SINO-SWISS ZEB PROJECT

让我们共同打造气候中和的未来
Building a climate-neutral future together

ZEB

Zero Emission Building Design and Construction Guideline

中华人民共和国
住房和城乡建设部

IBE环能科技

中国建筑节能协会

Schweizerische Eidgenossenschaft
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Lead Authors

Team intep-Skat

- Roland Stulz
- ZHU Jilong
- Dr. Feng Lu-Pagenkopf
- Dr. André Ullal

Low-Tech Lab GmbH

- Martin Ménard

Co-Authors

Faktor Journalisten AG

- Paul Knüsel

China Academy of Building Research

- Dr. ZHANG Shicong
- Dr. YANG Xinyan

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- Swiss Agency for Development and Cooperation
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1. Summary

This report focuses on the key challenges and response strategies of the Swiss construction industry in achieving the goal of "net-zero emissions." It systematically outlines the core content from national policies and carbon accounting to building design and material selection, aiming to provide both theoretical guidance and practical references for the industry's low-carbon transformation and circular development.

Thanks to advanced technologies and strict regulatory requirements, new buildings in Switzerland generally achieve high energy efficiency and low emissions during their operational phase. However, embodied carbon emissions throughout the building lifecycles, especially from construction, maintenance, and demolition have become a new challenge. The goal of this report is to promote a shift in the construction industry from focusing solely on operational carbon reduction to a comprehensive lifecycle carbon-neutral approach.

Main Content and Highlights

1. National Greenhouse Gas Emissions Overview and Trends

Switzerland has legally committed to achieving net-zero emissions by 2050 and has set phased reduction targets. Since 1990, emissions from the building sector have dropped by approximately 44%, mainly due to the electrification of heating systems, the use of heat pumps, and enhanced building insulation standards.

2. Lifecycle Carbon Footprint Assessment for Buildings

As operational emissions decrease significantly, embodied emissions (Scope 3) from building materials have become the dominant source, accounting for over 74% of total emissions in high-efficiency buildings. The report draws on European standard EN 15978 and Swiss technical standard SIA 2032 to define all lifecycle stages and stresses the importance of early-stage decision-making in maximizing emission reductions.

3. Emission Reduction Pathways and Circular Strategies

The report introduces three core strategies— "Avoid new construction," "Material substitution," and "Extend lifespan"—along with the 5R principles of circularity (Refuse, Rethink, Reduce, Reuse, Recycle). Together, these form a comprehensive design and management framework for decarbonization and resource efficiency in the built environment.

4. Standards and Policy Instruments

Switzerland has developed a robust system of building certification and carbon limits, including the MuKEn model ordinance, Minergie certification, and the SIA 390/1 standard. These frameworks are evolving to regulate not only energy performance during operation but also emissions generated during construction, accelerating the industry's low-carbon transition.

5. Assessment Methods and Key Challenges

The report reviews key tools such as the KBOB data platform and SIA 2031/2032 standards and highlights current gaps and controversies. These include the lack of regulatory clarity on carbon storage duration in biobased materials and the limitations of on-site energy generation as a compensatory measure for unavoidable emissions. The definition and governance of negative emissions remain ongoing challenges.

Achieving truly net-zero buildings requires not only technological innovation and policy support but also integrated carbon management across all lifecycle stages.

Switzerland’s practical experience shows that embedding decarbonization into the design, construction, operation, and end-of-life processes is essential for transforming “energy-efficient buildings” into “climate-positive architecture.”

2. Performance and Construction

2.1 Context and Challenge

The state of the art and the legal requirements for the building sector in Switzerland are congruent: new buildings have a high level of energy efficiency. The energy demand for heating, cooling and hot water by the property market is increasingly covered by renewable energy sources. The energy performance of new buildings in the use phase therefore generally is able to meet the requirements for carbon-emission-free or climate-neutral operation.

The next challenge is carbon emissions up- and downstream. The construction and demolition (disposal included) of buildings are further sources for carbon emissions with a relevant share during the life cycle of these buildings. They can be disclosed through an ecological product assessment.

Figure 1: Understanding the whole life-cycle of buildings with the emission stages up- and downstream. Source: Archdaily.com

2.2 GHG Emissions in the territorial perspective

Nearly 42 million tons of greenhouse gases (GHG) were emitted in Switzerland in 2022, which is less than 5 tons per capita – and almost a third less than in 1990. The consumption of fossil fuels for heat production accounts for nearly 80 % of all emissions.

According to the international climate agreement (Paris Agreement), the respective emission areas are to be reported according to the polluter-pays principle. Accordingly, the domestic CO2 statistics record territorial emissions from the areas of transport, buildings, industry, agriculture and waste incineration.

Transport causes the most emissions. The fossil-fuelled heat supply generates the majority of greenhouse gas emissions in the building sector. Industry emits almost as much as buildings today; this includes cement and steel works, which are relevant for the construction sector.

The proportion of waste incineration is low, but remains constant. A large proportion of the waste heat generated is utilized via district heating networks in residential areas.

GHG Emissions in Switzerland by sectors (Data for 2022)

- Transport: 33 %
- Buildings: 23 %
- Industry: 16 %
- Agriculture*: 15 %
- Waste: 10 %
- Others: 3 %

* GHG emissions are mainly: methane (CH_4) and N_2O

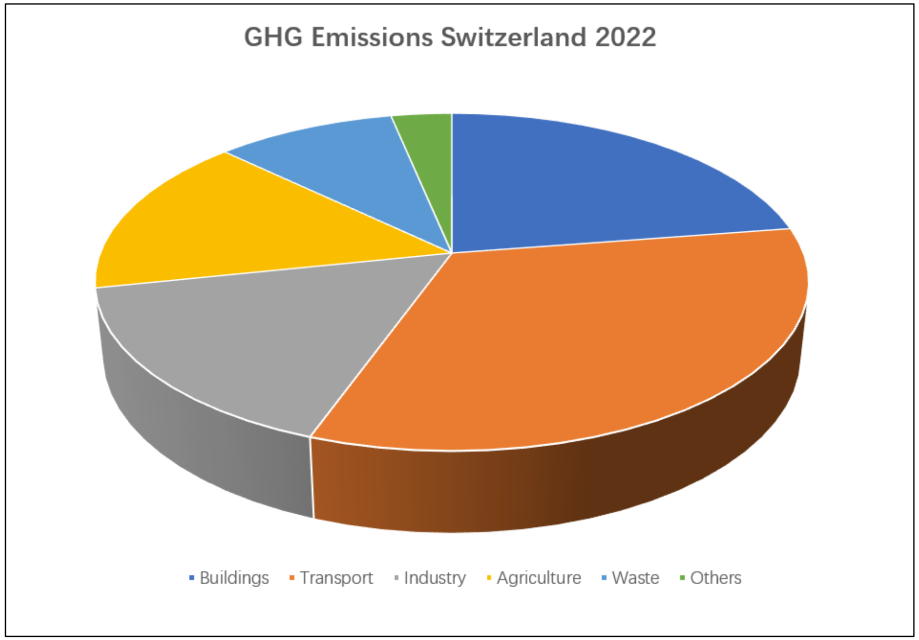

Figure 2: Share of emissions by activity in Switzerland's greenhouse gas inventory; Source: FOEN

Carbon-Inventory Switzerland: Development from 1990 to 2022, by sectors

Switzerland has improved its overall CO2 balance by a quarter since the reference year 1990. In the building sector, emissions have even fallen by a third in the same period.

Homeowners are replacing their fossil-fuelled heating systems with a CO2-free heat supply (mainly by heat pumps) so frequently that direct emissions are falling despite the ongoing construction boom. And the insulation standards in construction have been improved to such an extent that the building stock also consumes less energy in absolute terms (weather-adjusted).

- Transport: − 7 %
- Buildings: − 44 %
- Industry: − 37 %
- Waste: + 10 %

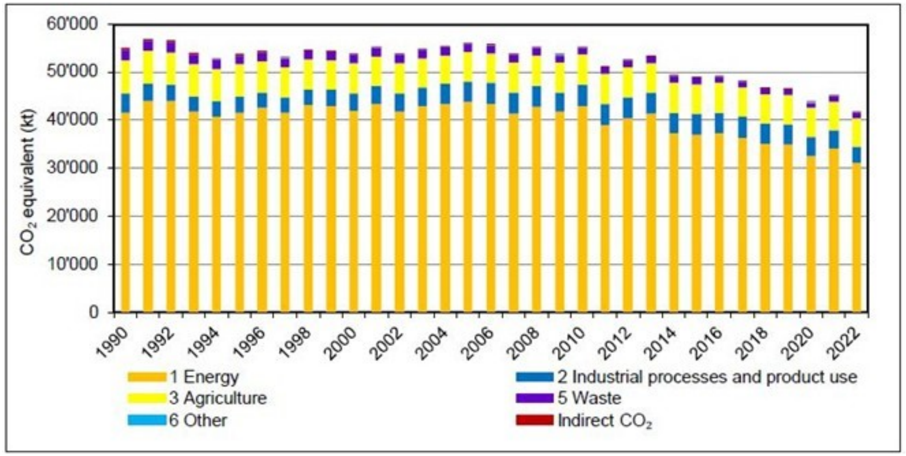

Figure 3: Greenhouse gas emissions in CO2 equivalent (kt) by sectors; Source: Switzerland's greenhouse gas inventory, Swiss Office of Energy

2.3 Carbon-Inventory Buildings, Switzerland

By 2025, the national Climate Protection Act has enshrined the net-zero target by 2050 in law. The reduction path defines commitment in 10-year stages.

By 2020, Switzerland should have reduced its climate-damaging emissions by 20 % compared to 1990. This target was narrowly missed. By 2030, Switzerland must halve its direct greenhouse gas emissions compared to 1990, including in the building sector.

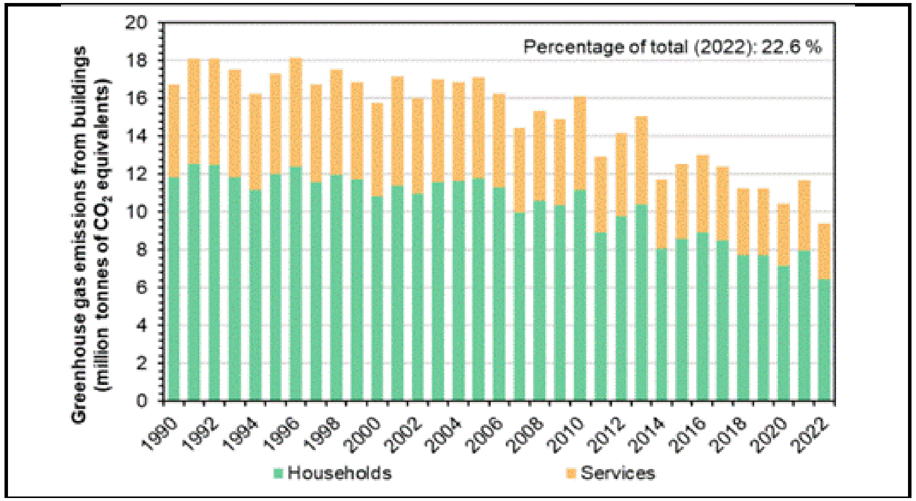

Figure 4: GHG emissions in the building sector (residential and office) evoked through energy consumption. Source: Switzerland's greenhouse gas inventory, Swiss Office of Energy

Building Standards: Optimizing Energy-Efficiency

On average, every building in Switzerland currently emits 12.5 kg of CO2 per m2 of energy reference area. The federal government and cantons are therefore providing financial support to private homeowners for building renovations and heating replacements.

As described in the survey «Swiss experience on technical regulation for energy and emissions in the building sector» Switzerland has a long-standing experience with policy design and technical regulation (TER) for moving the building sector to more energy efficiency and lower greenhouse gas emissions.

The policy instruments and technical regulations were constantly developed and widened their focus from the building performance by energy consumption during the operation phase to an integral approach including a shift to renewable energies. The quantitative requirements in the technical requirements were stepwise increased, leading to significantly lower energy consumption of new buildings (improvement of building envelope efficiency). Since 2014 the cantons have already prescribed a maximum share of fossil fuels for heating purposes.

Benchmarks for Heating Energy Demand (residential buildings)

- Codes or Law: Model Regulations of the Cantons on energy in Buildings (MuKEn) 2014: 35 kWh/m^2y
- Market Standard, e.g. Green Architecture Label Minergie 2022: less than 30 kWh/m^2y

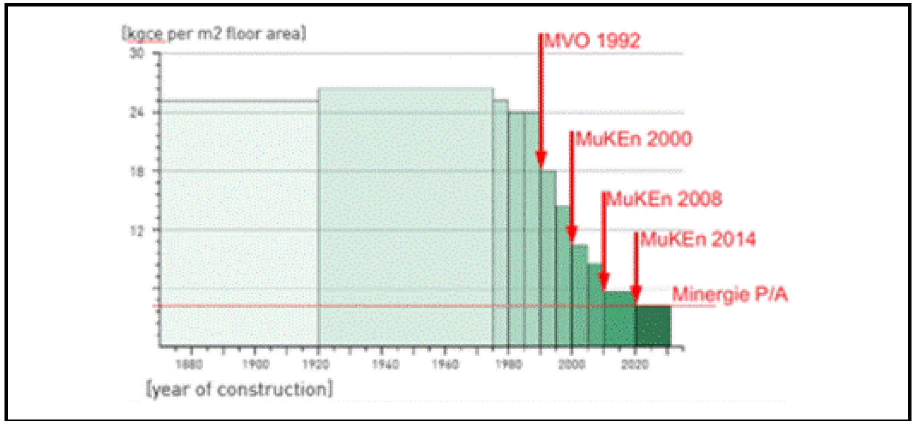

Figure 5: Development of energy standards for new buildings in Switzerland; MVO/MuKEn – regulations by law, Minergie – market standard. Source: Sino-Swiss ZEB Project

Carbon Emission of Buildings – Scope 1 and 2

The territorial Perspective on building emissions, regarding the Paris Agreement, is as follows:

- Emissions from building heating and hot water (Scope 1)
- Emissions from purchased energy (heat, electricity) (Scope 2)

Scope 3: Indirect Emissions

A sectoral allocation of the budget of carbon emissions from buildings widens the territorial perspective and includes also the following sources:

- Indirect (production-related) greenhouse gas emissions from upstream and downstream activities for building materials, energy sources and services (Scope 3)

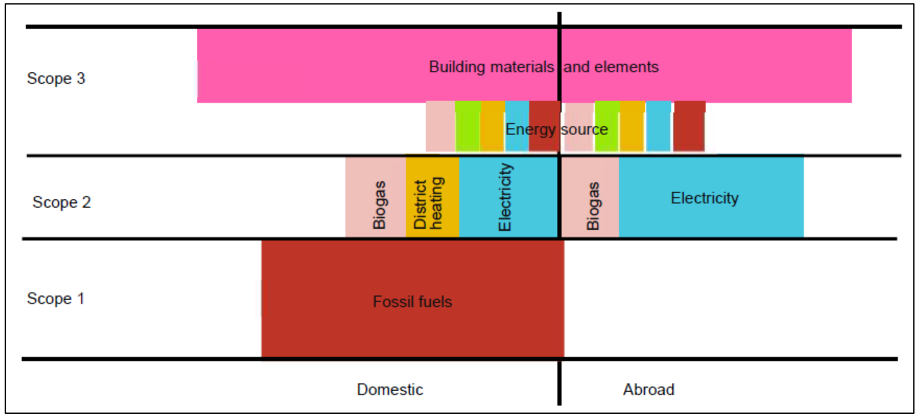

Figure 6: Sectoral perspective on carbon emissions from buildings, allocated to the scopes from the Paris Agreement. Source: LowTech

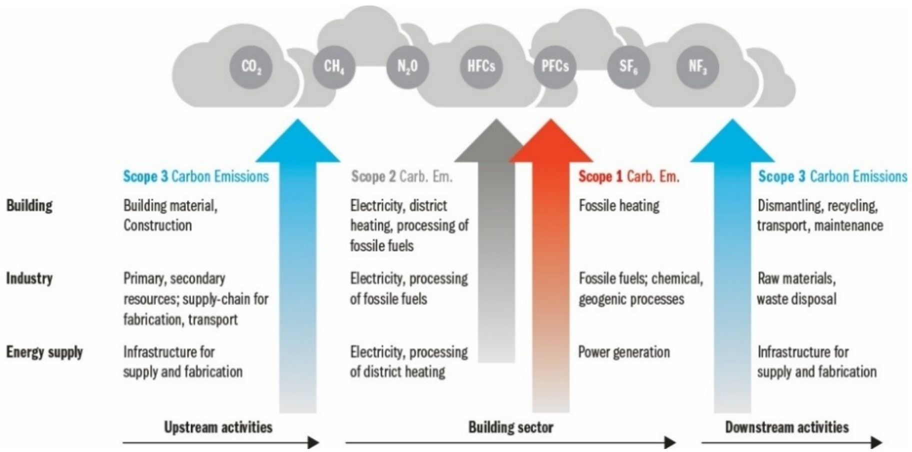

Figure 7: Survey and classification of carbon emissions of the building sector, according to the GHG-Protocol. Source: LowTech

3. Aiming to Net-Zero

3.1 Context and Challenge

In Switzerland the authorities as well as building sciences and frontrunners in the real estate market are working together for a holistic understanding of «net-zero buildings». The following definition of the goal can be described as a common result: Net-zero aims for a minimum of Carbon emissions for construction and operation of buildings over the entire life cycle and reduces the remaining emissions through creditable negative emissions at the level of building materials and elements. Negative emissions should reduce the GHG content in the atmosphere and mainly facilitate a permanent storage of biogenic carbon in the geosphere.

Currently an option is discussed that focuses on buildings with temporary carbon sinks using biogenic building materials. A remaining challenge is how to convert them downstream into permanent negative emissions.

Figure 8: House of Woods, Sursee (Canton of Lucerne) 2022; marc syfrig architects

Source: Pirmin Jung AG

3.2 Whole Life Carbon Emissions of Buildings

Thanks to high efficiency and renewable energy sources, a new building in Switzerland usually causes only a few direct CO2 emissions during operation. However, a building's carbon footprint also includes indirect emissions, which are attributable to the materials used in its construction. They account for more than 75 % of the total emissions over the life cycle of a new energy-efficient building. The extraction, production, transport and dismantling of building materials and components are sometimes associated with very high emissions.

In order to reduce indirect emissions from upstream and downstream processes, strategic decisions must be made as early as the property development phase.

The CO2 savings potential decreases with each concretization step in building planning. Reducing embodied and material bound emissions is therefore to integrate in developing the building structure and by evaluating the various components.

Carbon Emissions in the Life-Cycle of buildings (with high energy standard)

- Operational Emissions: 26 %
- Material bound Emissions: 74 %

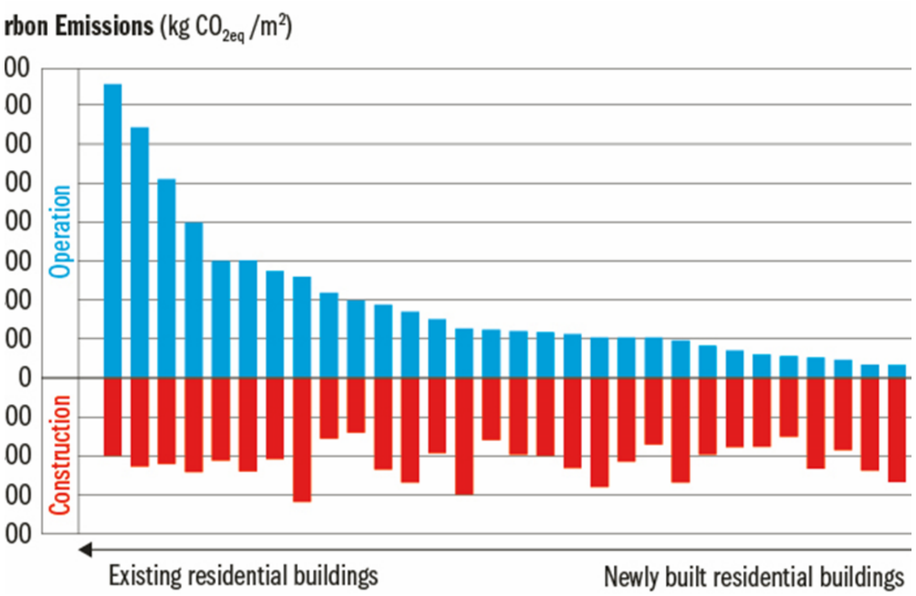

Figure 9: Different shares of emissions according to the age of buildings; blue columns: operational emissions, red columns: embodied emissions, Source: LowTech

Accumulated Emissions in the Life-Cycle of Buildings

Operational emissions come from:

- energy consumption on site for space heating and domestic hot water (Scope 1)
- consumption of electricity or district heat (Scope 2)

Material bound Emissions come from (Scope 3):

- Production of materials
- Construction of buildings
- Maintenance
- Demolition

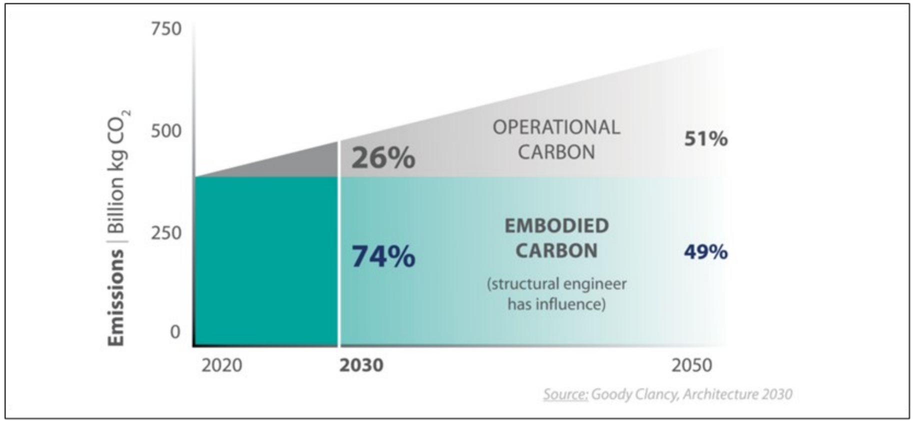

Figure 10: Share of emissions in a life cycle assessment of buildings, Source: LowTech

Life-Cycle of Buildings (EN 15978)

The life-cycle of buildings is defined by the technical regulation EN

15978 on European scale, since the carbon intense stages are:

- Extracting raw materials
- Production, processing
- Construction
- Use
- Maintenance
- Demolition
- Recycling
- Disposal
- Reuse

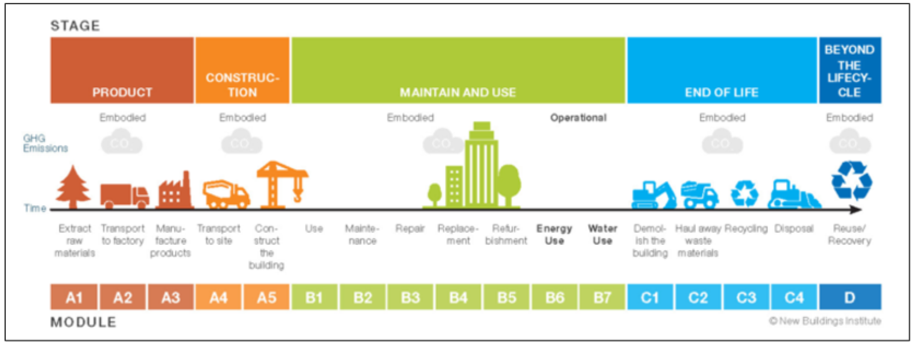

Figure 11: Modules for the assessment of the life-cycle of buildings, defined by EN 15978; Source: NBI

Remark: The technical regulation of the life-cycle assessment for buildings in Switzerland diverges from EN 15978 and skips some modules keeping with their low relevance. The technical regulation SIA 2032 accounts for the following stages (see ch. 5):

- *Production: A1, A2, A3*
- *Maintenance / replacement: B4*
- *End of Life: C3, C4*

Emissions from energy consumption during the operational phase (B6) are addressed by the Swiss standard SIA 380.

Carbon Footprint of Buildings Components

The majority of indirect emissions are attributable to the supporting structure of a building, i.e. the components with a primarily static function. In most case studies the following building components are mentioned as relevant of their carbon intensity:

- Foundations
- Ground floor
- Structure
- Columns and beams
- External walls
- Floor slabs
- Internal doors
- Internal walls
- Stairs and ramps
- Doors, windows
- Roof
- HVAC/Technical systems for heating, cooling, ventilation, lighting etc.

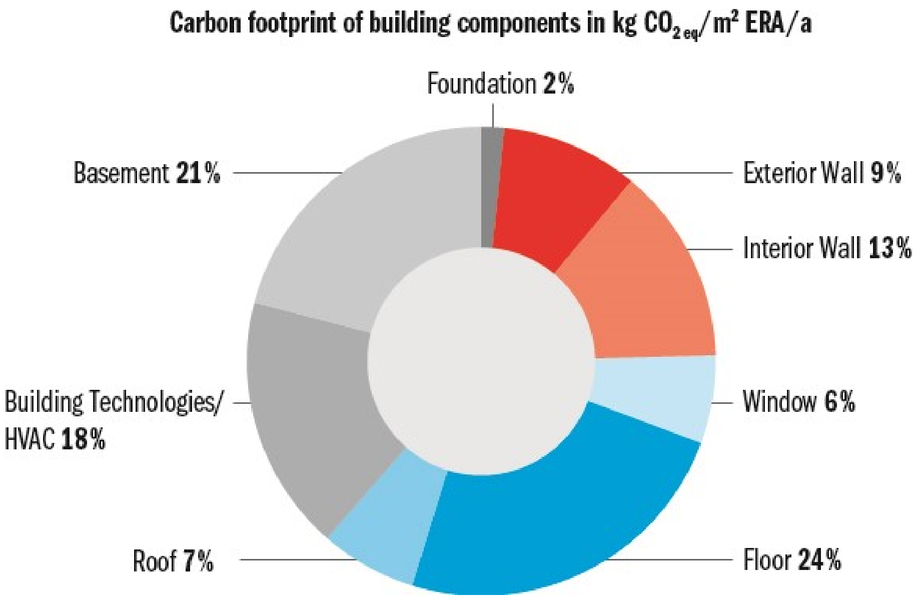

Figure 12: Carbon footprint of building components; source: Nova Energie

Carbon Footprint of Building Materials

An assessment of case studies with multi-family buildings in Switzerland shows the carbon footprint of typical materials in the following order:

- Concrete
- HVAC
- Minerals, Glas
- Plastic (or other burnable materials)
- Steel
- Wood
- Masonry

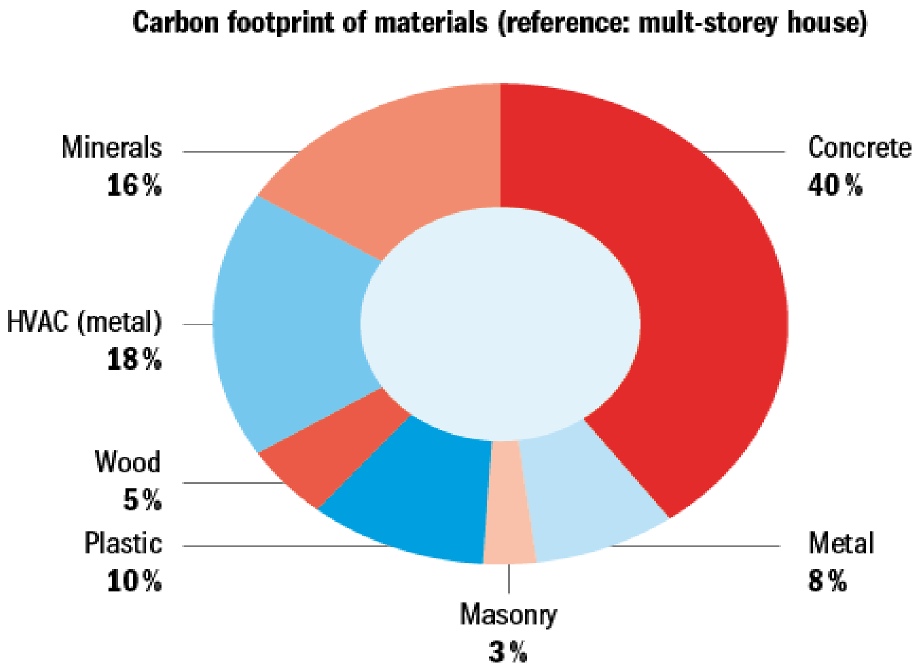

Figure 13: Share of typical building materials to the carbon footprint of an average building; Source: Faktor

3.3 Codes and Standards

Based on Switzerland's net-zero strategy, the cantons intend to regulate indirect emissions in the building sector. The MuKEn 2025 proposes limit values for construction-related greenhouse gas emissions. Comparable regulations are already implemented in codes by various european countries, as shows the table below.

	Regulation (Law, Code)	Market (Standard, Label)
Switzerland	14 kg CO_{2eq}/m^2a (MuKEn 2025)	13 kg CO_{2eq}/m^2a (Minergie)
		11 kg CO_{2eq}/m^2a (SIA 390/1 B)
Denmark	7 kg CO_{2eq}/m^2a	6 kg CO_{2eq}/m^2a (reduction roadmap)
Germany	n. p. (nothing planned)	9 kg CO_{2eq}/m^2a (DGNB)
France	8 – 14 kg CO_{2eq}/m^2a (RE2020)	n. p.

MuKEN 2025: Draft for the regulation of emissions up- and downstream

The Swiss Authorities initiated a plan for circular buildings that aims to regulate the embodied carbon emissions. Therefore, the cantons defined limits for the construction stage of buildings. This draft is part of the revision of the model regulations MuKEn 2025.

Minergie-Eco: A Label for sustainable buildings

The Minergie building certificate plays a pioneering role in the Swiss property market for energy-efficient buildings. Since 2022, greenhouse gas emissions have also been recognized during construction. For the 'Minergie-Eco' label, new buildings must even comply with a limit value. This assessment is also required for buildings that are certified in accordance with the Swiss Sustainable Building Standard (SNBS).

SIA 390/1: Swiss Society of Architects and Engineers sets a Climate Standard

The technical Standard SIA 390/1 «Climate pathway – Greenhouse gas balance over the life cycle of buildings» invites building owners and planners to realize a building with the lowest possible carbon footprint on a voluntary basis. It defines target values for emissions during construction, operation and induced mobility. The sum of the carbon impact of all three areas is defined as a binding target value.

Target Values

- Ambitious Value A, according to Paris Agreement: 6 kg CO2/m2y for construction; 1 kg CO2/m2y for operation (additional 1 kg CO2/m2y for mobility)
- Base Value B, according to the Swiss Climate Law: 8 kg CO2/m2y for construction; 2 kg CO2/m2y for operation (additional 1 kg CO2/m2y for mobility)

The target values include carbon emissions from construction, operation and (location-related) mobility. The «additional requirement» includes only carbon emissions from construction and operation. It is planned to adjust the level of the target values and additional requirements with periodic technical reviews of SIA 390/1, every five years (see figure below).

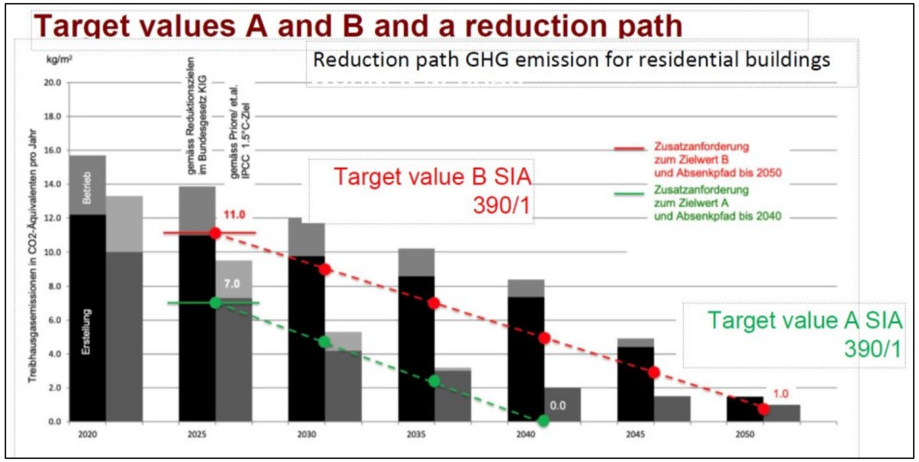

Figure 14: Target path of GHG-emissions in Switzerland (black columns) and requirements for the climate path SIA 390/1 (level A – green / B – red; black – construction / grey – operation); source: SIA

Further Discussions: Climate Target Path on a legal basis

Federal authorities, scientists and building experts are elaborating a common understanding for a net-zero-building. A proposition is currently formulated by a study on behalf of the Swiss Office of Energy (SOE):

«A building with net zero greenhouse gas emissions has minimum greenhouse gas emissions for construction and operation over its entire life cycle and reduces the remaining greenhouse gas emissions from construction and operation that are difficult to avoid to net zero by means of creditable negative emission.» (source: SOE)

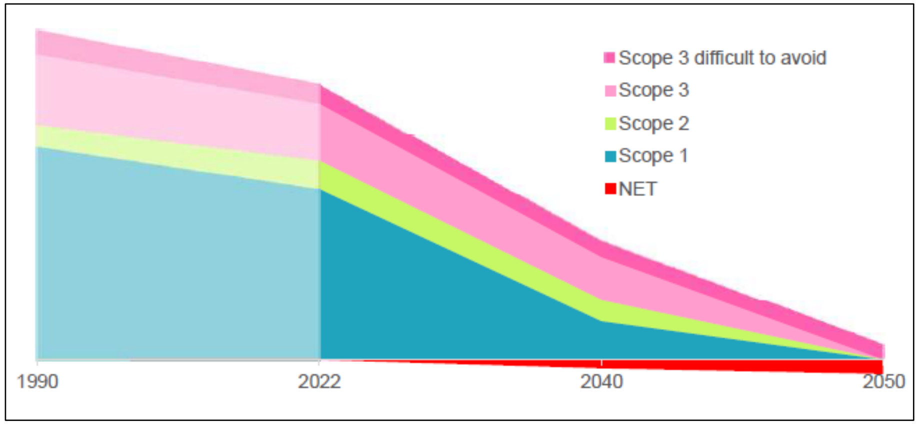

Figure 15: Climate Target Path; proposition of the study: Net zero greenhouse gas emissions in the buildings; source: NN-THGG/SOE

4. Strategies in Planning

4.1 Context and Challenge

An important learning from the still young green building discipline is that the first decisions for the design and the structure have the greatest impact. Therefore, the players themselves – owners, developers and architects – are crucial in setting the goals and course for net-zero buildings, including carbon emissions upstream and downstream.

Just as the life-cycle of buildings consists of defined stages, the planning process also follows a established timeline with a logic from large to small: It starts with a rough idea, followed an evaluation of the options by studies, which in a sense represents the raw material for the final program and the commissioning of a building. The challenge is therefore to harmonize each decision-making phase with the strategy for reducing carbon emissions.

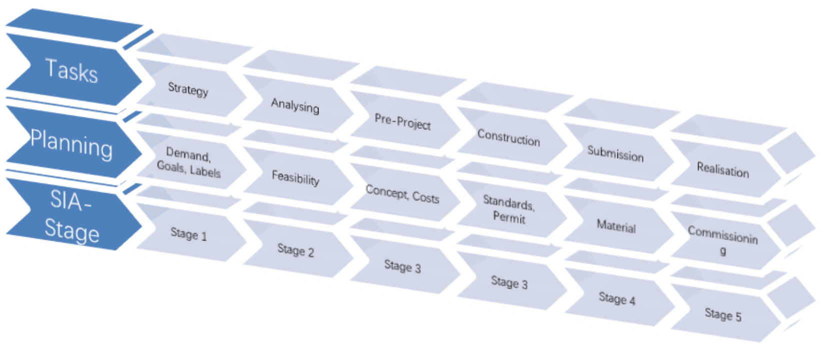

Figure 16: Regulation governing architects' services and planning stages, according to the swiss society of engineers and architects. Riatsch

4.2 Strategies for Design and Building Commissioning

On a strategy level stakeholders need frameworks to ensure the goal to reduce emissions in the life-cycle of buildings. Currently there are various concepts for saving resources that are adapted to the building sector.

Framework for Sustainable Buildings

Strategy	Goal	Implementation for building design
Avoid	Build with less (material, waste), Sufficiency	Reduction in living space per person, resource and energy efficiency, avoidan of new buildings
Shift	Use of materials with low Carbon Emission	Materials from low-CO_2-emission, bio-based resources; local supply-chains, reusable materials and components; renewable energy
Improve	Use for longer	Reuse of building components and

		buildings; flexible building systems and floor plans; decarbonization of the energy supply

Another relevant input comes out of the circular economy: The concept for the 5 «R»-Strategies is adaptable for the property sector, as follows:

Strategy	Implementation
R-efuse	Build nothing new
R-ethink	Utilize existing resources differently and more flexibly
R-educe	Consume less resources, reduce emissions and waste
R-euse	Extending the life cycle of components
R-ecycle	Separate materials (during dismantling) and recycle them

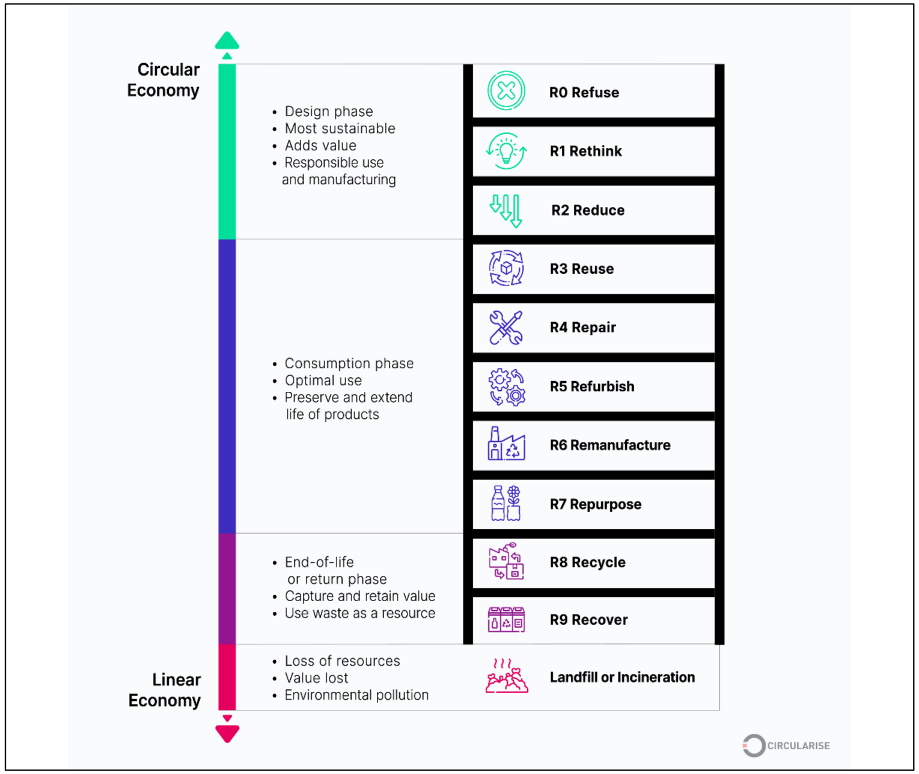

Figure 17: R-Hierarchy for the sustainable use of primary resources; source: circularise

5. Climate-friendly Design and Structure

5.1 Context and Challenge

Up to 70 % of a building's mass is in the supporting structure. The proportion of resources consumed for this, and the induced emissions caused in the upstream and downstream processes are similarly high.

Design and structural measures can massively reduce the climate-damaging output. For new buildings, the greatest leverage lies in the leanest possible dimensioning and materialization of the structural elements.

Alternative or supplementary factors influencing the building supporting structure are: flexible utilization through easily adaptable structures in order to extend the service life of the building.

Figure 18: Conversion of a load-bearing structure: from warehouse to apartment block. Source: Freilager, Gataric

The study «ZeroStrat: Strategies for new buildings with the lowest emissions during construction» by Intep and ETH Zurich analyses the extent to which indirect, construction-related emissions can be reduced with currently known measures. To this end, the material balance of a building – with different construction methods and choice of building materials – was evaluated. The reference was the new construction of an apartment block – supporting structure without interior fittings and building services – with conventional concrete walls and ceilings. The comparison with other construction methods shows:

- A timber construction with environmentally friendly insulating materials and prefabricated parts such as system ceilings achieves a reduction of emissions in the construction stage up to 45 % compared to a concrete construction.
- Modernizing existing buildings instead of building new ones reduces indirect emissions by up to 65 %.
- If environmentally friendly building materials and components are used for this refurbishment, the reduction in indirect emissions increases to up to 75 %.

Exemplary recommendations for the design of supporting structures:

- Compact and simple design
- Optimization of the (linear) supporting structure

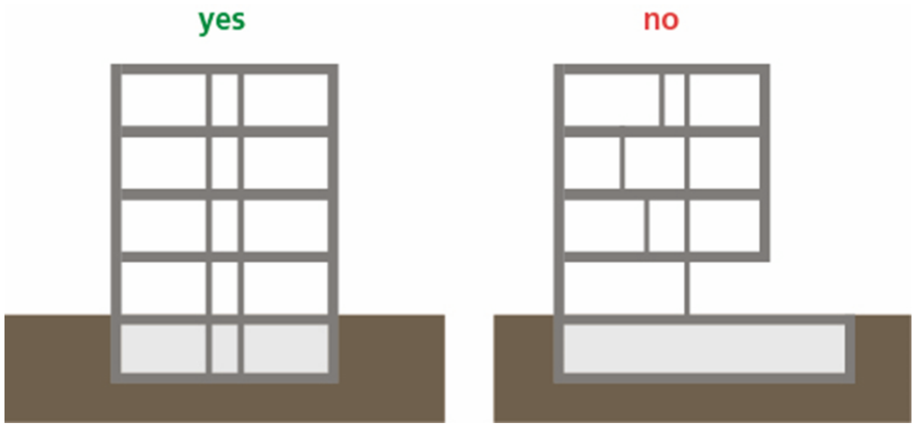

Figure 19: Linear supporting structure; source: Faktor

Exemplary recommendations for the design of basement:

- Reducing basements or car parks

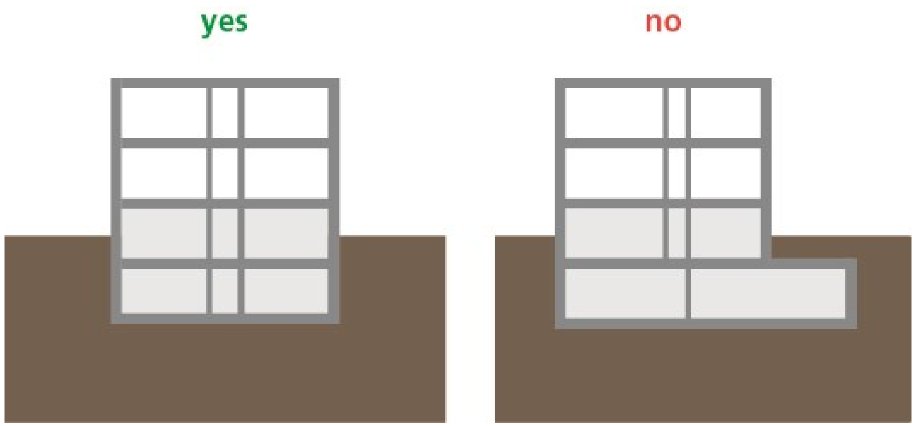

Figure 20: Reducing basement volume; source: Faktor

Exemplary recommendations for the design of envelopes and facades:

- max. 50 % surface-ratio of window (glass) to wall

Figure 21: Office building in Winterthur; Architecture: BGP Partner

5.2 Use of components according to their durability

The most important lever for avoiding carbon emissions is to use the structure for as long as possible. However, if a building is demolished and replaced by a new building, the emissions for the shell are generated again. From a climate perspective, it is therefore better if a property that no longer meets the requirements is modernized with a low level of intervention so that only relatively few additional emissions are produced. Therefore, buildings and components have to be constructed without mixing the layers to facilitate further adaptions and the decommissioning.

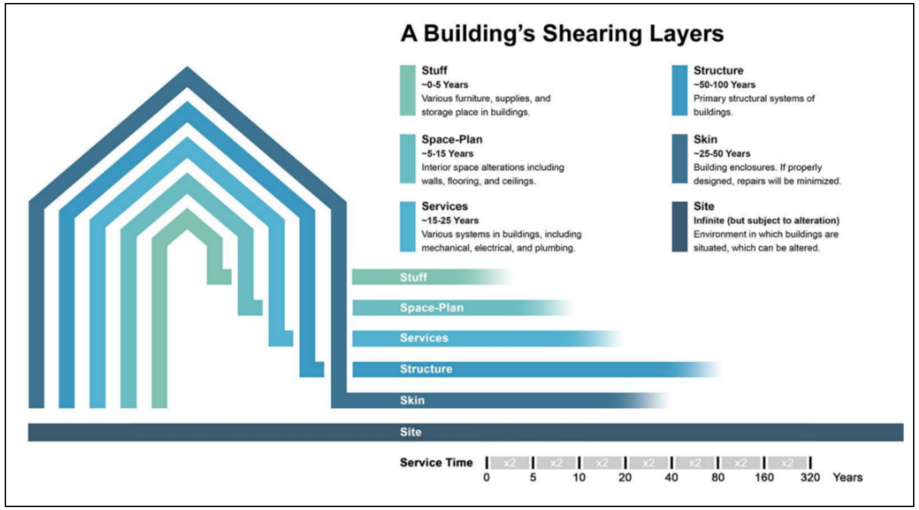

Figure 22: Building layers according to their life period. Source: LowTech

6. Circular

6.1 Context and Challenge

Circular construction is measured by the requirements for easy dismantling of buildings, components and building materials. The design for disassembly must be integrated at an early planning stage for new buildings.

The increased use of recycled materials (secondary building materials), regenerative building materials and recyclable building materials further conserves the resource pool.

Figure 23: The red facade and the supporting structure of the three-storey head building of Hall K 118 (2021) on the ZHAW-Campus in Winterthur consist mainly of reused components. Architecture: Baubüro in situ; source: Martin Zeller

6.2 Evaluation of embodied emissions in buildings

Case Study: Carbon Footprint of building materials

Figure 24: The Construction Material Pyramid from the Royal Danish Academy makes it possible to compare Carbon footprints between different categories of materials or between material types within the same category. It also makes it possible to view different kinds of environmental impacts across the different materials. Source: www.materialepyramiden.dk.

In Switzerland, carbon emissions from the construction of buildings have hardly decreased in recent years. A study by Swiss Energy and the City of Zurich examined what may be expected from construction material manufacturers, if they optimize their own processes. For that purpose, the life cycle of future production of construction materials relevant in structural engineering, namely mineral and metal materials, wood and plastics produced and/or used in Switzerland was assessed.

The findings were: With future construction materials manufacture, carbon emissions by the industry are reduced on average by 65 %. At building level, construction and dismantling emissions can be reduced by 50 to 60 %.

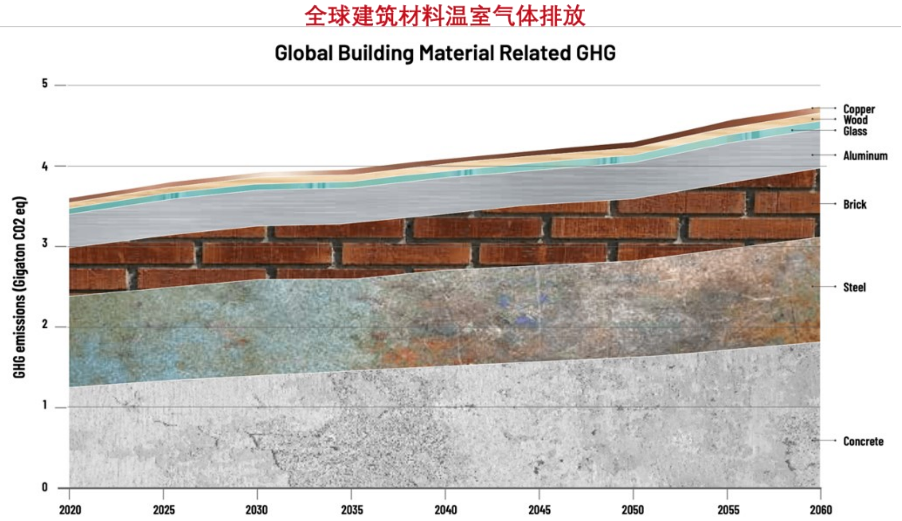

Figure 25: Carbon emissions of the fabrication of building materials; source: rmi.org

Case Study Switzerland: concrete

Material	Carbon Intensity*
Concrete, with biochar	238 kg CO_{2eq}/m^3
Concrete, conventional	230 kg CO_{2eq}/m^3
Concrete, recycled	230 kg CO_{2eq}/m^3
Concrete, carbonized	227 kg CO_{2eq}/m^3
Concrete, (clinker-reduced cement)	167 kg CO_{2eq}/m^3

** Calculations are made with the Swiss wide established KBOB-method (see ch. 6).*

Recycling rates for Switzerland

The waste management routes for typical building materials in Switzerland are:

- Concrete granulated and mixed granulate from demolished buildings can be recycled and refabricated as mineral construction materials. The recycling rate is approximately 80 %.
- Metal waste like scrap iron and steel are separated during the demolition of buildings. The recycling rate of steel for construction purposes is nearly 100 %.
- Approximatively 20 % of glass components can be recycled.

Biobased Materials

Biobased circular materials can be applied as building components, for example

- Wood for structure, facade, interior
- Clay für structure, facade
- Straw for insulation
- Hemp for structure, façade, insulation
- Cellulose for insulation

Figure 26: Actual research for building materials: «Mycelium-Bound Composite», a project by Future City Laboratory, ETH Zurich-Singapore; source: ETHZ

6.3 Carbon Storage in Building Materials

Building Materials	Specification	Effect on carbon emissions
Concrete, with biochar	Regular concrete mixed with biochar	Production of biochar is binding carbon; the amount of biochar, supplemented to concrete, corresponds with the quantity of emissions by producing concrete
Concrete, carbonized	Carbonization of recycling granulate	To turn demolition waste into a carbon sink, a Swiss company has developed a solution by capturing and mineralizing CO_2 in demolished concrete. This process works as an add-on to concrete's normal recycling process. The CO_2 is stored as long as the building material is reused.
Biobased Materials (wood, straw, hemp, cellulose)	Organic Resources with Carbon	Production of building materials from organic resources stores carbon, as long as they are in use.

Existing processes to store carbon in concrete:

Adding biochar

Figure 27: Biochar added to concrete; source: beyond zero/Empa

Figure 28: Combining the recycling of demolition waste with the capturing of carbon; source: neustark

7. Challenges for the assessment and Key Points

Figure 29: Claystone-walls as a climate-friendly alternative to mineral building materials in the atrium of the headquarters for the environmental authority, canton of Vaud. Source: Baud, Früh architects

7.1 Accounting Carbon Emission

Data on the construction stage must be taken into account when assessing carbon emissions in the life cycle of buildings. The Swiss construction and planning industry uses a standardized model of material and energy flows as well as freely accessible life cycle assessment data for building materials, building technology (HVAC), energy and transport, which is kept up to date by the state body KBOB. Further bases for assessment are provided by the SIA, namely by the technical regulation SIA 2032 and SIA 2031.

Life-Cycle-Assessment

Whole Life-Cycle Carbon Emission: Assessment and Calculation for products, components and buildings through all stages:

- Supply Chains: assessment defined by the technical regulation SIA 2032
- Fabrication/Processing: assessment defined by the technical regulation SIA 2032
- *Use/Operation: assessment defined by the Swiss standard SIA 380*
- Decommissioning: assessment defined by the technical regulation SIA 2032

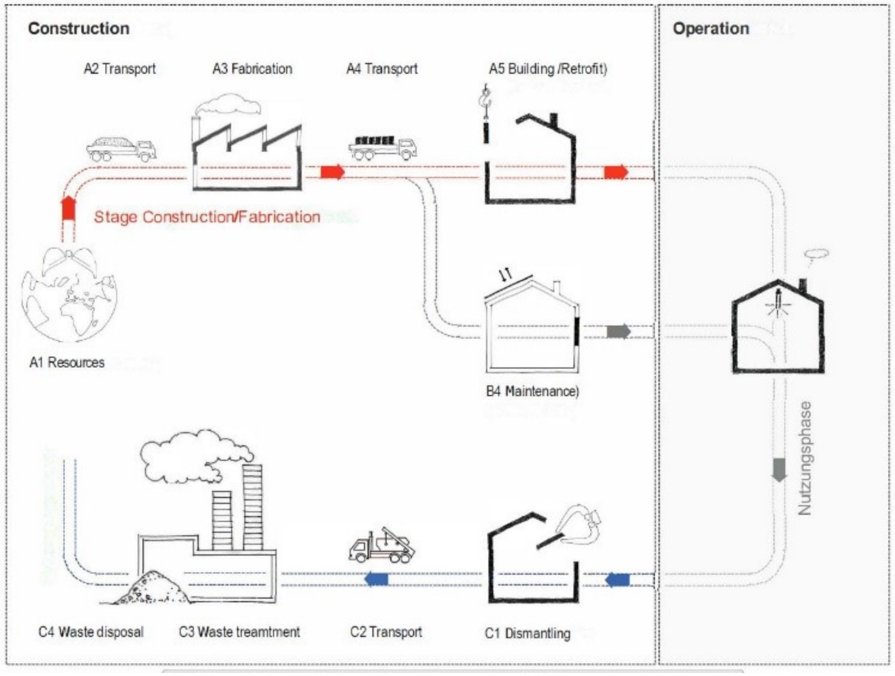

Figure 30: Illustration of the life cycle assessment of a building as defined with the technical regulation SIA 2032 (white box) and SIA 380 (grey box); source: SIA

Tools for Architects and Planners, established national or international standards

Swiss Standards

- Life-Cycle-Assessment LCA and ecodata sources for the building sector in Switzerland by KBOB, SIA

European Standards

- Life-Cycle-Assessment LCA and ecodata sources for the building sector in Switzerland by KBOB, SIA

International Standards

- Life-Cycle-Assessment LCA of products/buildings: ISO 14040
- Carbon footprint of products: ISO 14067

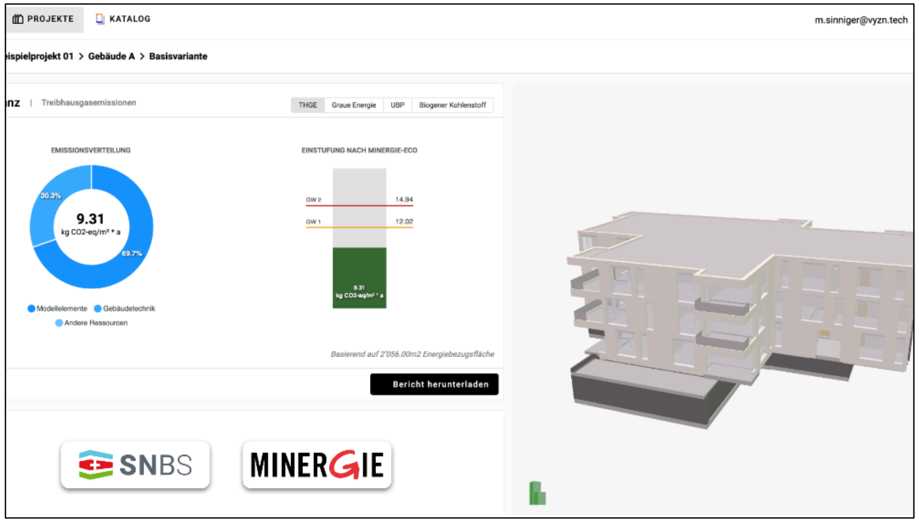

Figure 31: Software-tools combine life-cycle assessments for buildings with BIM-applications. Source: vyzn.ch

How about negative emissions?

There are ongoing discussions over the definition of negative emissions in the building sector. A frequent question is for example: Can carbon emissions that are difficult to avoid (from cement or brick production) be compensated by energy production on site?

The answer in the recent SOE-study is: Local production of solar energy is not valuable as a negative emission technology, because the carbon occurs in a different stage in the building-life-cycle than the emissions from the supply chain.

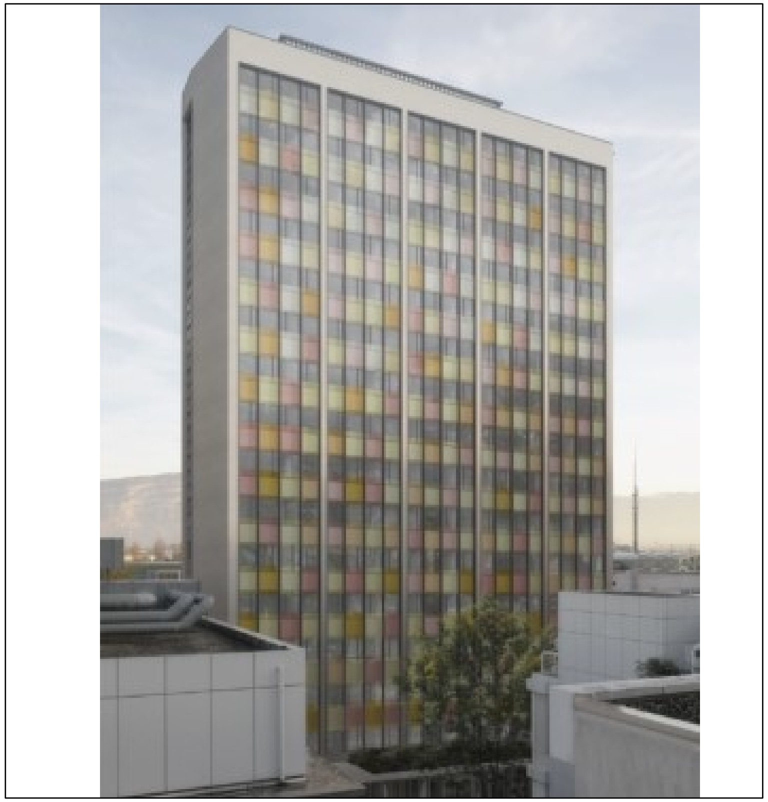

Figure 32: The facade of a refurbished office building in Geneva with integrated photovoltaic. Source: Baud, Früh architects

But are carbon-binding materials a first step to climate-positive building? The scientific approach says: Building materials – biobased or with stored carbon – are not (yet) calculated as negative emissions, because the permanence of the storage is not (yet) given without legal restrictions.

7.2 Key Points

1. Carbon Emission from Buildings:
   Carbon emissions are generated at different stages in the life-cycle. The emissions up- and downstream the building life-cycle become more important than emissions during operation.
2. Strategies for an all-embracing carbon reduction:
   To address an optimization in design and structure, architects and civil engineers will shift their routines to circular and sufficient concepts.
3. Material consumption:
   Bio-based building materials can substitute materials with a bigger carbon-footprint and reduce the footprint of the whole building remarkably. They are also promising to promote a positive impact as they keep carbon stored.
4. Market Standards, Green-Building-Labels and Governmental Regulations:
   In European countries various initiatives address a limitation of embodied carbon emissions. In Switzerland the authorities, professional associations and other property stakeholders are collaborating as drivers for the introduction of target and limit values.
5. Assessment and Commissioning:
   As Switzerland shows: Green building labels and national technical standards for a life-cycle assessment are important instruments for the implementation of climate-friendly buildings.

让我们共同打造气候中和的未来
Building a climate-neutral future together

The Sino-Swiss Zero Emission Building Project is a national-level collaboration jointly initiated and fully guided by SDC and MoHURD. It is implemented by the Swiss intep-skat team and the China Academy of Building Research.

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intep
skat Swiss Resource Centre and Consultancies for Development