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Draft policy guidelines/principles on advancing low carbon construction in cities

Note by the Secretariat

Summary

This document, prepared by the secretariat, is a first draft of policy guidelines/ principles on advancing low carbon construction in cities. The document highlights the importance of low carbon construction for cities and the forest-based sector and proposes possible ways forward.

The document was developed under the project E416 "*Forests and Forest Knowledge for Resilient, Low-Carbon Urban and Rural Communities*".

Member States are invited to comment and provide guidance on the structure and content of the document and consider providing a mandate to the secretariat for publishing the final version as an official publication.

I. Objective

1. This document, developed under the project E416 "*Forests and Forest Knowledge for Resilient, Low-Carbon Urban and Rural Communities"* provides an overview for policymakers and decision takers on how sustainably grown wood can contribute to the efforts of cities to reducing the carbon footprint in the built environment.

2. The document gives an overview on the carbon and other technical advantages of an increased use of wood as low carbon construction material in cities in the ECE region and beyond. It further provides guidance on how various actors could contribute to facilitating an increased utilization of wood from sustainable sources as a key raw material in low carbon construction in cities.

3. As wood construction technologies are rapidly evolving, this document does not highlight specific technologies which strongly depend on local conditions, legal frameworks, and technical requirements and are subject to technical feasibility studies.

II. Background

4. Urbanization is one of the global demographic "megatrends"; the share of the world population in urban areas is projected to increase from 55% today to 68% in 2050 (UN DESA 2018). This concentration will also trigger significant increases in energy use and economic output. Cities are hotspots of the global carbon cycle, with considerable fossil fuel CO_2 emissions from electricity consumption, ground transportation, residential and commercial buildings (www.globalcarbonatlas.org).

5. The IPCC estimated in 2021 that global greenhouse gas (GHG) emissions from buildings amounted to the equivalent of 21% of the global GHG emissions in 2018. Of this, 57% are indirect emissions from the offsite generation of electricity and heat, 24% are direct emissions produced onsite and 18% are embodied emissions from the production of cement and steel used in buildings.

6. Globally, cement and steel used in buildings emitted 2.2 $GtCO_2$-eq, more than twice the amount reported for the aviation sector (1.04 $GtCO_2$- eq) in 2018. Over the period 1990-2019, global CO_2 emissions from buildings increased by 50% (IPCC 2021).

7. Building-specific drivers of those increasing GHG emissions include the larger floor area per capita, driven by the rising size of dwellings while the size of households kept decreasing, especially in developed countries. In addition, the inefficiency of newly constructed buildings, particularly in developing countries, and the low renovation rates in developed countries when existing buildings are renovated exacerbate the problem (IPCC 2021).

8. Cities can achieve net-zero emissions if emissions are reduced within and outside of their administrative boundaries through supply chains, which will have beneficial cascading effects across other sectors (IPCC 2021).

9. Cities of the future could become major carbon storehouses and remain economic powerhouses if they take advantage of highly energy efficient building materials with a low carbon footprint, such as wood.

10. Already today, more than 75% of the population in ECE member States live in urban areas and rapid urban expansion is less of a driver for construction needs. A major part of 2050's building stock in the ECE region already exists today. Most low carbon or carbon neutral construction activities in the ECE region will focus on urban densification, re-purposing or renovation of existing building stock. ECE member States are the major producers of sustainable forest products, key innovators in modern wood construction in the world and are best placed in leading the transition to low carbon or carbon neutral construction with wood.

III Carbon emissions and the built environment

A. Embodied emissions

11. Embodied emissions[1] account for 20–50% of an average building's whole-life emissions, and most of them occur before anyone even sets foot in the building. These include emissions from material extraction, manufacturing, transport, construction, maintenance and end of life. Most construction materials used in cities (and their associated emissions) are imported from beyond city boundaries. This aspect is only too often overlooked.

12. Production of common construction materials, such as concrete and steel cause very high carbon emissions. The production of cement, a key ingredient in concrete, is alone responsible for 8% of all global CO_2 emissions. If the cement industry were a country, it would be the world's third-largest emitter.

13. Switching construction materials, i.e. from concrete and steel to less energy and carbon intensive materials is not the first step to decrease carbon emissions of the built environment in cities. The need for new construction in cities could be significantly reduced if existing and unused or underutilized building stock could be used more efficiently or brought back to use. Some cities developed dedicated tools to:

- Document vacant and underused spaces (e.g. Milan)
- Introduce or increase taxes on unoccupied or unused properties (e.g. Paris or Vancouver).
- Relax regulations for "adaptive reuse" projects that repurpose buildings for new uses (e.g. Los Angeles).

14. The Ellen MacArthur Foundation estimates that eliminating waste, sharing buildings more, as well as reusing and recycling construction materials, can reduce the emissions from construction materials by 38% by 2050. The C40 Knowledge Hub summarized the priorities in their construction hierarchy (see graph 1 in the Annex).

15. When new materials are required, the rule of minimizing the embedded emissions of construction material needs to be applied equally to any type of future construction, whether it is a new construction or renovation, refurbishment, repurposing or extension of existing building stock.

16. There is a vast choice of materials available for renovation, refurbishment, or repurposing existing stock with high variations in embedded emissions. Wood consistently features among the low or carbon negative materials. Repair and remodeling are already today a major market for the forest-based industries. The 2023 ECE/FAO Data Brief on sawn softwood found that about one third of the sawn softwood production in the United States is being used for repair and remodelling mainly of single and multifamily homes.

17. When it comes to materials that can be used as structural elements with defined load-bearing capacities (walls, beams, columns, arches, etc.) the choice of materials and products is rather constrained. The Centre for Industrialised Architecture at the Royal Danish Academy for Architecture, Design, Conservation compared the Global Warming Potential[2] of functional units (e.g. 3m load-bearing columns) and found that wood is the only building

[1] Embedded emissions of goods that are being consumed (also referred to as "embodied emissions", "embodied carbon emissions", or "embodied carbon"). The UNFCCC measures emissions according to production, rather than consumption. Consequently, embedded emissions on imported goods are attributed to the exporting, rather than the importing, country. The question of whether to measure emissions on production instead of consumption is partly an issue of equity, i.e., who is responsible for emissions (Wikipedia, 2023)

[2] Global warming Potential (GWP): Global warming is caused by greenhouse gases, including the chemical substance CO_2. GWP is calculated in CO_2 equivalents (CO_2eq), which means that CO2 is used as a reference substance and indicator unit. The use of "equivalents" is common to all environmental impacts, in that there are many different substances that can cause the same damage to the environment, ecosystems, or health, but in different orders of magnitude. For example, 1 kg of methane causes the same potential damage as approximately 25 kg of CO_2 when emitted into the atmosphere. GWP is also what is referred to as the "carbon footprint" in connection with products. (https://www.materialepyramiden.dk/#)

material for structural application that has a negative carbon footprint (i.e. stores more carbon than is emitted during the processing and lifetime) from material extraction up to production ("cradle-to-gate") (www.materialepyramiden.dk) (see graph 2 in the Annex).

18. The embodied emissions of wood as structural building element are impressive and wooden buildings can be carbon negative. However, this should not lead to a maximization of carbon stored in a single building since the availability of sustainably produced wood products is not unlimited. Cities need to maximize the substitution of construction materials with high embodied emissions and not the carbon storage per building.

19. Wooden buildings or buildings with wooden elements must also follow the principle of maximizing their lifetime by re-use, repurpose and recycling. These measures will further delay the release of stored carbon and contribute to maximizing duration of carbon storage in future cities.

B. Sufficiency of buildings

20. The International Energy Agency estimates that operations of buildings account for 30% of global final energy consumption and 26% of global energy-related emissions (8% being direct emissions in buildings and 18% indirect emissions from the production of electricity and heat used in buildings).

21. The Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) differentiates between energy sufficiency and energy efficiency: sufficiency is about long-term actions driven by non-technological solutions, which consume less energy in absolute terms; efficiency, in contrast is about continuous short-term marginal technological improvements. Sufficiency policies are a set of measures and daily practices that reduce demand for energy, materials, land and water while delivering human well-being-for-all within planetary boundaries. Sufficiency measures tackle the causes of GHG emissions by limiting the demand for energy and materials over the lifecycle of buildings and appliances.

22. A big part of the ECE's building stock of 2050 already exists today. Improving the sufficiency of this existing stock is therefore essential in further reducing the cities carbon footprint that arises from heating and cooling these buildings. This will often require a significant improvement of insulation (e.g. walls, ceilings, roofs, windows, balconies, doors, etc.). The source of heating or cooling or the energy efficiency of heating or cooling devices is beyond the scope of this policy brief.

23. Good insulation materials minimize the loss of energy from a building. This capacity is expressed by the "u-value[3]" of materials. Untreated wood is a natural champion among structural materials in terms of insulation capacity and people in boreal regions traditionally have built log-wood homes owing to the abundance of this raw material and the natural insulation characteristics. Structural elements of modern wooden construction maintain the low energy conductivity of the raw material.

24. In contrast, concrete, steel, glass and aluminium have extremely poor insulation capacities. That is why these buildings often require thick additional layers of insulation – most of these insulation materials are currently being derived from fossil-based products or products with significant embodied emissions. Modern wood construction with similar insulation efficiencies can have thinner walls and thus provide up to 10% more interior space with the same exterior dimensions than other construction materials.

25. Research and development efforts in the past decades led to biobased products with low or negative embodied emissions that fulfil all the functional properties required for insulation materials. Wood-based insulation elements are among those and comply with durability and fire resistance requirements and when compared to their fossil-based

[3] The U-factor or U-value is the overall heat transfer coefficient and can be found by taking the inverse of the R-value. It is a property that describes how well building elements conduct heat per unit area across a temperature gradient. The elements are commonly assemblies of many layers of materials, such as those that make up the building envelope. It is expressed in watts per square metre kelvin: W/(m2·K) (Wikipedia, 2024)

competitors, have much lower or negative embodied emissions and can store more carbon than is emitted during their production. (see graph 3 in the Annex).

26. Increased requirements for the accounting of embodied emissions of insulation materials will certainly contribute to further reducing the carbon footprint of cities and will likely boost the demand in organic based insulation materials, including wood.

C. End of life

27. Construction and demolition waste is one of the leading waste streams in the UNECE region, representing about one third of all municipal waste. The composition of the waste stream varies greatly depending on the prevailing construction materials used and the recovery rate of these materials.

28. Landfilling of non-organic construction and demolition waste is still widespread while landfilling of organic components is mostly forbidden or strictly regulated. Wood, like any organic material, is biodegradable and will decompose if not recycled or burnt at the end of its lifecycle. Landfilling wood bears the risk that micro-organisms, in the absence of oxygen create methane.

29. The IPCC has indicated a global warming potential (GWP) for methane between 84-87 when considering its impact over a 20-year time frame (GWP20) and between 28-36 when considering its impact over a 100-year time frame (GWP100). This means that one tonne of methane can considered to be equivalent to 28 to 36 tonnes of CO_2 if looking at its impact over 100 years.

30. The strength of wood as an organic, renewable construction material can easily turn into its biggest weakness in terms of carbon balance if landfilled and any methane emissions must be prevented. Biobased construction material, such as wood, should be reused, recycled as long as possible and incineration only be considered as the last possible step.

IV. Indirect carbon effects

31. Modern wood construction has further advantages over competing materials with high embodied emissions that further improve the competitiveness of the material.

A. Lightweight material (vertical extension)

32. Wood is a lightweight construction material with a much higher weight to load bearing capacity than steel or steel reinforced concrete. Modern wood construction can be used for multi-floor construction of impressive high-rise buildings. These taller, bigger, larger building attract the media’s attention and help to raise public awareness of the technical capacities of wood.

33. The three biggest advantages related to the low weight to load bearing ration of modern wood construction are:

- Reduced dimension of the foundations: The foundation of buildings directly correlates to the weight of the building. A reduced weight of the superstructure will therefore reduce the size of its foundation – which, in most cases, is produced in concrete and steel – and thus further reduces the embodied emissions of the building.
- Reduced urban sprawl: Cities may have areas which cannot be used for constructions owing to limited load-bearing capability of the ground (construction exclusion zones), e.g. because of underground cavities, underground infrastructures, or other reasons. Modern lightweight wood construction allows urban planners to use formerly excluded spaces within the cities’ boundaries in their development plans. London’s 10 storey Dalton Lane building, made of in cross-laminated timber and built above underground road and rail tunnels, is only one example.

- Vertical extension of existing stock: Modern wood construction is perfectly suited for vertical extension of existing buildings and is already widely used for that today. Vertical extension and reduced urban sprawl contribute to a more efficient use of existing infrastructures such as transportation, amenities, etc.

B. Seismic resilience

34. The best earthquake-resistant construction materials have an important quality in common: high ductility. Ductility refers to the material's ability to move and change shape without breaking or losing strength. Traditionally, steel and wood are the best and most common earthquake-resistant materials..

35. The weight to strength ratio of modern wood construction and its capacity to flex make wood the material of choice for earthquake proof buildings. Recent shake table tests by woodworks indicate that wooden buildings remained damage free even after receiving seismic shocks from two simulated seismic events with 6.7 and 7.7 magnitude on the Richter scale (like the 1994 Northridge earthquake and the 1999 Chi Chi earthquake). It is for this reason that L'Aquila in Italy used wood for rebuilding the communal buildings of the city after the devastating earthquake in 2009 (6.3 magnitude on the Richter scale). The Turkish State Forest Service used wood structures to rebuild 97 thousand square metres of their administrative buildings in the region that was struck by the 2023 Turkey-Syria earthquakes which had 7.8 and 7.6 magnitudes.

C. High precision

36. Modern wood construction is often highly mechanized and extremely precise. Wood processing and wood construction industries are constantly increasing the vertical range of manufacture of building components. The precision of the production processes combined with the light weight of the material allow for pre-production of all the modules of a construction project. Pre-production is becoming more and more the standard.

37. Off-site pre-production under standard industrial conditions radically improves the working condition of construction staff since these workplaces are indoor under controlled climate, highly mechanized and with regular working hours. Most of the skilled workers no longer need to commute to various construction sites but will have one production site. Considering the ageing workforce in many ECE member States, it is likely that better working conditions will enable these industries to successfully attract skilled workers.

38. Modular, off-site prefabrication accelerates the process since many steps of the construction process can be implemented in parallel. Woodworks states that, depending on the project, taking a modular approach can reduce the duration of construction by 30% to 50% compared to on-site methods.

39. Only a small number of workers are needed to assemble the prefabricated modules. McKinsey estimated in 2019 that "typically, one team of five workers can assemble up to six 3D modules, or 270 square meters of finished floor area, per day. This is significantly faster, and therefore cheaper, than traditional construction".

D. Reduced risk

40. Construction projects using wood instead of concrete, bricks or steel have often been more expensive than more established construction types. With economies of scale and a wider use of wood as construction material, costs already started to decrease.

41. Looking beyond the simple metrics of construction cost is therefore important; wood construction projects as an investment will radically change the result of their economic viability. Modern wood constructions with a certain degree of prefabrication can be delivered much quicker to the market, as the high share of prefabricated parts allow for the simultaneous production of various parts of the building. The precision also allows for accelerated inspection

and approval. The time difference can be more than half a year compared to conventional buildings, shortening the lag between investment and lease or sale.

V. Low carbon construction and forests

42. Boosting the use of wood for construction today and in the future will certainly have an impact on supply and demand for wood and ultimately increase prices for raw material and thus influence the balances of wood production and trade of wood and wood products from and to the ECE region.

A. Forest in the ECE – wood supplier and carbon sink

43. More than 40% of the world's forests (by area) are in the ECE region. These forests produce 60% of the global wood for material uses (industrial roundwood) and three out of four hectares certified for sustainable forest management are in the ECE region. The forests in the region have been managed sustainably for decades and the ECE region is the only region in the world with a continuous increase of forest coverage. At the same time, the ECE region was an important producer of wood and wood products globally, forests in the ECE region increased their growing stock from 187.2 billion m^3 in 1990 to 205.5 million m^3 in 2020. The most recent ECE/FAO Forest Sector Outlook Study, 2020-2040 (https://unece.org/info/Forests/pub/362308) found that the growing stock will likely continue the trend until 2040 and beyond.

44. Forests in the ECE region are owned by 16 million forest owners and are a significant source of income. Forests in the ECE region can provide additional amounts of sustainably grown wood to a limited extent (outlook study) without decreasing in area or carbon/wood stock.

45. The effect of annual storage per hectare (tonnes of CO2 eq/yr.) in forests in the ECE region without harvesting will decrease in the long term as older trees decrease their growth rate and even emit CO_2 in the decay phase. Storing wood carbon in long-lived harvested wood products maximizes the overall carbon sink function of wood in the ECE region (outlook study).

B. Increased wood construction's impact on forests in the ECE region

46. The availability of the raw material wood is in the short, medium and long term one of the key questions for policy makers, city planners, architects, structural engineers and others using wood for construction.

47. The ECE/FAO Forest Sector Outlook Study, 2020-2040 found that forest in the ECE region will further increase the carbon stock in any scenario by 2040. There is a very high probability that even under the most dynamic scenarios for wood construction (Europe or China), forests in the ECE region will stock more carbon in 2040 than today. ECE's member States have tools at hand to monitor sustainable management regularly and report their trends to the Forest Europe or the Montreal processes every five years. This information is made available to the public in the INForest website (https://forest-data.unece.org/Indicators/1).

48. Forests in the ECE region have physical limits of how much wood can be removed on a sustainable level each year. Those limits are strictly regulated and assessed on a regular basis by ECE member States.

49. The ECE region is an important exporter of wood and wood products globally. A strong increase in demand in wood for construction in ECE member States will very likely change global trade pattern and redirect exports to domestic consumption.

50. Non-structural elements in wood construction, such as insulation boards, fibre boards and particle boards, could also use wood and other cellulose rich resources deriving from space-efficient land management other than forests, such as agroforestry, roadside greenings, infrastructure maintenance, recovered waste streams or wood co-product.

51. Considering the non-destructive re-use of wood construction elements in new constructions today will help to decrease demand for fresh fibres from forest in the future. Ideally the cities become storehouses of carbon and wood construction elements so that future demand for wood construction modules can be satisfied by both forests and the obsolete buildings in cities.

V. Enabling conditions

52. All the above outlined features and advantages of wood as low embodied emissions material already exist today. However, there are many hurdles that hinder wood construction to fully unlock its potential.

53. Policy makers, decision takers, planners, public and others involved in making low embodied emissions a reality are required to contribute in various ways. The non-exhaustive list below outlines some of the main tasks.

A. Legislate a framework

54. *Identifying key barriers:* The legislative framework plays a key role in enabling the use of construction materials with low embodied emissions. Identifying and mapping these barriers is the first step in enabling low carbon construction at a wide scale and would ideally use a holistic approach involving consultation with the entire sector and value chain.

55. *At any scale:* Legislative framework conditions related to construction and building requirements are often not created and changed at national level, but rather at local or sub-national. Peer learning from experiences in successfully implemented legislative reforms can reduce the efforts, reduce costs and harmonize legislative requirements for new materials.

56. *Fire regulations:* In many cases, wood is explicitly excluded from mid-rise construction because of outdated fire safety concerns which define maximum building height if built with wood. When fire safety requirements permit the use of wood, these may be too strict and lead to increased embodied emissions (e.g. requiring concrete staircases and elevator shafts) or which may drive up the cost (e.g. in case of mandatory sprinkler systems). These may significantly decrease the competitiveness of wood as construction material.

57. *Performance driven:* Policies on carbon and energy emissions should be inclusive for all materials and allow for the best mix of materials. This could be achieved by revising and centring regulations around embodied emissions, sufficiency and circularity of any stage of the life of buildings. Building codes will need to be more performance driven, science based, not exclude any low carbon material and allow for the most efficient mix of materials and construction methods. Legislation can define the key parameters and conditions for life cycle assessments and environmental performance features that need to be met by the building. Ideally these requirements would be phased in, with increasingly strict requirements to allow for long-term planning security of the sector.

58. *Offsetting of emissions:* Low carbon construction evolved significantly over the past two decades and new materials and technologies are available to allow for any type of building. The offsetting of embodied emissions or emissions from maintaining the building should be minimized or avoided.

59. *End of life:* It is crucial for the performance of organic construction materials in their life cycle that the legislative framework prevents any possible methane emissions at the end of its service. The legal framework needs to ensure that any methane that could arise from anaerobic decomposition are fully captured or completely avoided.

B. Lead by example

60. Public procurement policies can be a powerful tool in boosting demand for new materials and construction techniques. Such policies can prescribe the carbon performance of public buildings at any stage of the lifecycle, especially for embodied emissions of

materials used, the sufficiency of new or renovated buildings as well as the circularity of the interventions. These public buildings are often open to or visited by the public (e.g. kindergartens, schools, hospitals, churches) and lead to a lighthouse effect, increasing the outreach and acceptance of these new forms and materials.

C. Communicate

61. Communicating the need to decarbonize the built environment to the public is key in creating acceptance among the broad population. Communicating the performance of new building materials and techniques is key to change the public's attitude towards organic construction materials (they rot, they burn, they are not durable, etc.). The establishment and widespread use of these buildings, materials and methods must be demand driven.

D. Educate, innovate, standardize

62. Low carbon construction will require new competencies, know-how and capacities and even new job profiles for specialists involved along the entire value chain. These capacities are needed for the successful planning, developing, implementing and finalizing any low carbon construction.

63. Universities, schools and other institutions involved in the education of construction experts such as architects, fire safety experts, structural engineers, urban planners, workers, etc. need to adjust their curricular to include materials with low embodied emissions and their varying technical features. It will be particularly important to offer access to this knowledge and training to practitioners and fully trained experts as training on the job. Support will be needed to allow for a quick transition of the entire sector.

64. Universities and research in close collaboration with practitioners should be given the responsibility to help the sector to:

- innovate (e.g. clever mix of materials, new or more efficient processes)
- improve the circularity aspects of low carbon construction (e.g. improved modularity, improved non-destructive re-use, better use of residues, use of alternative resources, etc.)
- help the sector in standardizing single modules to allow for interchangeable use of various modules and materials in the buildings.

E. Finance

65. Home ownership rates and the number of households with a mortgage show large differences across countries of the Organisation for Economic Cooperation and Development (OECD). For most households, purchasing a home is their biggest lifetime investment. In most cases, this purchase comes with their largest financial liability as well, since many households rely on mortgage loans to finance their home. The structure and functioning of mortgage markets can therefore have important consequences for people's access to housing and their financial situation.

66. The finance sector will only be willing to provide loans or mortgages for projects whose possible risks and probabilities are well understood. This information is based on successes and failures from past experiences. The finance sector does not have the information required for assessing possible risks and probabilities of new constructions with new materials, such as wood construction. The risk aversion of the financial sector and the lack of reliable data on the economic viability and risks of building with low carbon materials often results in less competitive mortgage rates for less well understood materials and methods. This, however, is not compatible with the need for disruptive change in decarbonizing the construction sector.

67. Decision makers could therefore envisage developing a trust fund for the economic risks arising from innovative low carbon construction projects.

68. Some banks have already aligned mortgage rates with environmental goals such as the reductions in greenhouse gas emissions from the housing stock. Policies can create a favourable environment by

- Establishing international standards for energy-efficient, or “green”, mortgages;
- Creating mechanisms to ensure the quality of the energy certification of dwellings;
- Setting supervisory standards for green mortgages to properly reflect their risk (which is typically reduced compared with standard mortgages).

F. Measure

69. Data and information in the ECE region on low carbon construction in general and wood construction is scattered and not readily available. Such information would be key for a better understanding of the current situation and future potentials. Better data on low carbon construction are required to enable evidence-based policymaking and decision taking. It would allow for assessing the effectiveness of policy measures and enable policy makers to adjust the legislative framework. Such information would also allow peers to learn from experiences made and to quickly adjust their own policies.

70. Regular assessments of the quantity of low construction housing permits issued and starts recorded would also allow the forest sector to anticipate the current and future demand for raw material and adjust production accordingly. These data will also allow for developing trends and enable the forest sector to provide feedback about the anticipated availability of raw material.

VI. Key messages

71. The following key messages summarize the above outlined aspects that will enable cities to significantly reduce or eliminate the embodied emissions arising from the built environment:

- Minimize new construction where possible.
- Maximize substitution of construction materials with high embodied emissions.
- Take into full consideration embodied emissions of materials at any stage of a building’s lifecycle.
- Maximize global material efficiency.
- Maximize sufficiency of any building.
- Strive for destruction-free deconstruction at the end of life of buildings or building modules.
- Improve global standardization of (wooden) construction elements.
- Prevent any methane emission at the end of life of organic construction materials.
- Allow for clever mix of materials.
- Keep the supply of raw material as local as possible to maximize creation of local livelihoods and minimize embodied emissions from transportation.
- Innovate.
- Educate.
- Communicate.
- Measure.

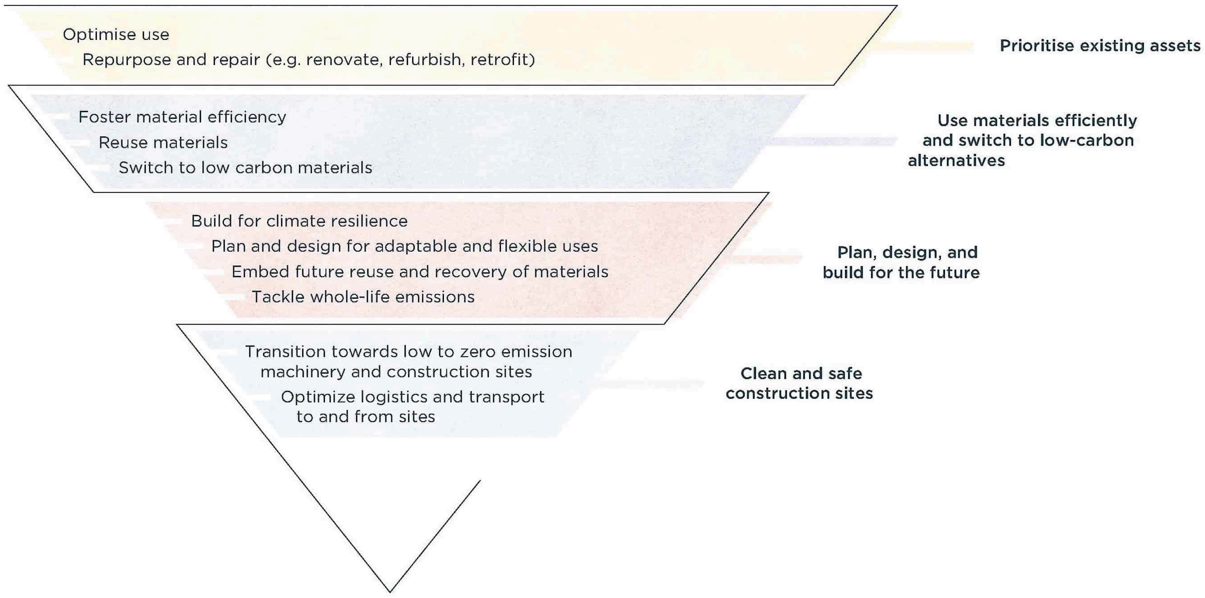
72. ECE member States have sufficient forest resources to fully embrace low carbon construction. By becoming early adapters and trailblazers, they will be able to use their experiences and role as global provider of wood products to boost wood construction in other regions and foster revenues ensure multifunctionality of forest management in the region.

VII. Way forward

73. Member States are invited to comment and provide guidance on the structure and content of the document and consider providing a mandate to the secretariat for publishing the final version as an official publication.

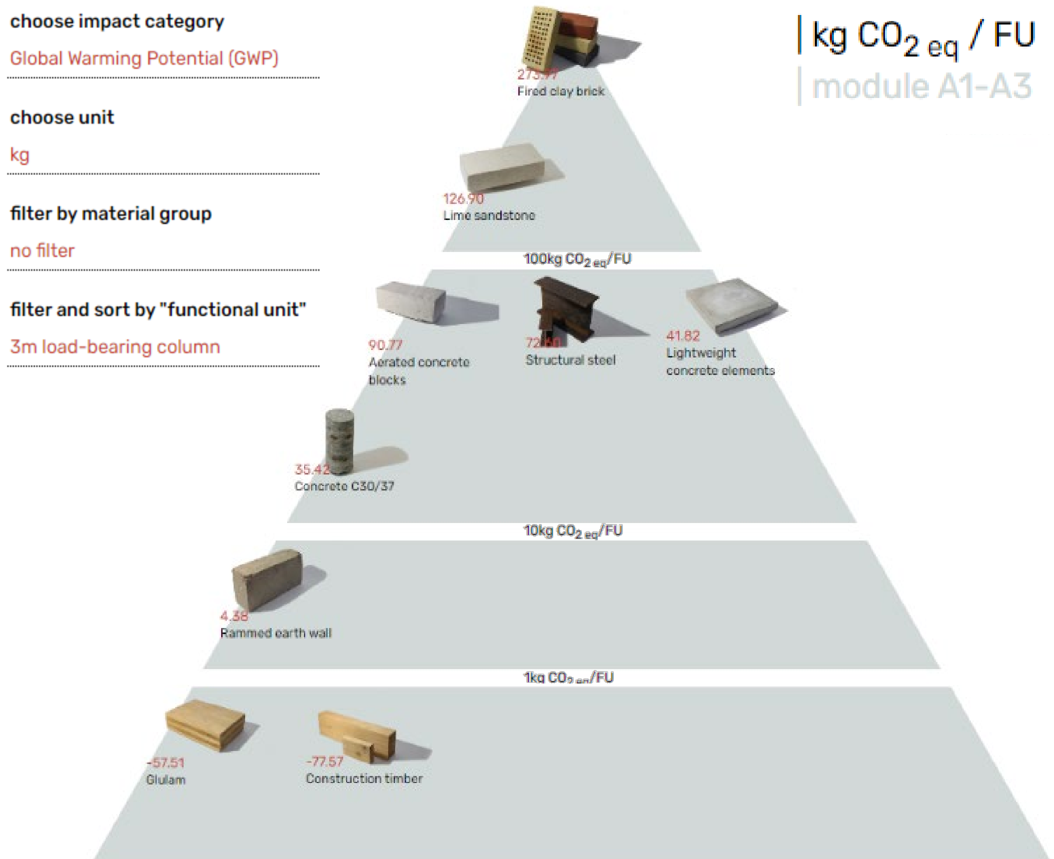
Annex

Graph 1:
Construction hierarchy



Source: https://www.c40knowledgehub.org

Graph 2:
Global warming potentials for comparable functional units of load bearing elements

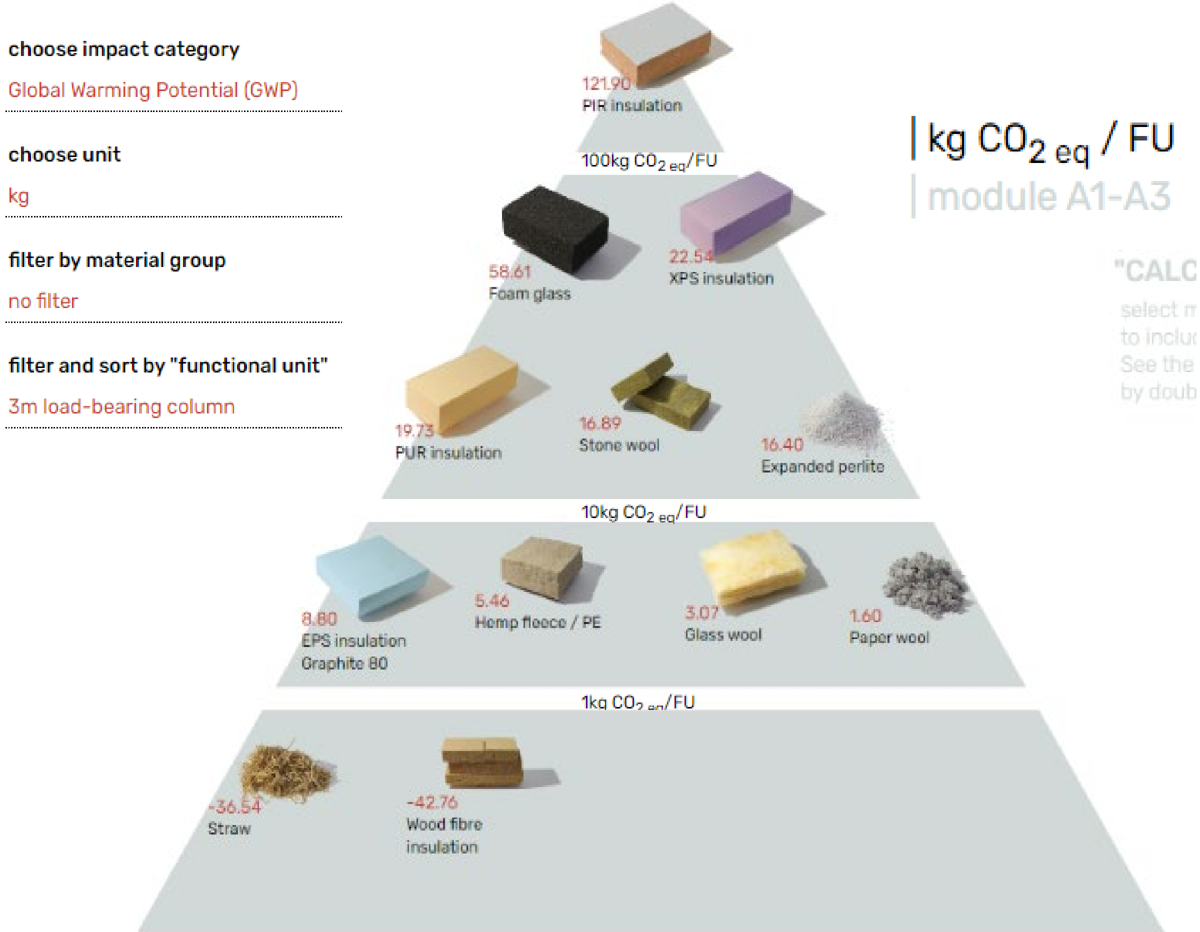


Note: FU: functional unit. 1FU=3m load bearing column. Global warming potentials kg CO2eq/FU. Global warming potentials kg CO2eq/functional unit

Source: CINARK – Centre for Industrialised Architecture, The Royal Danish Academy – Architecture, Design, Conservation, www.materialepyramiden.dk

Graph 3:

Global warming potentials for a comparable functional unit of insulation materials



Note: FU: functional unit. 1FU=1m2 insulation u-value 0,15. Global warming potentials kg CO2eq/FU.

Source: CINARK – Centre for Industrialised Architecture, The Royal Danish Academy – Architecture, Design, Conservation, www.materialepyramiden.dk.