

# Monte Verità Declaration on a built environment within planetary boundaries

Outcome of IEA EBC Annex 72

## 0 Preamble

Buildings substantially contribute to and influence the quality of life. At the same time, they are one key element to help achieving several of the Sustainable Development Goals launched by UN Environment, in particular #11 Sustainable Cities and Communities, #12 Sustainable Consumption and Production and #13 Climate Action. A comprehensive assessment of buildings addresses the environmental, the social and the economic performance. The environmental dimension covers life cycle based impacts such as climate change caused by greenhouse gas emissions along the life cycle of buildings, impacts on the local environment and potential health risks e.g. due to indoor air quality.

The declaration and its recommendations focus on the life cycle based environmental impacts and resource consumption, the core topic of the experts and their research institutes co-operating in IEA EBC Annex 72. While this declaration has a special focus on greenhouse gas emissions, further environmental impacts including resource consumption are also addressed to avoid burden shifting.

The experts co-operating in the IEA EBC Annex 72 “Assessing Life Cycle Related Environmental Impacts Caused by Buildings” acknowledge that

- mankind is responsible for the rapidly increasing global temperature which is causing severe human suffering and irreparable damages on fragile ecosystems.
- CO<sub>2</sub> emissions need to be urgently and drastically reduced and globally reach net zero well before 2050 to stay within the remaining global budget which increases the likeliness that the global temperature increase stays below 1.5°C.<sup>1</sup>
- the emissions of all other greenhouse gases (GHG) need to be reduced similarly.
- the planetary boundaries are exceeded with respect to pressure on biodiversity, nitrogen and phosphorous flows.
- freshwater is overused in several regions of the world.
- the concentration of aerosols (air quality) is far too high in many metropolitan areas and agglomerations of the world.
- Buildings put pressure on local and global natural resources
- buildings are causing about 40 % of global CO<sub>2</sub> emissions, either directly, or indirectly via the energy and the construction materials sectors.
- buildings, building related infrastructures and their supply chains are one driver for land use and land use change and landscape fragmentation and subsequent biodiversity losses.
- airborne pollutants emitted by the construction material industries are contributing substantially to the impairment of outdoor air quality.

<sup>1</sup> The emissions of other greenhouse gases need to be reduced to similarly low levels. That is why this Declaration addresses greenhouse gas emissions instead of CO<sub>2</sub> only.

Actions to reduce the carbon, environmental and resource footprints of the built environment are due in several domains and by different actors, namely:

1. Government and administration;
2. Investors, banks and financial institutions;
3. Research organisations (universities, research institutes);
4. Designers, Architects and Engineers;
5. Operators of EPD programs, sector specific LCA databases, certification schemes and labels;
6. Construction material and building technology manufacturers;
7. Construction companies;
8. Real estate agents;
9. Users and tenants.

The IEA EBC Annex 72 experts working in the field of environmental life cycle assessment of buildings<sup>2</sup> and further domain experts who signed this declaration agreed on the following recommendations.

## **1 Government and administration**

- 1.1 Introduce legally binding maximum target values for GHG-emissions of new constructions and of refurbishments by 2025 latest with a roadmap to net zero by 2035.
- 1.2 Consider introducing a legally binding minimum benchmark for biogenic carbon stored in buildings (biogenic carbon content) taking local availability, building tradition and suitability into consideration. Define the benchmark in a way that it helps to maintain, preferably increase the amount of biogenic carbon stored in buildings and in the built environment in general.
- 1.3 Facilitate the development, introduction and operation of a national and regional life cycle assessment database for the construction sector, covering construction materials, building technology, energy supply, transport and waste management services.
- 1.4 Specify the contents of international and national standards to ensure consistency among the life cycle assessments of construction materials, building technologies and buildings in your country.
- 1.5 Facilitate the development of bill of materials, material passports, digital logbooks, digital twins and digital permits to document the material and environmental characteristics and to enable the future use of material resources embodied in buildings.
- 1.6 Consider launching research programs on sustainable construction and on construction materials and building technology (e.g. HVAC) with low environmental, resource and GHG footprints.

---

<sup>2</sup> Visit <https://annex72.iea-ebc.org/> for further information about the experts involved and for guidelines and recommendations (expected to be published in late 2022).

- 1.7 Launch a research program on negative emission technologies, either in a joint effort involving several countries or co-ordinated with other countries' research activities.
- 1.8 Enhance the education in environmental sustainability and feasible solutions to address environmental challenges in the general population.

## **2 Investors, banks and financial institutions**

- 2.1 Consider sufficiency ("build less") and to refurbish existing buildings and urban areas as a relevant alternative to new construction following deconstruction.
- 2.2 Reconsider the construction and real estate sectors including upgrade and adaptation strategies as an economically attractive sector for financial investments.
- 2.3 Demand the quantification of GHG emissions, environmental impacts and resource consumption as a basis for risk assessment and economic valuation which is a precondition to invest in building projects.
- 2.4 Invest in building projects with low GHG emissions, environmental impacts and resource consumption and promote and support measures to reduce GHG emissions, environmental impacts and resource consumption of building projects.
- 2.5 Demand the integration of an assessment of GHG emissions, environmental impacts and resource consumption in the building design stages as relevant decision criteria and demand their improvements and reduction, respectively.
- 2.6 Keep yourself informed about existing and new targets, regulations and target values for buildings with regard to GHG emissions, environmental impacts and resource consumption, including the EU taxonomy for sustainable activities.

## **3 Research organisations (universities, research institutes)**

- 3.1 Establish a knowledge/information centre on sustainable construction.
- 3.2 Foster research on the assessment and reduction of life cycle based environmental impacts of buildings and of construction materials manufacture, on budget based environmental benchmarks for buildings and on negative emission technologies by establishing chairs on sustainable construction, sustainable manufacturing and climate mitigation.
- 3.3 Offer mandatory/obligatory courses on environmental life cycle assessment and its application in the construction sector and its suppliers within the curricula of designers and architects and of civil and process engineers, business administration and facility management. The courses should also address the awareness and the environmental concern of employees in the building and construction sector.
- 3.4 Train engineers and architect to design with low carbon building materials and to design buildings with low GHG emissions, environmental impacts and resource consumption.
- 3.5 Offer courses on negative emission technologies in process engineering and forest management.
- 3.6 Embed courses on environmental sustainability in all curricula of the university.

## **4 Designers, Architects and Engineers**

- 4.1 Discuss the overall design targets and actively address the sufficiency question: Challenge the clients brief in view of size and level of comfort of the building project and support the client in target setting.
- 4.2 Identify options to reduce the environmental impacts of the building project by changing the design, the static and/or materialisation of the building.
- 4.3 Consider the refurbishment of an existing building as a relevant alternative of demolition following new construction.
- 4.4 Assess the different design options with environmental life cycle assessment (LCA) and discuss the results with the client.
- 4.5 Identify and realise solutions to increase the adaptability and the longevity of the building.
- 4.6 Apply circularity principles using locally sourced materials, recycled materials and materials with low environmental impacts, and design building elements for easy disassembly and easy reuse. Use LCA to ensure lower life cycle based environmental impacts of such solutions.
- 4.7 Strive for lowering operational energy demand and cover the remaining demand with energy from renewable sources.
- 4.8 Introduce GHG emissions, environmental impacts and resource consumption of construction materials, building technology and energy supply during use as an important decision criterion when selecting (construction material and building technology) suppliers and energy systems.
- 4.9 Use advanced and reliable tools to quantify the GHG emissions, environmental impacts and resource consumption of the building project from early design stage to hand over and ensure continuity along the design process.
- 4.10 In the early design stage, consider to apply safety factors on the environmental impacts of building elements to cope with the uncertainties and to avoid unwelcome surprises later-on.
- 4.11 Structure the LCA model of the building and its life cycle according to well accepted schemes.
- 4.12 Consider to systematically document the characteristics and materialisation of your buildings and to use digital options such as bill of materials, material passports, digital logbooks/building passports, and digital permits to document the material and environmental characteristics and facilitate the future use of material resources of buildings.
- 4.13 Periodically attend further education courses on sustainable construction.

## **5 Operators of EPD programs, sector specific LCA database, certification schemes and labels**

- 5.1 Follow international standards on environmental life cycle assessment to the extent possible.
- 5.2 Close the room for manoeuvre offered by international and national standards to ensure consistency among the life cycle assessments of construction materials and building technologies in your country.
- 5.3 Ensure to include product, use and end of life stages and consider to also include transport to construction site and construction.

- 5.4 Assign and require one single life cycle inventory database to be used to establish the LCA of all products and systems embedded in a construction work and of buildings. Allow to use life cycle inventory data from other databases in exceptional cases.
- 5.5 Be cautious in dealing with environmental credits attributed to the building, in particular if borrowed from future generations and other third parties. Check for and eliminate any possible double counting of these environmental credits.
- 5.6 Apply the core list of environmental and resource indicators requested by international standards and complement those by indicators that are used or required in your national context to quantify the life cycle based environmental impacts and resource consumption of buildings.
- 5.7 Consider method, data, tools and environmental benchmarks and targets as interdependent elements needed for a consistent, reliable and relevant assessment and evaluation of environmental impacts and resource consumption of buildings.
- 5.8 Consider keeping benchmarks and target values for environmental impacts of the building and for potential benefits beyond the building's perimeter separate.
- 5.9 Introduce a binding and demanding target value for life cycle based GHG emissions of buildings (carbon footprint) including a road map to net zero by 2035. Introduce a second, other than GHG-related footprint target value for life cycle based environmental impacts and resource consumption of buildings to avoid burden shifting.
- 5.10 Prefer absolute target values to relative ones (defined against a virtual reference building)
- 5.11 Consider introducing a minimum benchmark for biogenic carbon stored in buildings (biogenic carbon content) taking local availability, building tradition and suitability into consideration. It may help to maintain or even increase the amount of biogenic carbon stored in the built environment.

## **6 Construction material and building technology manufacturers**

- 6.1 Establish a roadmap to net zero GHG-emissions of construction material and building technology manufacture and their end of life treatment to be reached by 2035.
- 6.2 Establish and publish environmental life cycle assessments of your products and your organisation. Use Environmental Product Declarations (EPD) or other suitable and established ways to document and supply the information and data.
- 6.3 Optimise your manufacturing process incl. your supply chains by introducing take back systems, increase the share of recycled raw materials, increase the material and energy efficiency, and generally foster circularity, and further reduce the environmental, resource and GHG footprints of your organisation and your products.
- 6.4 Purchase electricity products based on renewable energy, for which production and quality (guarantee of origin, GO or renewable energy certificate, RECS) of the electricity stem from the same power plants or ask the electricity provider for such an electricity product.
- 6.5 Invest in negative emission technologies rather than purchasing CO<sub>2</sub> emission certificates to neutralise remaining fossil CO<sub>2</sub> emissions.

- 6.6 Engage with suppliers and ask them to reduce their GHG emissions to net zero or change to suppliers with lower GHG emissions and more ambitious reduction targets. Give preference to suppliers, which additionally cause low environmental impacts and low resource consumption.
- 6.7 Adhere to international standards, use an acknowledged and transparent LCA database when performing the LCA and report according to a “true and fair view”.

## **7 Construction companies**

- 7.1 Reduce GHG emissions, environmental impacts and resource consumption caused by construction processes for construction and deconstruction.
- 7.2 Choose or recommend suppliers of construction materials with low GHG emissions, low environmental impacts and low resource consumption.
- 7.3 Rely on supply transport logistics with low GHG emissions, low environmental impacts and low resource consumption.
- 7.4 Reduce the amount of waste, and sort and recycle material wasted during construction and deconstruction.

## **8 Real estate agents**

- 8.1 Encourage the owners of buildings for sale to inform about the buildings’ life cycle based GHG emissions, environmental impacts and resource consumption.
- 8.2 Encourage potential buyers and tenants to ask for life cycle based GHG emissions, environmental impacts and resource consumption caused by the buildings under examination.
- 8.3 Report on life cycle based GHG emissions, environmental impacts and resource consumption caused by the buildings you are offering.

## **9 Users and tenants**

- 9.1 Question your demand for a rental object in terms of size, level of comfort and equipment.
- 9.2 Use life cycle based GHG emissions, environmental impacts and resource consumption as key criteria when selecting your rental object.
- 9.3 Use energy and water economically and use the rental object and its equipment mindfully by e.g. following cleaning and maintenance instructions.
- 9.4 Choose energy carriers and products with low GHG emissions, low environmental impacts and low resource consumption.

### **Disclaimer:**

The contents of this document are established and supported by the signatories and do not necessarily reflect the views of EBC nor IEA.

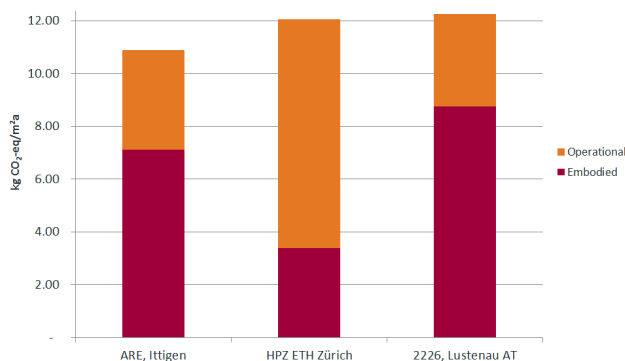


## Factsheet

# Assessing Life Cycle Related Environmental Impacts Caused by Buildings

## ANNEX 72

Investment decisions for buildings made today largely determine their environmental impacts over many future decades due to their long lifetimes. Furthermore, such decisions involve a trade-off between additional investments today and potential savings during use and at end of life - in terms of economic costs, primary energy demand, greenhouse gas emissions and other environmental impacts. Since the economic system does not fully account for external environmental effects, environmental resources are used inefficiently. Life cycle assessment (LCA) is suited to complement economic information on buildings with information on their environmental impacts. LCA helps to take measures and action to increase the resource efficiency of buildings and construction.



*Embodied and operational greenhouse gas emissions (kg CO<sub>2</sub>-eq per m<sup>2</sup> and year) of three office buildings in Switzerland and Austria (two new and one retrofit building); lifetime: 60 years  
Source: Tschümperlin et al. 2016*

### PROJECT OBJECTIVES

- 1 establish a common methodology guideline to assess the life cycle based primary energy demand, greenhouse gas emissions and environmental impacts caused by buildings
- 2 establish methods for the development of specific environmental benchmarks for different types of buildings
- 3 derive regionally differentiated guidelines and tools for building design and planning such as BIM for architects and planners
- 4 establish a number of case studies, focused to allow for answering some of the research issues and for deriving empirical benchmarks
- 5 develop national or regional databases with regionally differentiated life cycle assessment data tailored to the construction sector; share experiences with the setup and update of such databases

The project is advancing the research already conducted within EBC Annexes 56 and 57. It broadens the scope of Annex 57 by including operational impacts of buildings in use and by addressing environmental impacts in addition to primary energy demand and greenhouse gas emissions. It is the intention to cover residential, office and school buildings, hospitals and other public buildings, both new and retrofit.

The project is researching harmonization issues arising when applying LCA approaches on buildings. It functions

#### INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA) was established as an autonomous body within the Organisation for Economic Co-operation and Development (OECD) in 1974, with the purpose of strengthening co-operation in the vital area of energy policy. As one element of this programme, member countries take part in various energy research, development and demonstration activities. The Energy in Buildings and Communities Programme has co-ordinated various research projects associated with energy prediction, monitoring and energy efficiency measures in both new and existing buildings. The results have provided much valuable information about the state of the art of building analysis and have led to further IEA co-ordinated research.

#### EBC VISION

By 2030, near-zero primary energy use and carbon dioxide emissions solutions have been adopted in new buildings and communities, and a wide range of reliable technical solutions have been made available for the existing building stock.

#### EBC MISSION

To accelerate the transformation of the built environment towards more energy efficient and sustainable buildings and communities, by the development and dissemination of knowledge and technologies through international collaborative research and innovation.

as a platform to exchange experiences and knowledge within partner countries and to foster the application of LCA on buildings in countries with little experience yet.

The planned deliverables from this project are:

- harmonised guidelines on the environmental life cycle assessment of buildings,
- establishing environmental benchmarks for buildings (basics, methods, examples),
- national LCA databases used in the construction sector, including standardised characterisation of all relevant LCA databases,
- guidelines for planners on how to optimise the life cycle performance of buildings during the design process using planning tools such as BIM,
- building case studies using a standardised template,
- how to establish national or regional LCA databases targeted to the construction sector, and
- default publicly available, national data sets of LCA-based environmental indicators.

#### Project duration

Ongoing (2016 - 2022)

#### Operating Agent

Rolf Frischknecht  
treeze Ltd.  
Kanzleistrasse 4  
CH - 8610 Uster  
SWITZERLAND  
frischknecht@treeze.ch

#### Participating countries

Australia, Austria, Belgium, Brazil, Canada, Czech Republic, P.R. China, Denmark, Finland, France, Germany, Italy, R. Korea, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK, USA  
Observers: Hungary, India, Slovenia


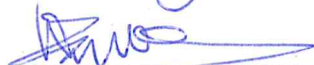
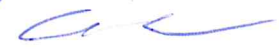
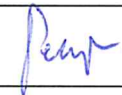
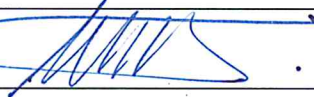

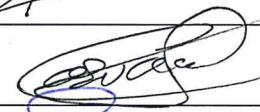

#### Further information



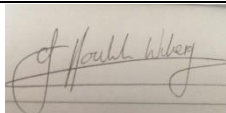


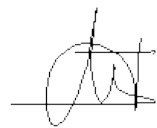
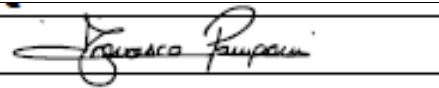

[www.iea-ebc.org](http://www.iea-ebc.org)

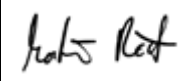

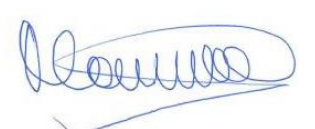
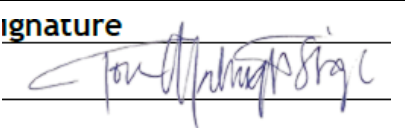

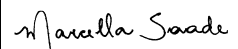




## 10 Signatures

Nr.	Title	Name, Surname	Affiliation	Signature
1	Dr.	Rolf Frischknecht	treeze Ltd.	R. Frischknecht
2	Dr.	Thomas Lützkehdorf	KIT (Germany)	T. Lützkehdorf
3	Dr.	ALEXANDER PASSEN	TU GRAZ	A. Passen
4	Dr.	Freja Rasmussen	Aalborg University	Freja Rasmussen
5	Dr.	Guillaume Habert	ETH Zurich	G. Habert
6		Livia Ransiere	treeze Ltd.	L. Ransiere
7	Dr.	Maria Belouktsi	<sup>(KIT)</sup> Karlsruhe Institute of Techn.	M. Belouktsi
8		Nicolas Francart	KTH (Stockholm)	N. Francart
9	Dr.	Ernst Hoxha	TU GRAZ	E. Hoxha
10	Dr.	Lasvaux Sébastien	HES-So	S. Lasvaux
11	Dr.	Rolf A Bohne	NTNU	R. A. Bohne
12		Roberta Di Bari	<del>Fraunhofer IBP</del> University of Stuttgart	R. Di Bari

Nr.	Title	Name, Surname	Affiliation	Signature
13	Dr	Ouellet-Plamondon, Claudiane	ETS Montreal	Claudiane Ouellet Plamondon
14	Dr	Damien TRIGAUX	KU LEUVEN / VITO	
15	DR.	NASTIJS, Lisa	Belgian Building Research Institute	
16		Veselka, Jakub	CTU in Prague	Jakub Veselka
17		PEŠTA, JAN	CTU in PRAGUE	Jan Pešta
18	Dr	ANTONÍN LUPÍŠEK	CTU IN PRAGUE	
19	Dr	BRUNO PEUPORTIER	MINES ParisTech	
20		Daniel SOTOTA	NTNU Norway	S. Sotota
21	Dr	ANTONIO GARCIA MARTINEZ	UNIVERSIDAD DE SEVILLA	
22		Nicolas ALAUX	TU GRAZ	
23	Dr	Lasvaux Sébastien	HES-So	
24		Kyriacos Blycaras	ow-uc	
25				

Nr.	Title	Name, Surname	Affiliation	Signature
25	Dr.	David Dowdell	Principal Scientist - Sustainability, Building Research Association of New Zealand (BRANZ)	
26	Dr.	Hollberg, Alexander	Chalmers University of Technology	
27	Prof.	Aoife Houlihan Wiberg	The Belfast School of Architecture and the Built Environment, UK	
28	Prof.	Mateus, Ricardo	University of Minho, Portugal	
29		Tajda Potrč Obrecht	Slovenian National Building and Civil Engineering Institute	
30	Dr.	Carmen, Llatas	University of Seville	
31	Prof.	Francesco Pomponi	Edinburgh Napier University	
32	Dr.	Sivakumar Palaniappan	Indian Institute of Technology Madras	

33	DI	Martin, Röck	KU Leuven, BE & TU Graz, AT	
34	Dr.	Sonia Longo	University of Palermo	
35	Prof.	Maurizio Cellura	University of Palermo	
36	Ass. Prof.	Tove Malmqvist Stigell	Royal Institute of Technology (KTH)	<u>Signature</u> 
37	Dr.	Lizhen Huang	NTNU	<u>Signature</u> 
38	Maestra Dr.	Marcella, Ruschi Mendes Saade	TU Graz	
39	Prof. Dr. Ms.	Wei Yang	School of Architecture, Tianjin University	
40	Prof.	Greg Foliente	The University of Melbourne and nBLue Pty Ltd, Australia	
41	Prof.	Harpa Birgisdottir	Aalborg University Copenhagen	