

IEA EBC Annex 72:

Assessing life cycle related environmental impacts caused by buildings

Overview of Annex 72 and Monte Verità Declaration

Rolf Frischknecht

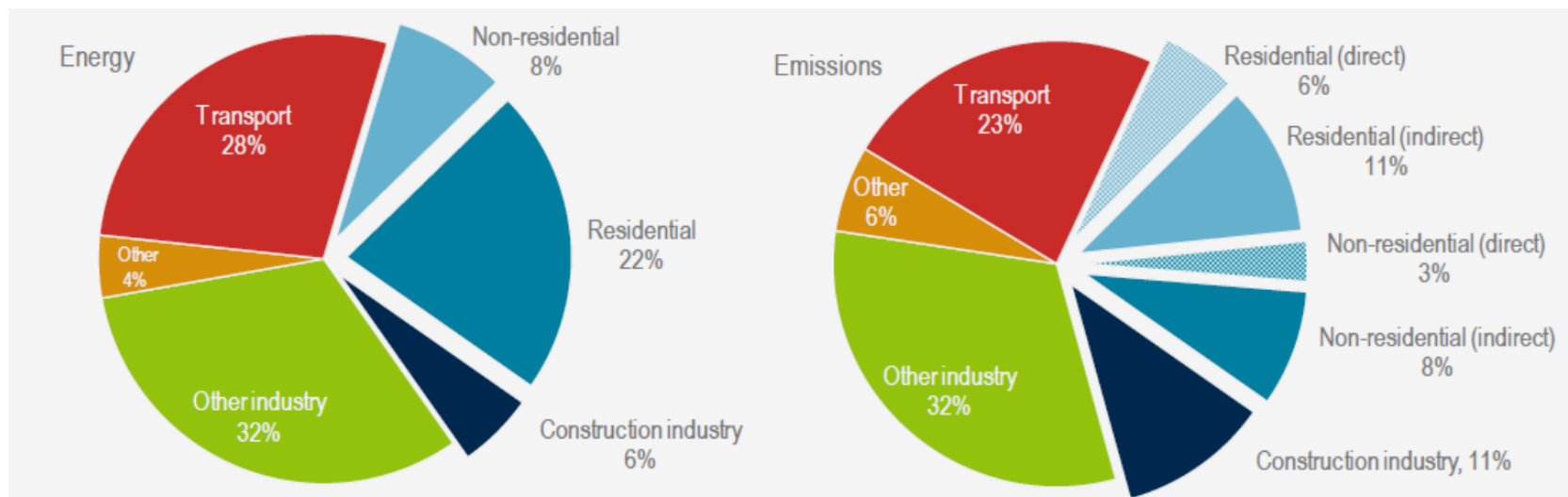
Operating agent, Switzerland

Final event:

SBE'22, Berlin, Germany, 21 September 2022

GHG-EMISSIONS IN THE WORLD – THE SHARE OF BUILDINGS

Buildings construction and operations accounted for **36% of global final energy use** and **39% of energy-related carbon dioxide (CO₂) emissions** in 2017



Note: *Construction industry* is an estimate of the portion of the overall industry sector that applies to the manufacture of materials for buildings construction, such as steel, cement and glass.

Sources: Derived from IEA (2018a), *World Energy Statistics and Balances 2018*, www.iea.org/statistics and IEA *Energy Technology Perspectives buildings model*, www.iea.org/buildings.

Global Alliance for Buildings and Construction

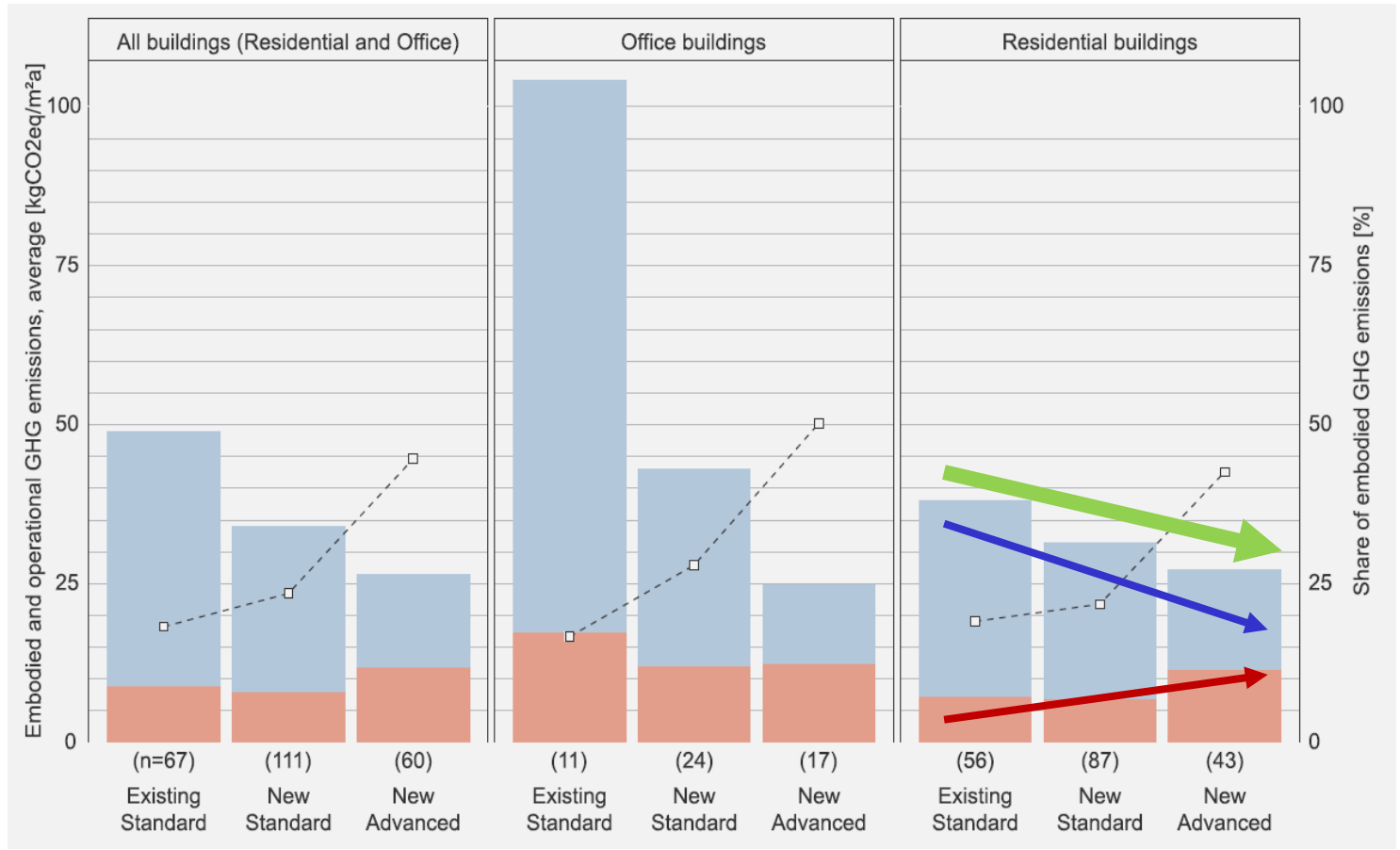
2018 Global Status Report

Towards a zero-emission, efficient and resilient buildings and construction sector

iea UN environment

<https://www.worldgbc.org/sites/default/files/2018%20Global%20Status%20Report.pdf>

ASSESSING OPERATIONAL AND EMBODIED EMISSIONS – CURRENT TRENDS



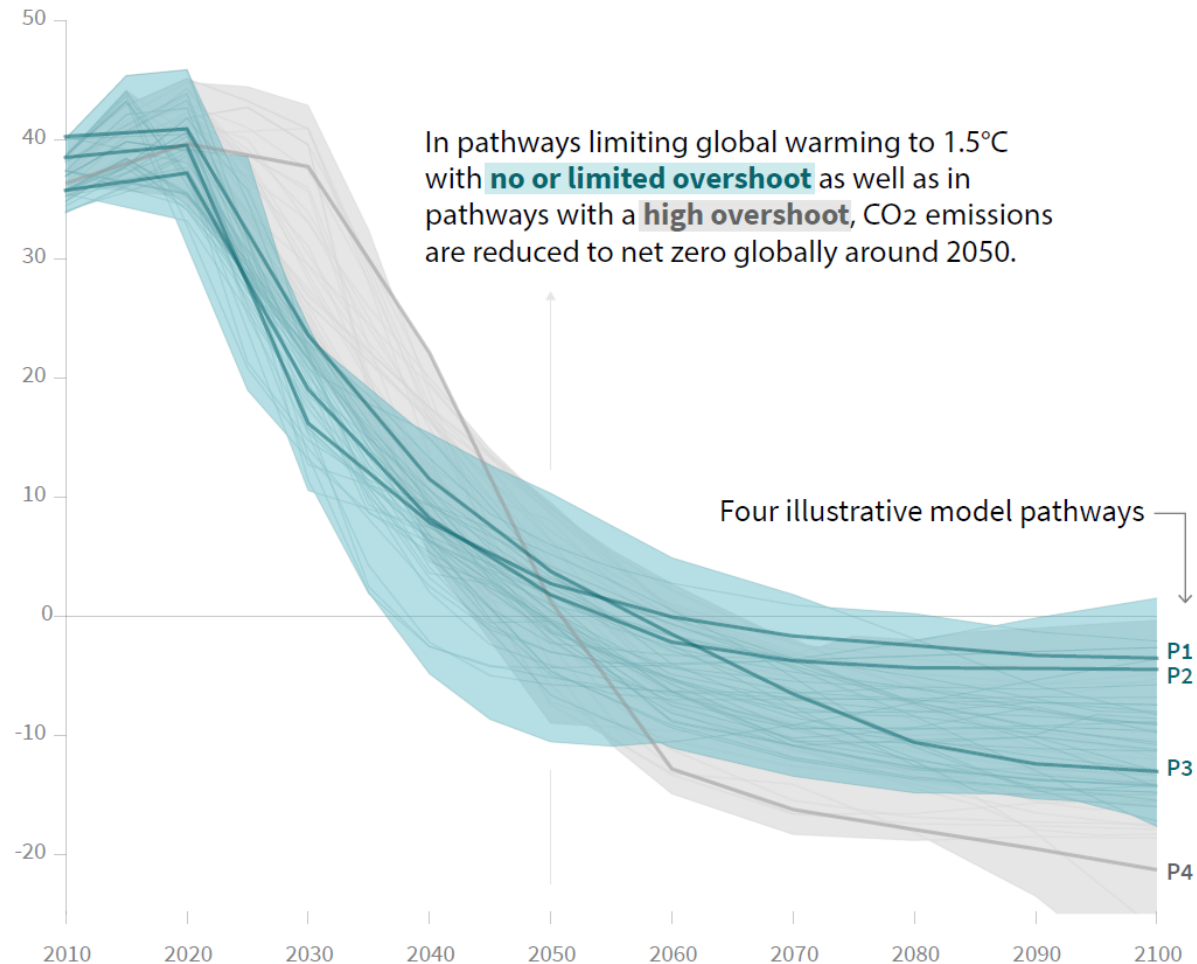
- There is a **downward trend in operational emissions** relating to an improved energy performance and increasing use of renewable energy.
- The relative and absolute values of **embodied impacts** (here embodied GHG emissions) **increase**.
- The consideration of the **entire life cycle**, the **limitation of the upfront/initial emissions**, as well as the development of **overall goals** and guidance values for operational and embodied GHG emissions are necessary.

Martin Röck, Marcella Ruschi Mendes Saade, Maria Balouktsi, Freja Nygaard Rasmussen, Harpa Birgisdottir, Rolf Frischknecht, Guillaume Habert, Thomas Lützkendorf, Alexander Passer, 2019.

DRASTIC REDUCTION IN CO₂ EMISSIONS NEEDED

Global total net CO₂ emissions

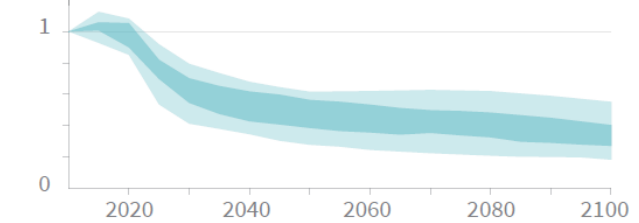
Billion tonnes of CO₂/yr



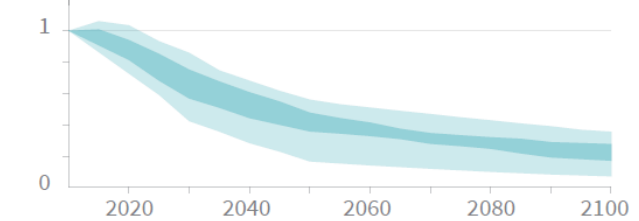
Non-CO₂ emissions relative to 2010

Emissions of non-CO₂ forcers are also reduced or limited in pathways limiting global warming to 1.5°C with **no or limited overshoot**, but they do not reach zero globally.

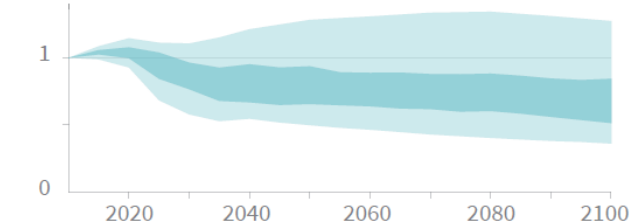
Methane emissions



Black carbon emissions



Nitrous oxide emissions





IEA EBC Annex 72 - Assessing Life Cycle Related Environmental Impacts Caused by Buildings

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.

ANNEX INFO & CONTACT

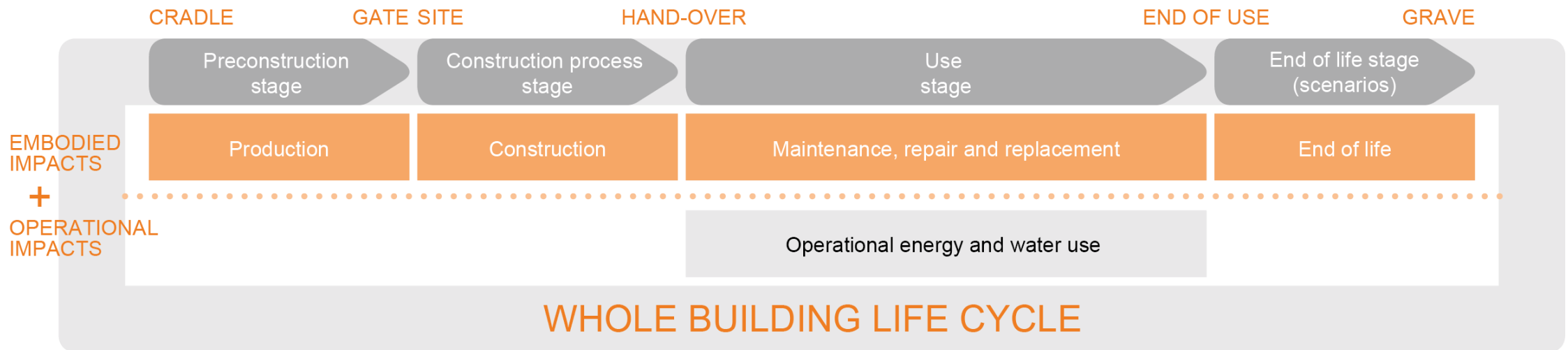
Status: Ongoing (2016 - 2021)

OPERATING AGENT

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IEA EBC Annex 72: Full scope environmental assessments of buildings



Net Zero

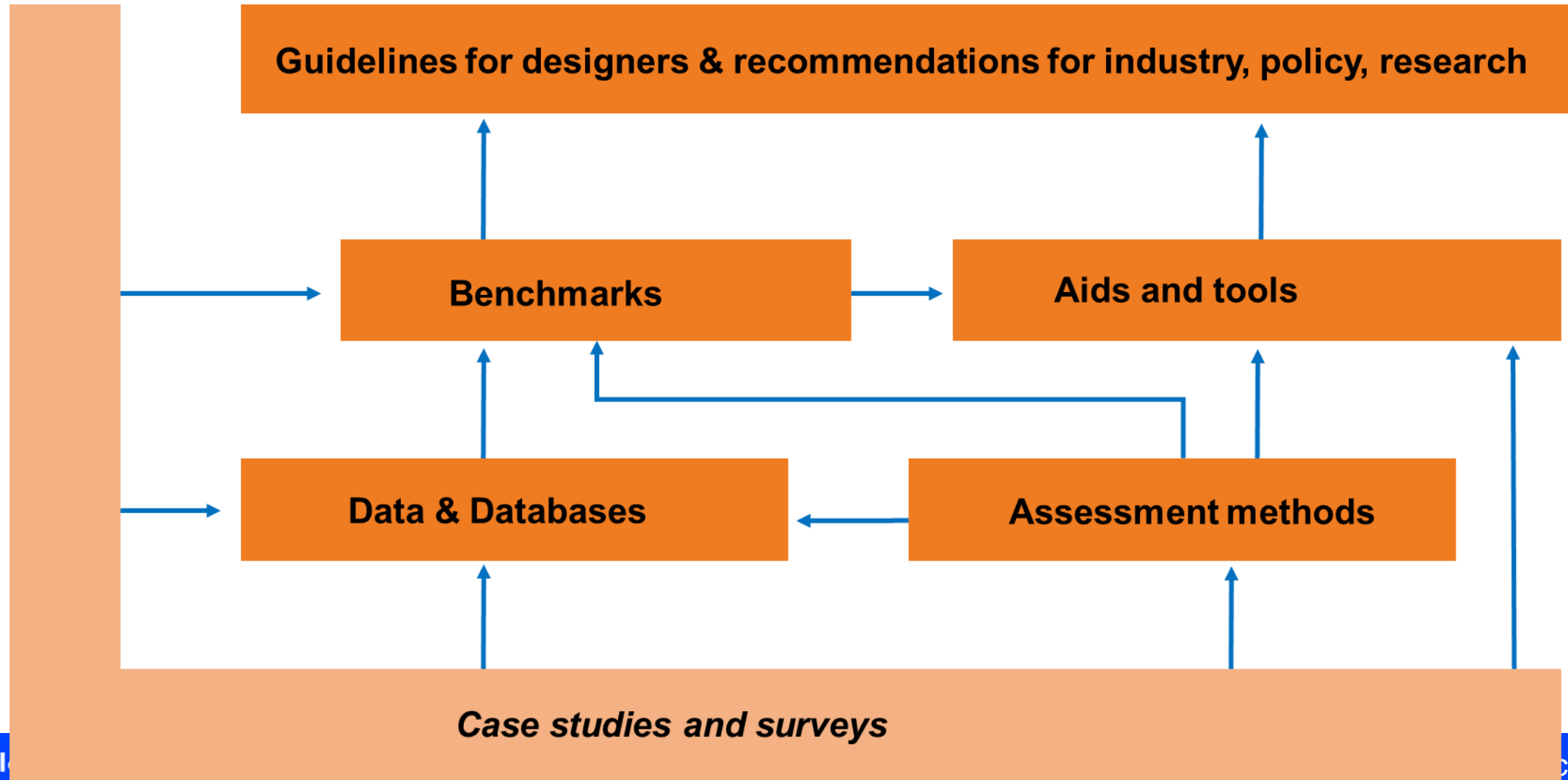
Objectives of IEA EBC Annex 72

Assessing life cycle related environmental impacts of buildings

- Common methodology guidelines (taking into account ISO/CEN standards, national and regional action plans/activities) → **Thomas Lützkendorf**
- Methods for the development of and case studies for deriving empirical environmental benchmarks → **Maria Balouktsi and Freja Nygaard Rasmussen**
- Guidelines how to use building design and planning tools (such as BIM and others) → **Alexander Passer and Tajda Obrecht**
- Guidelines to establish national/regional databases and share national experiences → **Rolf Frischknecht**

Objectives of IEA EBC Annex 72

Assessing life cycle related environmental impacts of buildings



Countries represented in IEA EBC Annex 72



A series of expert meetings

	working phase										
Expert meeting	1.	2.	3.	4.	5.	6.	7.	8.	8.5	9	10
Date	18-19 May 17	27-29 Nov 17	11-13 Apr 18	30-31 Oct 18	10-12 Apr 19	25-27 Sep 19	25-27 Mar 20	7-9 Oct. 20	2-3 Feb 21	17-19 May 21	26-30 Oct 21
Location	CPH, DK	GRZ, AT	MUC, DE	Gent, BE	SVQ, ES	LJU, SI	TSN, CN	(EDI, UK)	Online	Online	Monte Verità, CH
Countries	18	20	20	20	21	20	<i>cancelled</i>	23	23	20	18
Experts	31	35	32	36	44	39		43	50	49	39

- average # of meetings attended per country: 8.2 (10)
- average # of participants per meeting: 40.3
- average # of countries per meeting: 20.4 (25)

How does a net zero GHG emissions building looks like?



- Biogenic carbon in buildings
- Reuse of building elements




THE Monte Verità DECLARATION

On a built environment within planetary boundaries

Signed by **40+ scientists** from **25 countries** worldwide
(Europe, Asia, Americas, Oceania)



ANNEX 72 EBC 

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.
- CO₂ 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 likelihood that the global temperature increase stays below 1.5°C.¹
- 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 CO₂ 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.

¹ 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 CO₂ only.

Technology Collaboration Programme
by IEA




simplicity, a spirit of cooperation
Monte Verità

Monte Verità Declaration

On a built environment within planetary boundaries

- **Motivation:**
Mankind's pressure on the environment is beyond planetary boundaries
- **Vision and Goal:**
Buildings with small environmental footprints and net zero greenhouse gas emissions (full life cycle)
- **Contents:**
Recommendations towards different stakeholders
- **Level:**
Representing the shared vision and goal of Annex 72 experts beyond technical discussions

ANNEX **72** EBC 

Monte Verità Declaration on a built environment within planetary boundaries

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Monte Verità Declaration

9 types of stakeholders

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

Monte Verità Declaration

Selected recommendations

- GOV** 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.
- INV** 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.
- RES** Train engineers and architect to design with low carbon building materials and to design buildings with low GHG emissions, environmental impacts and resource consumption.

Monte Verità Declaration

Selected recommendations

- DES Assess the different design options with environmental life cycle assessment (LCA) and discuss the results with the client.
- OPE 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.
- MAN 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.

Monte Verità Declaration

Selected recommendations

CON Reduce GHG emissions, environmental impacts and resource consumption caused by construction processes for construction and deconstruction.

REA Report on life cycle based GHG emissions, environmental impacts and resource consumption caused by the buildings you are offering.

TEN Use life cycle based GHG emissions, environmental impacts and resource consumption as key criteria when selecting your rental object.

GOV 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.

- Construction, operation and deconstruction of buildings cause nearly 40% of the world's energy related CO₂ emissions
- Embodied emissions account for an increasing share and need to be addressed now
- Legally binding GHG emission benchmarks for buildings are needed by 2025 with a roadmap to net zero by 2035
- Many countries are ready to support governments with a package of method, data, tools and benchmarks

A big “Thank you” to the ANNEX 72 TEAM ...

... and their
funding
organisations



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