspective of sustainable development in the activities of **cities and municipalities**: understanding consumption-based emissions
- Transitions in **multistory housing systems** that meet ongoing climate-related and social challenges: creating novel, **human-centred solutions**, especially via renovations.
- **Digitalization**, data interfaces and standardisation of solutions for low carbon construction
- User-oriented solutions for changing demographics in **social and health care**
- **Towards Sustainable Architecture**: Finland's national architectural policy programme 2022–2035 offers a comprehensive perspective on goal-oriented development.

Life cycle approach into building norms

Material production | Construction | Use and replacement | End-of-life



Whole life carbon limits for buildings before 2025

Material production | Construction | Use and replacement | End-of-life

Carbon footprint

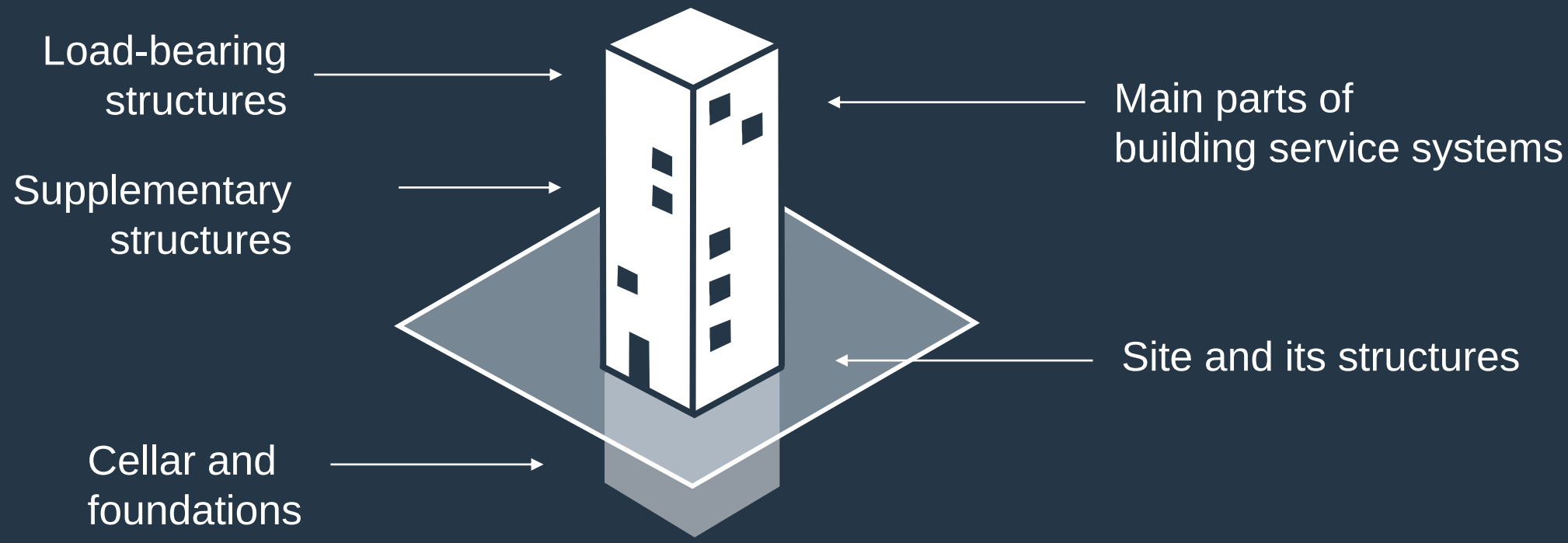
- Emissions caused by the building over its life cycle
- Limit values for new buildings
- Mandatory climate declaration for refurbishment projects

Carbon handprint

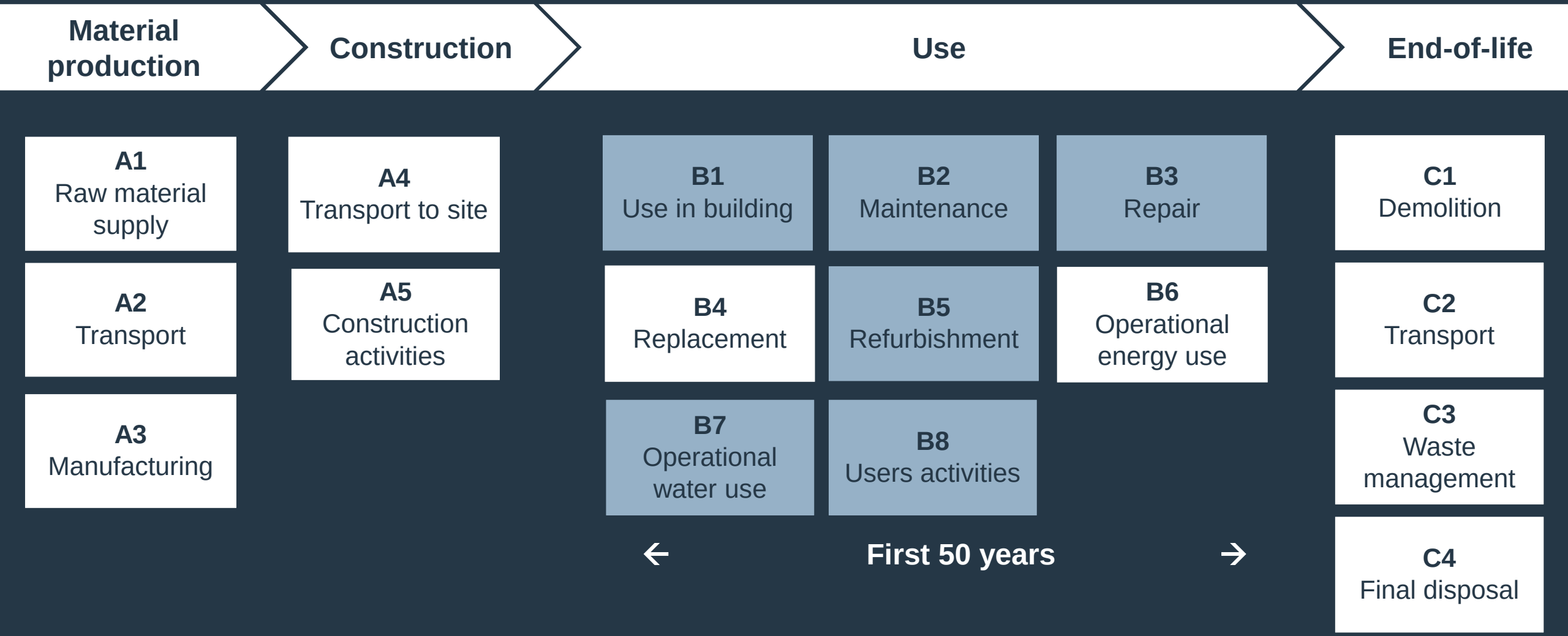
- Climate benefits based on EN and ISO standards
- Net benefits from reuse, recycling or energy recovery
- Long-term carbon storages
- Carbonisation of concrete
- Surplus renewable energy

System boundaries

Material production | **Construction** | **Use and replacement** | **End-of-life**



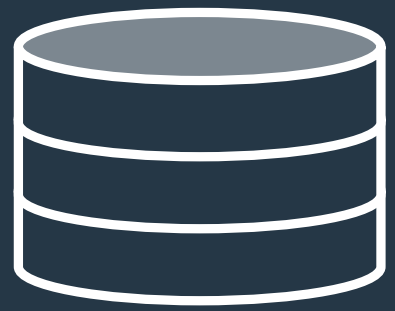
System boundaries



The essential toolbox

Life cycle assessment method for buildings

+



Open life cycle database
for building products, energy and processes

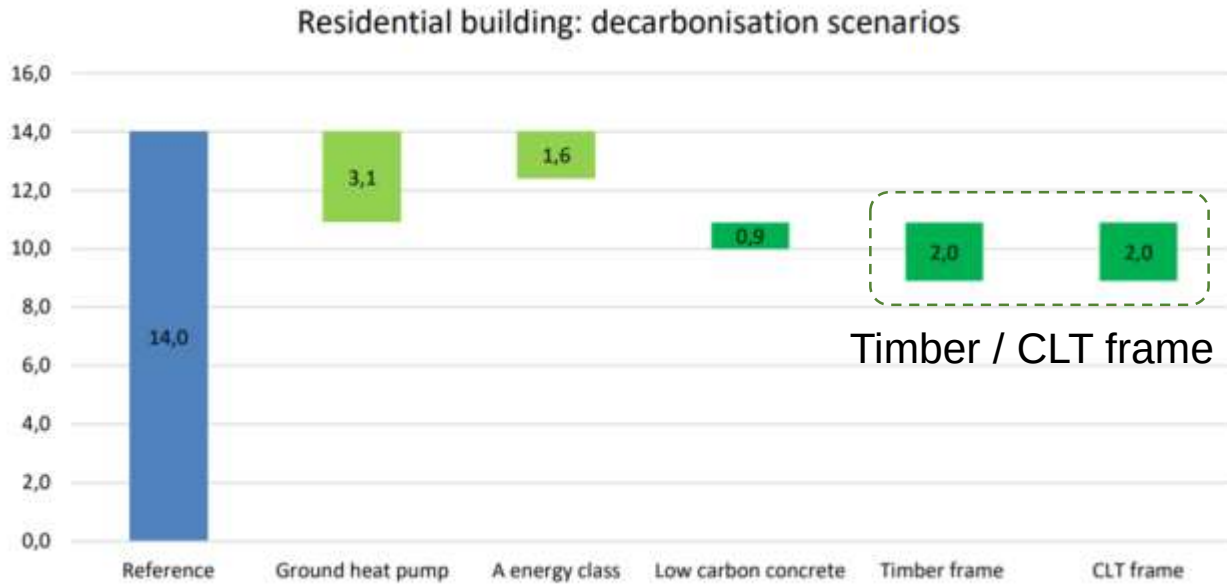
+

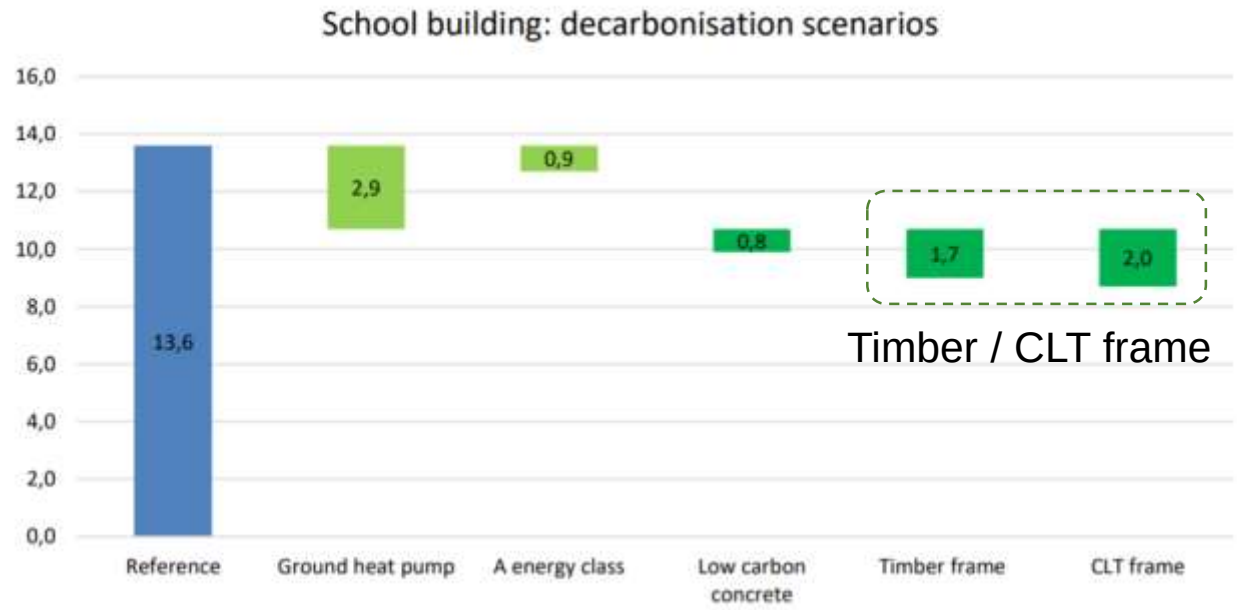
Digitalisation
Compatibility with digital building design and building permission processes

Effect of using wood to lower the footprint

Five **decarbonisation scenarios** were analysed: low carbon concrete; timber frame; CLT (cross laminated timber) frame; energy class A; and ground heat pump. [kg CO2e/m2/a]

- The materials-neutral (low carbon concrete) carbon reduction potential is **22-36 %**, and **maximum carbon reduction potential is from 28 to 43 %,** depending on the building type.
- NOTE: The authors draw special attention to the impact of the foundations, soil conditions and parking structures to the building carbon footprint.





Bionova study (**Carbon Footprint Limits for Common Building Types**)

Wood building carbon storage and substitution

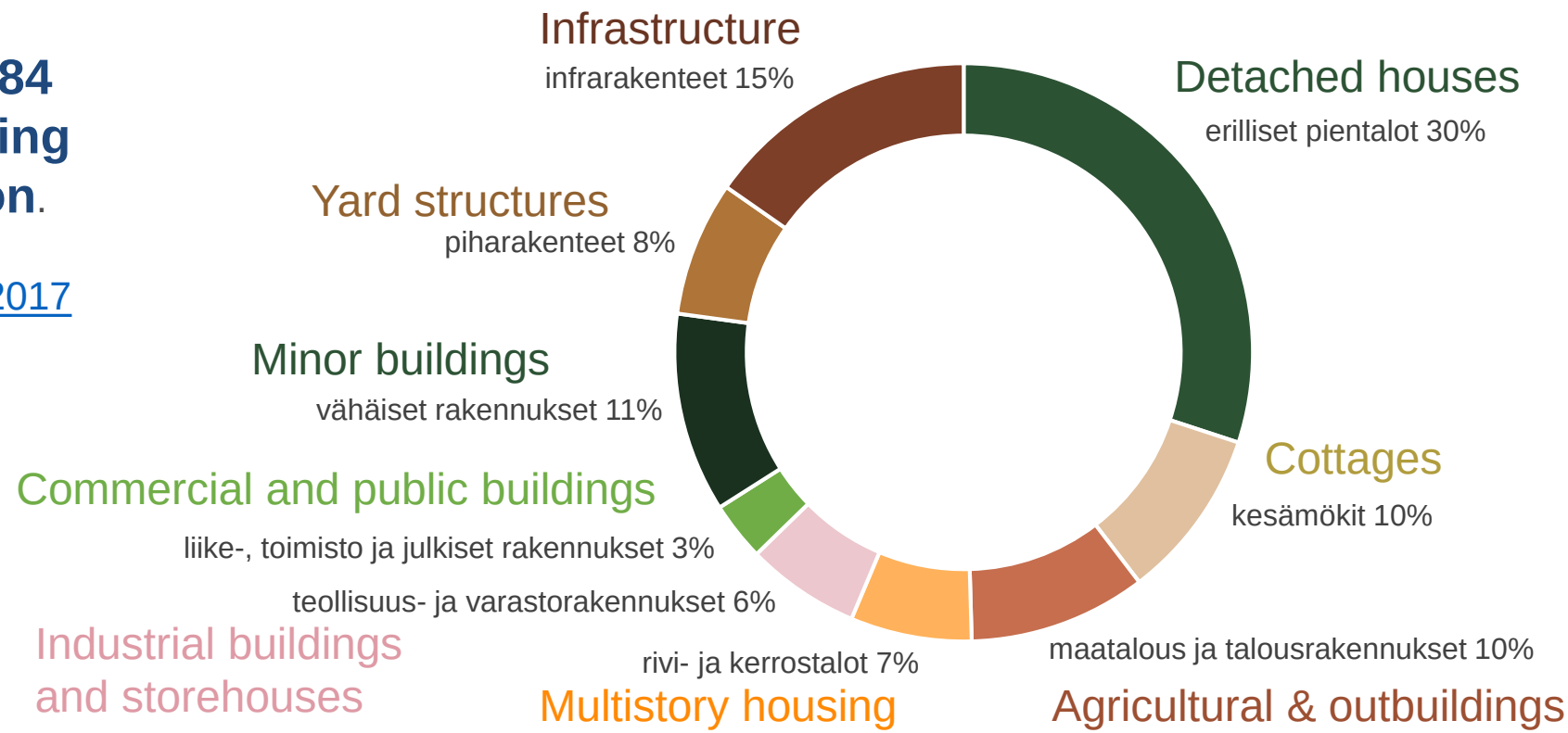
- Since 2000 Finnish forests absorbed average **34 million tons CO_2 equivalent/year.**
- The built environment of Finland currently contains about **46 million tons of wood** material = **84 million tons CO_2e**. Total carbon storage equals 2 years forest growth.
- The material emissions of a wooden apartment building with different structural systems are about **160 - 170 kgCO_2e/br-m^2**
- A wooden apartment building reduces the carbon footprint about **40 - 44%** compared to a concrete element apartment building. The carbon saved is about **120 kgCO_2e/br-m^2**
- The largest carbon storage is with CLT (**300 kgCO_2e/br-m^2**)
- *The carbon storage grows slowly with current building activity.*

https://www.puupaiva.com/sites/default/files/H%C3%A4kkinen%20Tarja%20Rakentamisen%20hiilivarasto.pdf

A total of 46 million tons of wood material, with a sequestration of 84 million tons CO_2 containing 23 million tons of carbon.

Rakentamisen hiilivarasto, VTT 2017

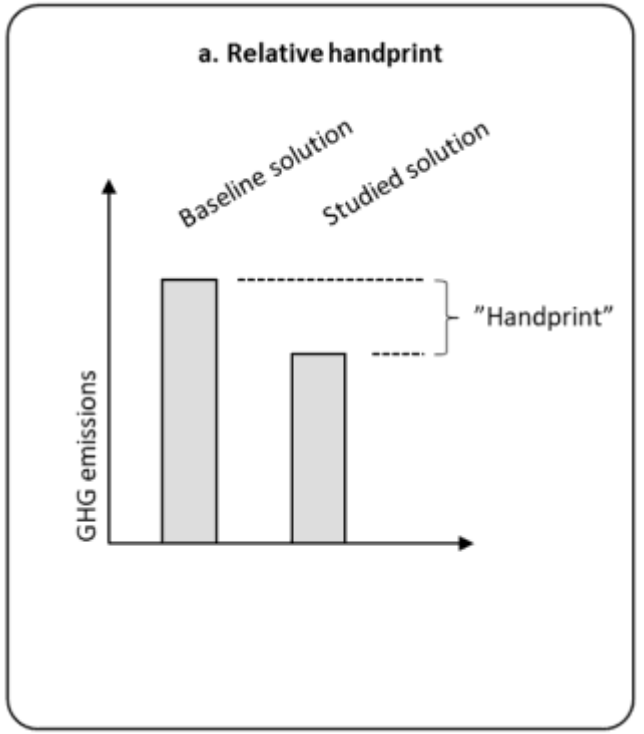
Carbon storage in the built environment of Finland (2016)

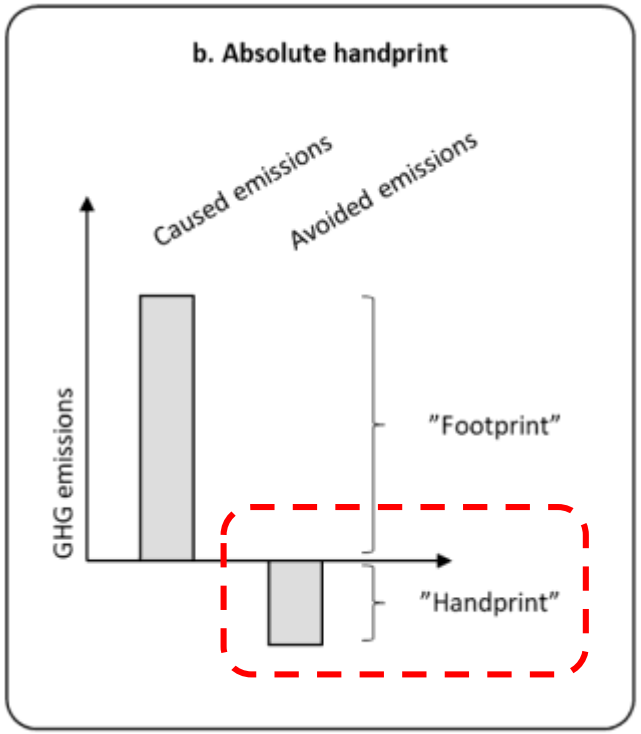


Reduced carbon footprints of buildings: new Finnish standards and assessments

The Finnish assessment method includes reporting of both carbon '**footprint**' and '**handprint**'. Carbon footprint describes the global warming potential associated with a building's life-cycle

- The carbon handprint is calculated as the **absolute climate benefits** that would not be achieved without the project. It is not a relative figure that indicates improvement in relation to a benchmark.
- the importance of carbon handprint thinking increases also because of relation to the issue of **carbon neutrality**





Matti Kuittinen, Tarja Häkkinen:
https://journal-buildingscities.org/articles/10.5334/bc.30/

Definition and methods for the carbon handprint of buildings (T. Häkkinen, S. Nibel, H. Birgisdottir, 2021)

- **The consideration of carbon storage as carbon handprint** is specifically stated in the Finnish assessment method published by the Ministry of the Environment (Kuittinen, 2019). Carbon storage (expressed as negative CO2 emissions) in buildings is reported as carbon handprint while carbon footprint includes the CO2 emissions from non-renewable materials.
- **If forests are sustainably managed**, the carbon store can be maintained at a constant level, whilst the trees removed and converted to timber products can form an **additional long term carbon store**. Therefore, the total carbon store in the forest and the associated 'wood chain' can be increased over time.
- There is evidence about the benefits of carbon storage in timber buildings for climate impacts. However, clearer **justification based on scientific results** is needed. The essential question is, how **harvesting of wood for long-term use** and **storage** in buildings affects the carbon balance of forest and future growth of wood.
- The need of the carbon handprint concept may arise, when there is a specific desire to describe the **availability of stored carbon in timber products to be reused/recycled** in the next systems.

National wood construction programme in Finland

- Goal: By 2025, at least 45 % of all public buildings will be built from wood
- Production of wooden buildings has 40 % lower CO_2e emissions than typical alternatives
- Long term carbon storages typically 150…300 $kgCO_2/m^2$ in wooden buildings

National targets for wood in public construction

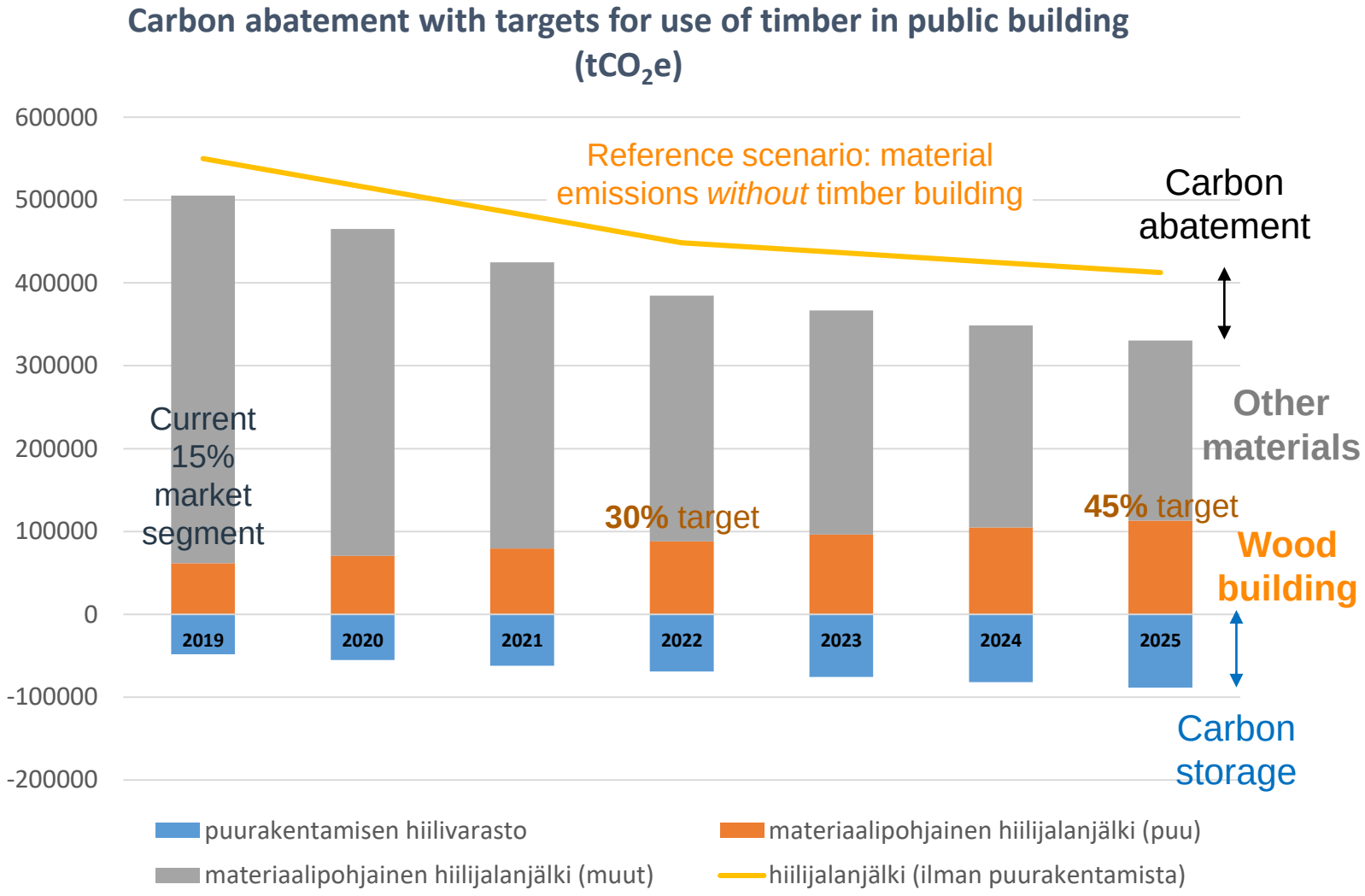
- **The 2019 Government Programme sets an clear objective to double the use of wood in construction during the government term and to set national targets for wood in public construction.**
- Municipalities play a key role in reducing emissions in building sector because the public sector controls all construction and builds itself.
- Wood construction has been identified as an important measure of reducing greenhouse gas emissions from construction.
- The carbon neutrality targets set by municipalities support wood construction and, in particular, the use of massive wood in the building stock, which is a long-term carbon stock.

National targets for wood in public construction		Total [1000 m³]	Wood [1000 m³]	Market share %
Educational buildings	2019	1998	614	31 %
	2022	**1220**	**671**	**55 %**
	2025	**1100**	**715**	**65 %**
Buildings for institutional care	2019	1178	66	6 %
	2022	**870**	**174**	**20 %**
	2025	**700**	**245**	**35 %**
Assembly buildings	2019	950	63	7 %
	2022	**650**	**130**	**20 %**
	2025	**550**	**165**	**30 %**
Residential blocks of flats	2019	674	18	3 %
	2022	**570**	**122**	**21 %**
	2025	**520**	**239**	**46 %**
Other construction	2019	2107	278	13 %
	2022	2351	663	28 %
	2025	2351	932	40 %
All public building	2019	6907	1039	15 %
	2022	**5661**	**1760**	**31 %**
	2025	**5221**	**2296**	**45 %**

Building classification 2018: * Incl. early childhood education (kindergartens), ** Including dormitories and apartments for special groups

big ambitions - slow impact

- National target to reach 45% market segment with timber framed publicly procured buildings by 2025
- 45% market segment with timber will be responsible for approximately 30% material based emissions from new construction
- 55% ”business as usual” will be responsible for 70% material based emissions in new costruction.
- Overall less public building



Collaboration for the public sector

- **Motiva** provides the public sector, businesses, municipalities and consumers with information, solutions and services that allow them to make resource-efficient, effective and sustainable choices. https://www.motiva.fi/julkinen_sektori/puurakentaminen
- **KEINO** is a network-based Competence center for Sustainable and Innovative public procurement in Finland https://www.hankintakeino.fi/en
- **SYKE** Finnish Environment Institute
- **LUKE** Natural Resources Institute Finland
- **Tandem Forest Values** bilateral research collaboration between Finland and Sweden
  - **KnockOnWood** project is to provides systemic information on how housing demand, housing supply and local governance mechanisms affect the wooden multistory housing market diffusion. https://www.slu.se/en/departments/forest-economics/forskning/research-projects/knock-on-wood/

1940

2020

Architecture with wood has important symbolic value for both public and private sector

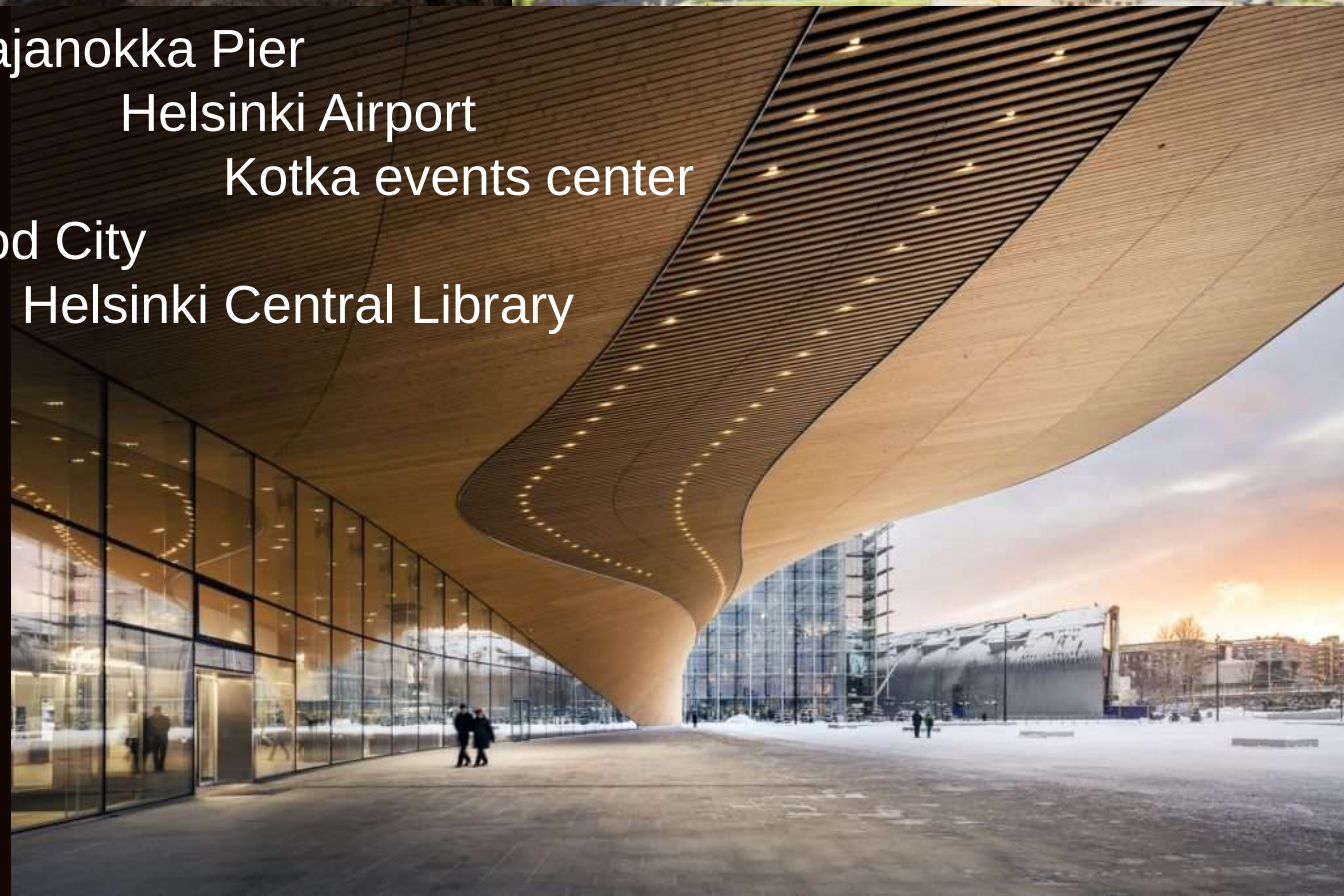
Katajanokka Pier

Helsinki Airport

Kotka events center

Wood City

Helsinki Central Library



Finnish multistory wooden apartment buildings (1995-2022)

Large elements 75000m2

CLT space elements 63800m2

Platform / light frame 61400m2

Platform / CLT flat elements
Platform /LVL flat elements
(floors CLT) 36000m2

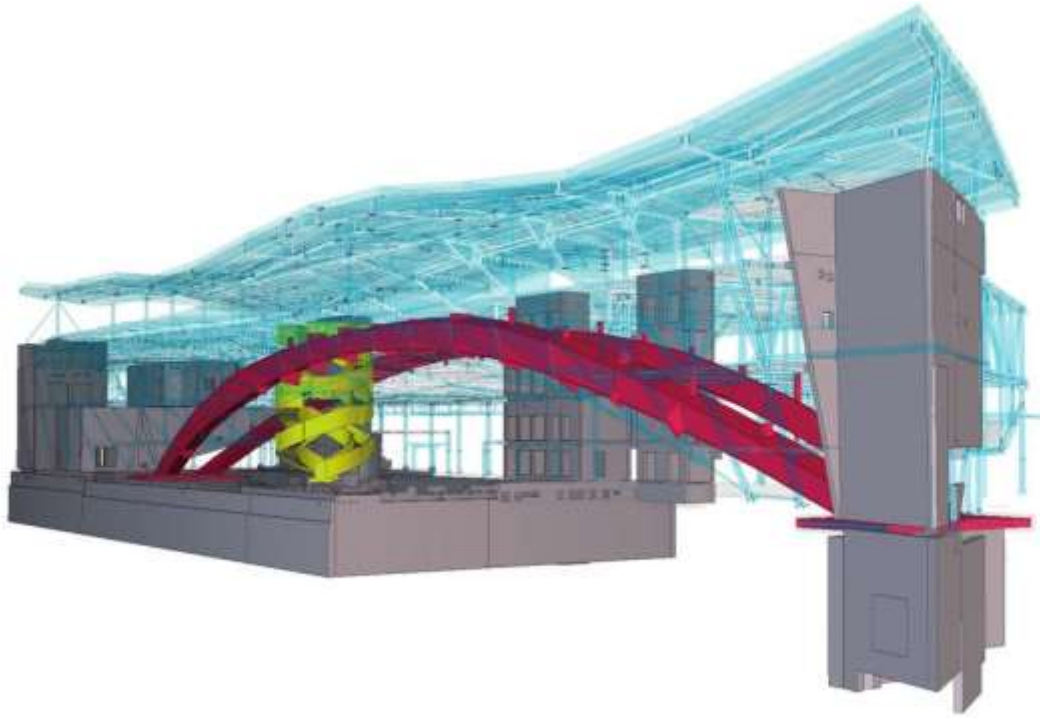
Light frame space elements 29200m2

Post and beam frame 7800m2

Laminated logs 1100m2

**TOTAL: 4161 apartments,
130 buildings,
248 703 m2 floor area**

HYBRIDS – WHEN IS A WOOD BUILDING WOOD?



Spinklers irrigated four dwellings in Europe's largest wooden apartment – the mould was disappointed.

Spinkleri kasteli neljä asuntoa Euroopan suurimmassa puukerrostalossa – homesieni pettyi

"On järkyttävää, että kaikki kaatui johonkin koulukuntaeroon"

“It's shocking that everything fell into some kind of **school differences**.”

View from outside

TECHNICAL EVOLUTION AND DEMANDING MARKET FOR NEW COMPANIES

Suomen halutuimpiin asuinaluisiin kuuluvan seudun maamerkki valmistuu 3 vuotta myöhässä – näin unelmien puukerrostalo kaatui asukkaiden syliin: "Pakostahan sitä rahaa on mennyt"

Teollisia puukerrostaloja Suomen markkinoille tuonut Suomen Puukerrostalot Oy on hakeutunut konkurssiin 2.2.2022.

The landmark of a region that is one of Finland's most desirable residential areas will be completed 3 years late – this is how the wooden house of dreams fell into the hands of the residents: “**money has gone**”

Suomen Puukerrostalot Oy, who brought industrial wooden houses onto the Finnish market, has filed for **bankruptcy** on 2.2.2022.

life cycle thinking and criteria development, green public investments, municipal strategies, digitalisation and industrial process efficiency, circular economy, energy efficiency, acoustics, user needs,

View from inside

MANAGEMENT OF A COMPLEX SET OF MEASURES

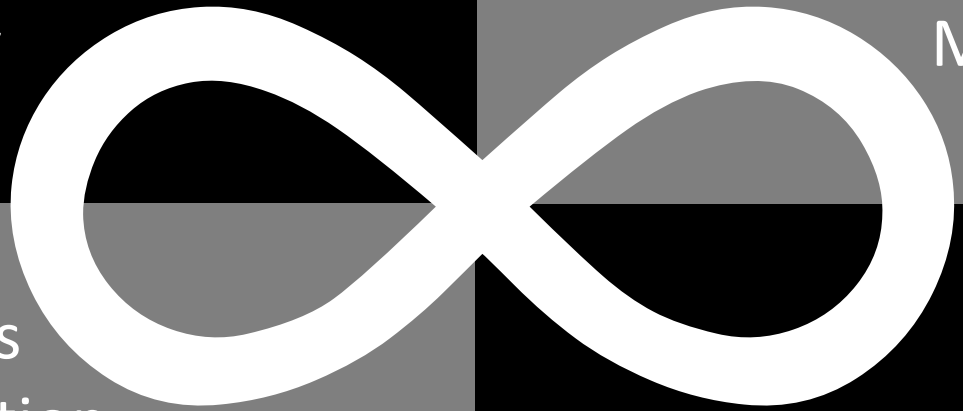
psychological and physiological properties, housing quality, indoor air quality, renovations and infill construction, real estate development, ecotourism, bio-based and organic construction products, biodiversity impacts

Emission targets
Low-carbon construction
Lifecycle analysis (LCA)

Environmental management
Space use adaptability
Climate change mitigation and adaption

Energy efficiency
Energy renovations
Renewable energy
Thermal comfort

Life cycle costs (LCC)
Local economy ja innovations
Maintain and repair
Useability



Land use planning
Environmental risks
Environmental protection
Urban ecology & green infra

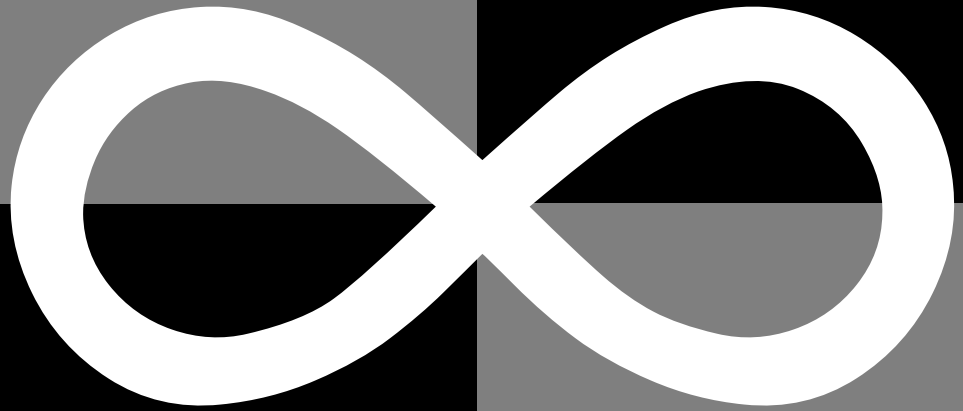
Public services
Accessibility
Access to services
Responsibility

Resource efficiency
Waste and Water management,
Circular economy
Service life

Health
Safety
Indoor quality
Aesthetic quality

Low carbon,
Energy efficient

Adapt, Resilience
Lifecycle

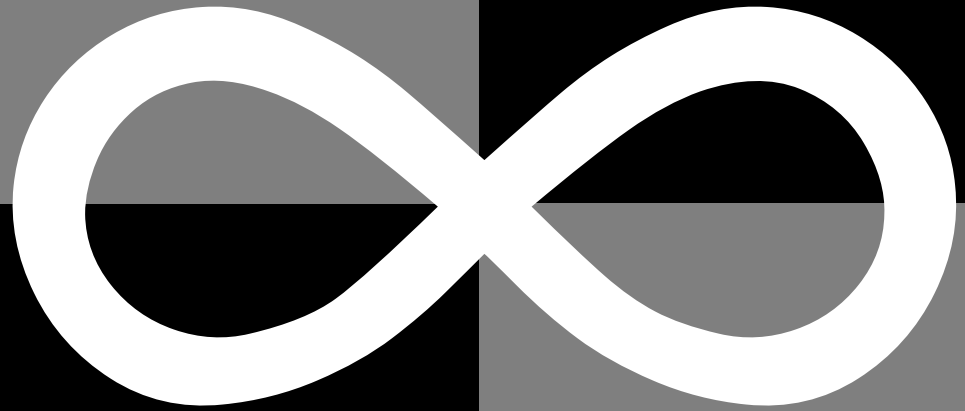


Protect,
Resources

Responsibility,
Health, Safety

Climate change

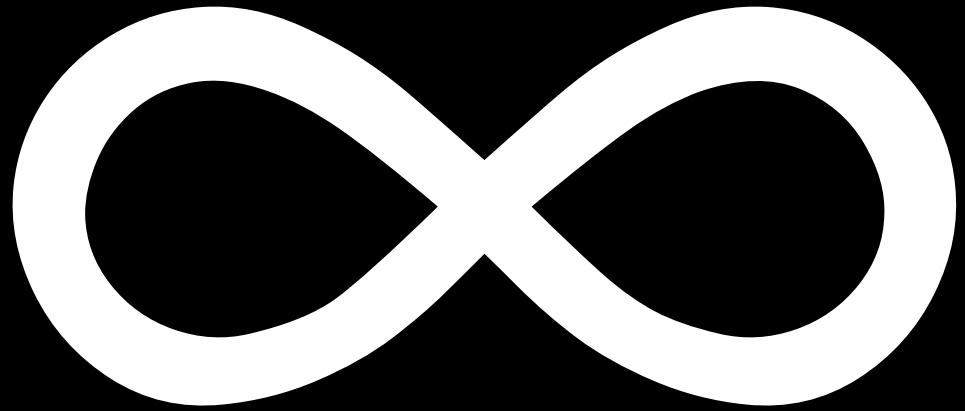
Economy



Natural resources

Society

Lifecycle impacts

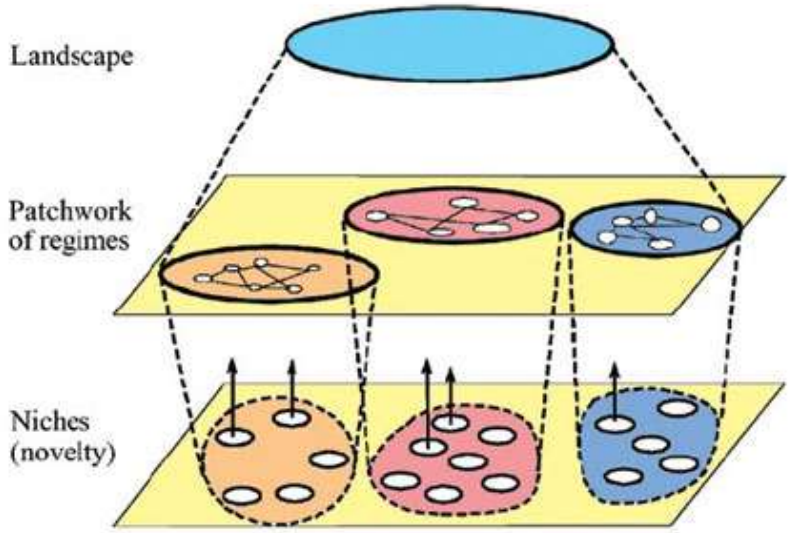


Quality, Perform, Value

Next steps for the wood building program

- Forecast of the wood products sector to **support public procurement** (VTT)
- Applying **humble governance** networking for long term city policy and practice (Demos)
- Researching **consumer preferences and policymaker attitudes** (LUKE)
- Quantifying impact of **low carbon policy and carbon storage** (Aalto University, SYKE)
- **Digital processes** for wood construction (VTT, Puuinfo)
- Funding **companies and municipalities R&D and innovation**
  - So far about 100 funded R&D projects: largest recievers of grants are universities and municipalities
  - ***Low-carbon Built Environment Programme 2021-2023*** supports climate work related to the built environment (Business Finland)
  - The Low-carbon Built Environment Programme contributes to the implementation of the Finnish Sustainable Growth Programme, which is part of the EU's Recovery and Resilience Facility (RRF).

Co-creation themes for wood?



- **Social and ecological innovations** in a socio-technical landcape: context and characteristics.
- **Nature based solutions** for decarbonisation and the quality of public life
- **Wood as a Nordic lifeline**: urban culture has become estranged from our natural resources.
- **Biodiversity and biophilia of wood in the urban context:** wood as our environment
- **Nordic wooden towns:** Nordic historical towns are wood with historic layers, cultural heritage, architecture politics, city planning, local tourism
- **Wood technique and knowledge, (re)education, and local doers**, restoration
- **Arctic perspective**, institutional cooperation for traditional knowledge in cultural landscape

“the tree is an element of regeneration which in itself is a concept of time.”

7000 Oaks – City Forestation Instead of City Administration

(Joseph Beuys, Kassel 1982 – 1987)

- an ongoing scheme of tree planting to extend throughout the world as part of a global mission to effect environmental & social change : **reconnect with the larger world outside the urban environment**
- **a growth of awareness within the urban environment of the human dependence on the larger ecosystem**
- GREEN URBAN RENEWAL: an ongoing process whereby society would be activated by means of human creative with social sculpture: **human-made structures and nature can coexist in harmony**
- **a recognition of the whole based upon a new concept of beauty that extends beyond the instant gratification**
- Beuys' *7000 Oaks* work is an example of the thread that links the *Situationist International's* approach to art and its re-creation by new groups continues to evolve through a new generation of socially conscious organizations that **merge art, education, and environmental issues** in their work.
- http://web.mit.edu/allanmc/www/cookebeuys.pdf

connecting art to the climate movement **‘a tree is a work of art, a forest a social movement’**

Wood Building Program

Petri Heino
Simon le Roux
Sini Koskinen
Iida Humphreys

petri.heino@gov.fi
simon.leroux@gov.fi
sini.koskinen@gov.fi
iida.humphreys@gov.fi

ym.fi/puurakentaminen
puupuhuu.fi