

Life Cycle Assessments In The Built Environment

CIRCULAR AND INNOVATIVE CONSTRUCTION PROCUREMENTS

International Workshop

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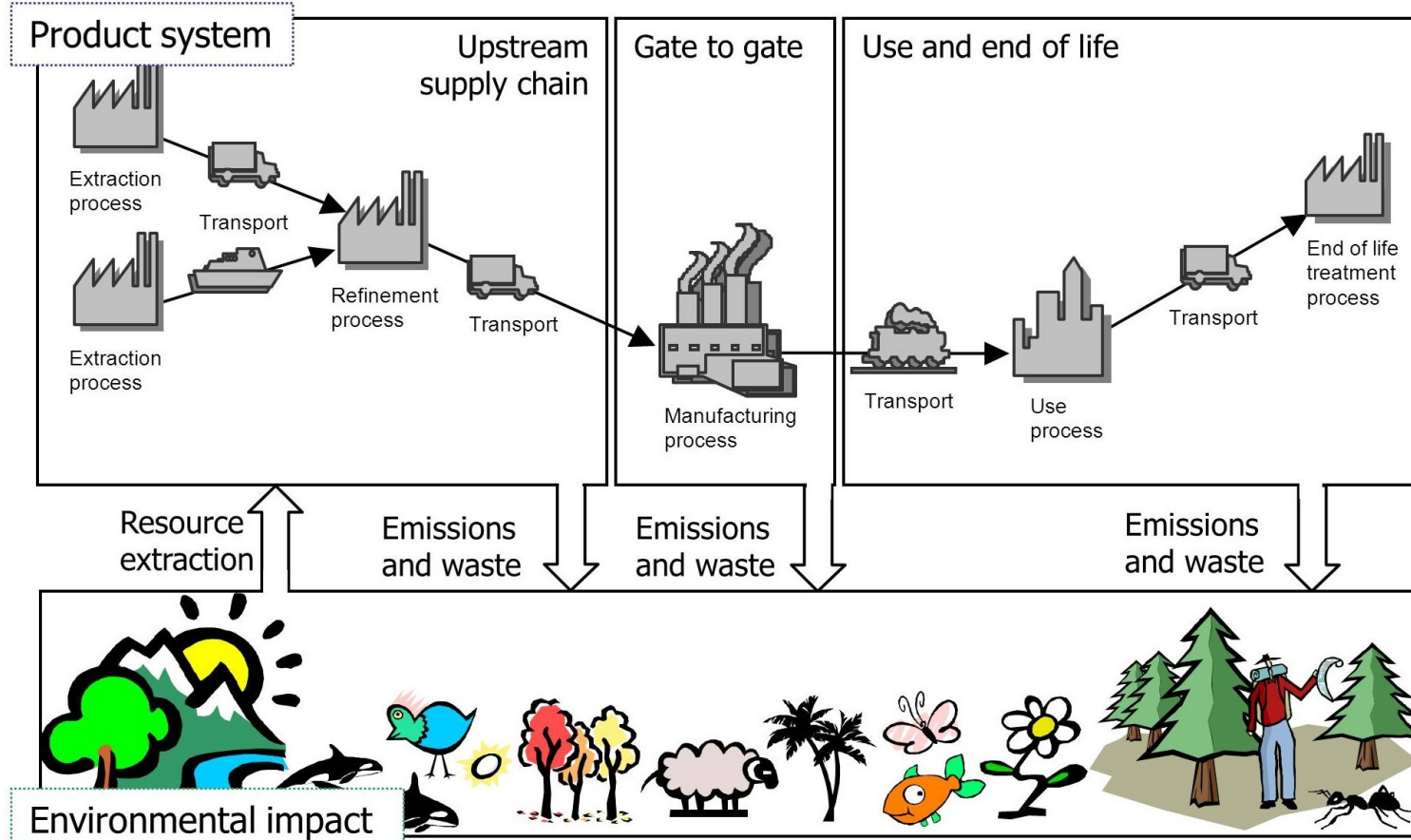
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Agenda



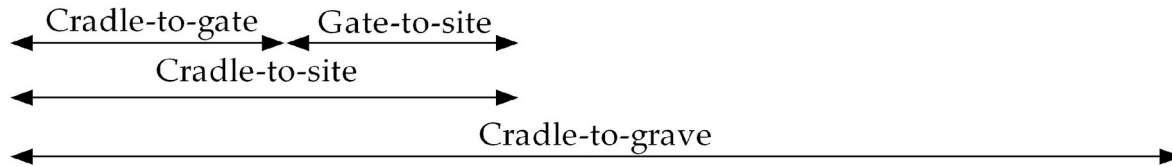
- Introduction to LCA
- LCA for the Built Environment
- Building LCA regulations in the EU

Introduction to LCA



LCA for Buildings

Building life cycle stage													Supplementary information			
Product			Construction process		Use						End of life		Benefits and loads beyond the system boundary (Reuse, recovery, recycling)			
Raw material supply	Transport	Manufacturing	Transport	Construction - installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction/demolition		Transport	Waste processing	Disposal
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	



ISO 14040 & ISO 14044
 General guidelines for LCA
 ISO 14025
 Guidelines for EPDs
 EN 15804
 Guidelines for construction product LCAs
 EN 15978 & ISO 21931
 Guidelines for building level LCAs

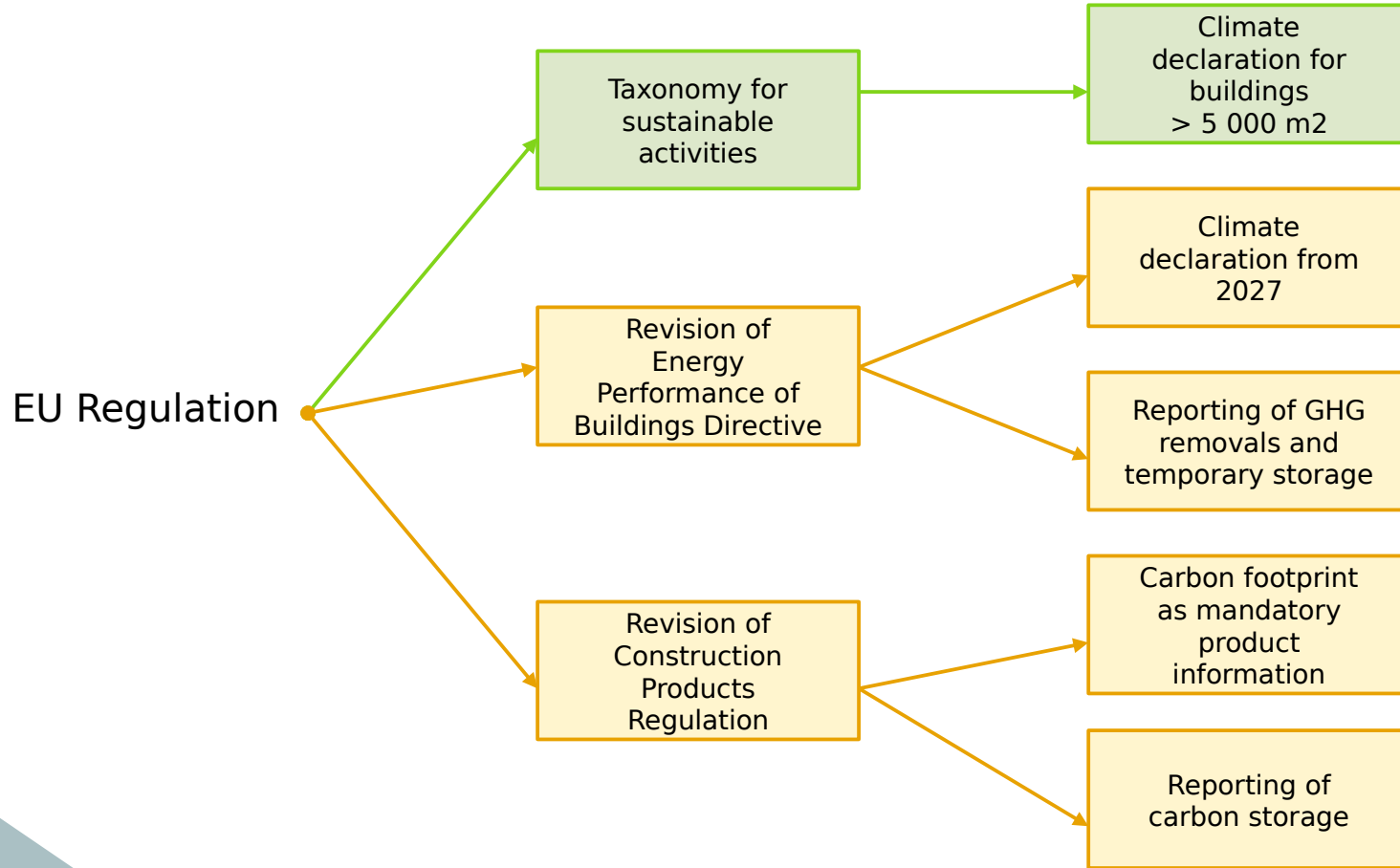
Building LCA regulation in the EU

Country	Methodology	In force	Applies to renovations	Timing of assessment	Applicable buildings	Acceptable data	Preference of EPDs	Compliance type
Denmark	Bygningsreglement	2023	No	Single assessment – Post construction	All	EN 15804 ¹⁶	Yes	Limit value
Finland	Finnish method / RakL	2024 Expected	Yes	Single assessment – Planning Stage (Building permit)	All Buildings requiring an energy declaration	EN 15804+A2, CO2data	Yes	Limit value
France	RE2020	2022	No	Multiple assessments (Building permit & Post construction)	Residential Offices Education	INIES database	Yes	Limit value
Netherlands	MPG	2013	No	Single assessment – Planning Stage (Building permit)	Offices and residential	NMD only	Yes	Limit value
Norway	NS 3720 / TEK 17	2022	Yes	Single assessment – Planning Stage (Building permit)	Residential and commercial buildings	EN 15804	Yes	Declaration
Sweden	Klimatdeklaration av byggnader	2022	No	Single assessment – Post construction	>100 m ² ¹⁷	EN 15804, Boverket	Yes	Declaration
UK	London Plan / Part Z ¹⁸	In force / Proposed	Yes	Multiple assessments (Prior and post construction)	>1000m ² Or >10 dwellings	EN 15804 and other standards	Yes	Declaration ¹⁹
EU	Level(s) via EPBD	2027/2030 Proposed	Yes	Multiple assessments (Conceptual / detailed / as-built)	All	EN 15804	Yes	Declaration

Comparison of methods and scopes

Included life cycle stages	Denmark	Estonia	Finland	Norway	Sweden	Level(s)
A1-A3	✓	✓	✓	✓	✓	✓
A A4 Transport to site		✓	✓	✓	✓	✓
A5 Construction		✓	✓		✓	✓
B1 Use in building						✓
B2 Maintenance				✓		✓
B B4 Replacements	✓	✓	✓	✓	✓	✓
B5 Refurbishment						✓
B6 Energy	✓	✓	✓		✓	✓
B7 Water						✓
C1 Demolition works		✓	✓		✓	✓
C C2 Transport		✓	✓		✓	✓
C3 Waste management	✓	✓	✓		✓	✓
C4 Final disposal	✓	✓	✓		✓	✓
D Additional	✓	✓	✓		✓	✓
Reference study period	50	50	50	50	50	50

EU regulation



Energy Performance of Buildings Directive (proposed amendments by the European Parliament)

Article 7.2:

- Climate declaration for all new buildings 2027

Amendment 2a:

- By 31 December 2025, the Commission shall adopt a delegated act ...by setting out a harmonised EU framework for the calculation of life-cycle Global Warming Potential, developed in an inclusive stakeholder process and building on the LEVELs framework and standard EN 15978.

Amendment 2b:

- Member States shall publish a roadmap detailing the introduction of limit values on the total cumulative lifecycle GWP of all new buildings no later than 1 January 2027 and set targets for new buildings from 2030, considering a progressive downward trend, as well as maximum requirements, detailed for different climatic zones and building typologies.

Energy Performance of Buildings Directive (proposed amendments by the European Parliament)

Annex II TEMPLATE FOR THE NATIONAL BUILDING RENOVATION PLANS

- **Targets for expected whole lifecycle greenhouse gas emission** (kgCO₂eq/(m².y) with five year milestones per building type
- **Targets for expected whole lifecycle greenhouse gas emission reduction** (%) with five year milestones per building type
- Targets for circular use of materials, recycled contents and secondary materials, and sufficiency with five year milestones, if any;
- **Targets to increase carbon removals** associated to the temporary storage of carbon in or on buildings

CPR – facilitating circularity

Used or remanufactured construction products	Clarify + establish conditions for marketing	Art. 10(2) and (3), and 12
	Protocol on dismantled construction products (safe re-use / remanufacturing)	Art. 29
	Information on reparability, re-use, remanufacturing + recyclability	Art. 22(2) and Annex I Part D
	Maximum flexibility: <ul style="list-style-type: none">• Unchanged used products on the EU market excluded• Voluntary assessment• Member States may exempt certain used products if they circulate only in their territory	Art. 2 (2), 10, 12, and 22
Surplus products	Permitting a second life	Art. 12
Closed material circles	Member States: may establish mandatory deposit-refund systems + ban destruction of products	Art. 7 (7) and (8)

Recommendations for emission reductions for the building sector (UNEP, 2022)



BUILDINGS SECTOR TRANSFORMATION

MOST IMPORTANT ACTIONS



EFFICIENT BUILDING SHELL: Optimize building shells to minimize the need for active heating and cooling.



SCALE UP ZERO-EMISSIONS HEATING AND COOLING TECHNOLOGY: Highly efficient air conditioners and heat pumps without hydrofluorocarbons can be powered by renewables, either on-site or supplied off-site through electricity.



ALL NEW BUILDINGS SHOULD BE ZERO CARBON IN OPERATION: New buildings should be designed and constructed so that they are zero carbon in operation, with a minimal energy demand that is met through zero-carbon sources (IEA 2021e).



MINIMIZE EMBODIED EMISSIONS: Emissions from construction materials should be minimized by reducing the emissions intensity of steel and cement production and substituting lower carbon materials, including recycled materials, where possible.



INCREASE RETROFITTING RATE: 2.5–3.5 per cent of buildings need to be retrofitted every year, but recent rates are below 1 per cent per year (IEA 2021a).

ACTIONS TO AVOID



AVOID INEFFICIENT BUILDINGS: Due to the long lifetime of buildings, the lock-in effect of inefficient new buildings is significant and currently potentially incentivized by low ambition or no building codes (Cabeza *et al.* 2022).



AVOID NEW FOSSIL GAS CONNECTIONS: New gas connections should be avoided to not create a lock-in, which would last decades. Improved insulation and electric heating and cooling can reduce fossil gas demand.



PHASE OUT FOSSIL FUEL SUBSIDIES: Several countries subsidize fossil fuel use in buildings, directly or indirectly.



Summary

- LCA getting into building regulations relatively rapidly
- Methodological background: Level(s), which is based on EN 15978
- System boundaries appear rather ambitious
- Scenarios allow decarbonization of energy, but unclear about future technologies
- Whole life carbon limits and roadmap for decarbonization of buildings ahead



Thank you for listening!