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Protecting the Environment and Climate – Creating Living Space – Improving Quality of Life

UBA and KNBau Recommendations for Sustainable Housing and Urban Development

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P.O. Box 14 06
D-06813 Dessau-Roßlau
Phone: +49 340-2103-0
buergerservice@uba.de
Website: www.umweltbundesamt.de

/umweltbundesamt.de
/umweltbundesamt
/umweltbundesamt
/umweltbundesamt

Authors:
UBA: Susanne Schubert, Stephan Bartke, Katja Beckeen, Maresa Breitmeier, Frank Brozowski, Sarah DeTroy, Detlef Grimski, Outi Ilvonen, Hermann Keßler, Dirk Messner, Valentin Meilinger, Ulrike von Schlippenbach, Alice Schröder, Jens Schuberth

KNBau: Annette Hillebrandt, Matthias Lerm, Thomas Lützkendorf, Christa Reicher

In cooperation with other colleagues from the German Environment Agency and members of the KNBau

English by Nigel Pye , npservices4u@gmail.com

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S. 11, 12, 13: Annette Hillebrandt
S. 16, 20, 25, 28: Matthias Lerm
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POSITION // MAY 2023

Protecting the Environment and Climate – Creating Living Space – Improving Quality of Life

UBA and KNBau Recommendations for Sustainable Housing and Urban Development

Dear Readers,

We are facing an enormous challenge: the climate crisis and scarcity of resources require a consistent paradigm shift in housing construction and urban development. Quality of life, health and aesthetics must be combined with environmental, resource and climate protection. Housing provision must become more sustainable in the future. **The goals of the EU's Green Deal and the ambitious national and European climate protection targets cannot be achieved without a change in the building sector.**

However, housing must also be affordable. Housing provision should promote societal cohesion and create a good quality of life and environment by establishing sustainable urban spaces, which requires urban planning, technical, environmental and socio-political answers. This socio-ecological transformation of urban spaces not only necessitates political will, but also a rapid and radical rethinking in crucial action fields of sustainable building, especially in the use of **building materials, heat supply and urban development**. Priority must be given to the preservation, further development, conversion and re-use of the existing building stock to avoid high energy and source streams and additional land take due to new buildings.

This **position paper of the German Environment Agency** and the **Commission for Sustainable Building (KNBau)** at the German Environment Agency presents **recommendations for the creation of affordable housing that is environmentally, climate and resource efficient,** and at the same time **climate-adapted, health and socially compatible**. The recommendations are primarily **addressed** to **federal policy-makers**, especially the departments of building and urban development, environment, climate protection, transport and health.

The proposals show the spectrum of potential actions. There are measures and instruments that are easy to implement and could be tackled quickly **("low-hanging fruit")**. Examples include ambitious climate protection in new buildings (cf. Section 2.1) or flexible floor plans in conversions and new buildings enabling long-term use (cf. Section 4.1).

Other measures and instruments are more difficult to implement, or the concrete solutions and implementation paths are still open (**"sticky issues"**). Examples are the use of alternative biogenic building materials (cf. Section 2.2.), the achievement of a circular land management (cf. Section 2.5) or the proposals to stop the trend of increasing per-capita living space (cf. Section 3.4). Politicians and researchers must quickly find sustainable answers to the question of what appropriate and feasible solutions are available for the increase in living space which is problematic in terms of environmental, climate and resource policy.

There are numerous measures and instruments where we already have a **political and social consensus** that facilitates the implementation of solutions. Good examples are the provision of a better planning basis for climate-sensitive urban development (cf. Section 2.4) and intensive research into the options of sustainable housing provision that is both resource-efficient and adapted to the requirements of climate change (cf. Section 4.4).

However, there are also **controversies** where not all stakeholders share a common view about the solution and implementation path. Examples are the introduction of compulsory solar energy systems in all residential buildings at suitable locations (cf. Section 2.1) and the creation of better market access for secondary building materials through a primary building materials tax (cf. Section 2.2). Here we need to explain more clearly where environmental and climate protection advantages lie, and we need good, practical implementation methods and transformation alliances for implementation.

With regard to turning the levers for an urgently needed change, we note that (cf. Chapter 4) our attention must focus much more strongly on the building stock for a successful socio-ecological transformation. Housing supply and new building construction must primarily constitute **climate- and resource-efficient conversions of existing buildings**. In this context, construction methods using circular approaches and climate- and resource-efficient building materials must gain in importance. **The most climate-efficient housing is that which does not have to be newly built**.

Where new buildings are unavoidable, greenhouse gas emissions in the construction and use phase, plus resource use and land take must be reduced to a minimum. This is incorporates **circular economy, resource conservation, greenhouse gas neutrality and net zero land-take** – all at the same time. It must include resilient urban structures adapted to climate change, the recovery of public spaces, enabling closer social interaction in urban neighbourhoods, the preservation and development of beautiful and economical buildings, and the preservation and expansion of green-blue infrastructure in urban areas. We need new, innovative planning approaches such as "triple inner urban development", which sustainably combines housing, mobility and green spaces, and a stronger focus on the neighbourhood as a crucial level of action.

Our discussion about the recommendations has shown that **conflicting goals** must be addressed at different levels. One level concerns the framework conditions of political action for sustainable housing and urban development. This includes the societal and social situation of prosperity and poverty, which goes far beyond the sphere of influence of housing and urban development.

Another level is presented by the conflicting goals that are influenced by measures and instruments at the interface of environmental, building and urban development policy. This includes, for example, the question of how we can **promote inner densification to save land and at the same time ensure the preservation and qualification of open spaces**, e.g. for climate adaptation, recreation and health.

Another level concerns the area of conflict of **sustainable development in the relationship between town and country**. We need a structural policy that strengthens shrinking areas and contributes to limiting the pressure of residential area increase on conurbations. Finally, a core concern is the conflict which arises between **new buildings and conversion of existing buildings**. The preservation of existing buildings must be given clear priority – this in turn requires the implementation of high energy efficiency standards in existing buildings as well.

This constructive resolution of conflicting goals and areas of conflict requires **answers** to environmental, building and urban development policy that go beyond competence boundaries – and the courage to start at their points of friction to find potential solutions. This Position Paper aims to contribute precisely in this respect.

Prof Dirk Messner
President, German Environment Agency

Prof Christa Reicher
Chairperson, KNBau at UBA

Dr habil Matthias Lerm
Chairperson, KNBau at UBA

Prof Annette Hillebrandt
Vice-Chairperson, KNBau at UBA

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1 Achieve Ambitious Goals for Housing Provision, Environmental and Climate Protection Simultaneously

The Federal Government has set itself ambitious goals of providing for up to **400,000 new residential units** per year, a total of up to 1.6 million in this legislative period, to meet the urgent demand for affordable housing. At the same time, **ambitious goals in environmental, climate and nature protection** must be achieved, not least against the background of the European Green Deal.

Emissions and Resource Consumption – Dimension in a Few Figures

The building sector is a crucial factor: around **30-35% of greenhouse gas (GHG) emissions** in Germany are due to construction, maintenance and operation of buildings (see Figure 1). Resource consumption (soil and land, raw materials, water, etc.) is also enormous – **50% of the total raw material extraction** in Germany is needed for building materials[1] and building products are the **second largest user of plastics**[2] after packaging.

At the same time, construction and demolition waste accounted for **55% of the total waste generated** in Germany in 2020.[3]

Therefore, no one wants "business as usual" in housing construction. A critical discussion must pose the questions: how, where and for whom should housing be created? What kind of housing is needed? How do we use the existing stock and develop it further? What does a strategy that contributes to environmental and climate policy objectives look like? In addition, shortages of raw materials and crisis-related supply chain problems, shortages of skilled workers and tight land markets require new, innovative approaches in many cities and regions. The crucial factor will be how **housing development can succeed in an environmentally and socially compatible** manner and how the climate protection goals to which Germany has committed itself can be achieved in the short and long term. Urban development is not only a societal and climate policy challenge, it is above all a socio-political opportunity. Innovative ideas such as those being developed within the **'New European Bauhaus' EU initiative** show the way: they intend to promote building transition and in doing so establish a new relationship between climate and environmental protection and building culture and aesthetics for socially inclusive spaces with a high quality of life. **Quality of life** will become tangible for citizens in their neighbourhood. The impacts of climate change and loss of biodiversity can be detected, as do successful or missing adaptation measures, building developments and changes of use in public space.

1.1 Housing and Urban Development as an Important Factor for Environmental, Resource and Climate Protection

The construction and building sector repeatedly failed to meet the set climate targets in terms of direct greenhouse gas (GHG) emissions during operation. The amendment of the Federal Climate Change Act (KSG) 2021 further tightened previous targets. **Greenhouse gas neutrality must be achieved when refurbishing and constructing new buildings with regard to the complete life cycle** of the real estate over the production, use and demolition phases of buildings and infrastructure.

Every new building activity is accompanied by further resource demands and GHG emissions. These must immediately be minimised and **climate-adapted building methods and neighbourhood development** (nature-based solutions such as natural cooling and urban green spaces, water retention/infiltration, etc.), drastic reduction of GHG emissions and integration of renewable energies (especially solar energy, geothermal energy and ambient heat using heat pumps) must be applied. From an environmental point of view, additional land conversion and sealing and the associated **pressure on open spaces and loss of ecosystems and biodiversity** remain particularly critical in connection with new buildings, especially single-family housing estates on city outskirts. Therefore, the **use of existing buildings** is of particular importance. This issue, **including renovation, conversion and further construction, must become the focus of efforts to create sustainable housing.** The aim is to improve the quality of the existing stock, to use it for longer periods of time

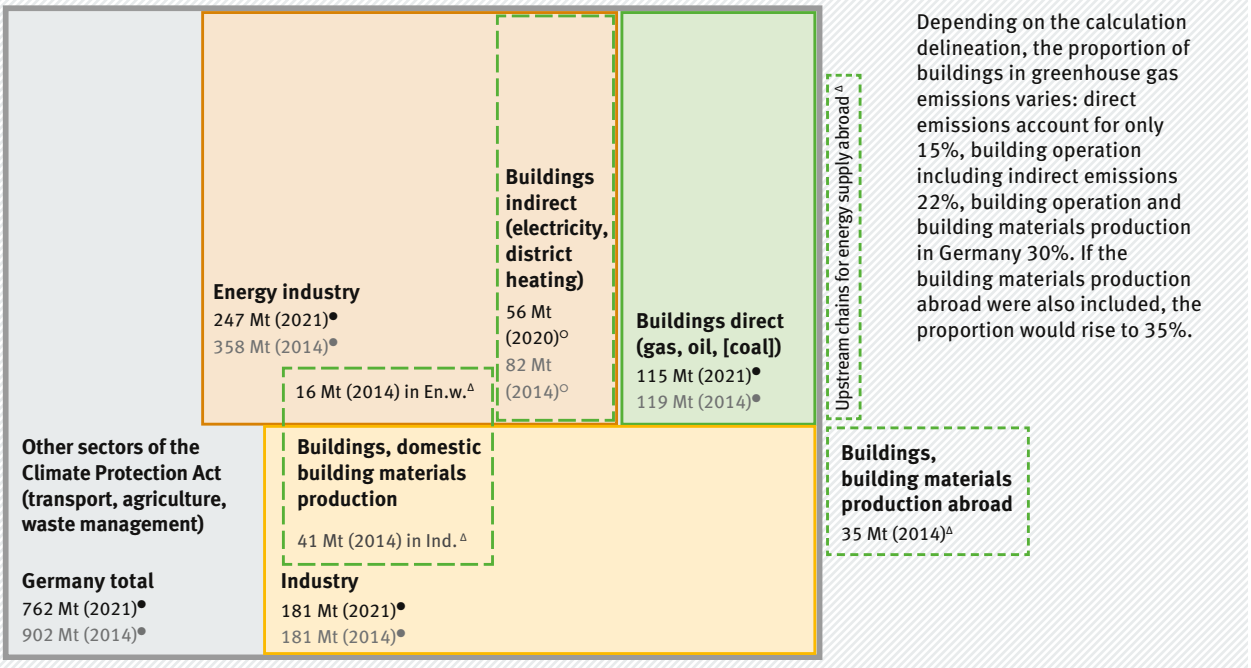
through proper maintenance, and to convert and extend it according to demand and in compliance with environmental and climate protection goals.

1.2 Overarching European Framework and Goals

The national goals cannot be considered in isolation from the EU level. The European Commission's **European Green Deal** (EGD) represents an ambitious transformation programme. Its aim is to transform the European economy in such a way that no net GHG emissions are released in 2050 and economic growth is decoupled from resource use. The EGD is a comprehensive programme for **the sustainable transformation of Europe into a GHG-neutral continent**: restoring biodiversity, preserving the EU's natural capital and protecting human health and well-being from environmental and social risks. The European Climate Change Act is the key building block, which stipulates the achievement of GHG neutrality by 2050. By 2030, the EU's GHG emissions should be reduced by at least 55% net compared to 1990 through measures of the comprehensive 'Fit for 55' package of laws. Within the framework of the EGD, the Commission presented the 'Zero Pollution Action Plan' in May 2021 with the aim of significantly reducing the pollution of air, water and soil by 2050. Ambitions are also high in other policy areas: the **'renovation wave'** for private and public buildings aims to promote energy efficiency and affordability of buildings. The EU Soil Strategy enshrines the goal of reducing land-take to 'net zero' by 2050. The **New European Bauhaus (NEB)** initiative gave the EGD a face. NEB is a creative interdisciplinary initiative that forms an interface between art, culture, social inclusion, environmental and climate protection, science and technology to establish a sustainable, liveable, beautiful and inclusive future in cities, municipalities and rural areas. The interdisciplinary New European Bauhaus Movement links the EGD's ambitious goals for more environmental and climate protection with the living environment and quality of life of people in Europe.

Figure 1

Proportion of buildings in the greenhouse gas footprint



● https://www.umweltbundesamt.de/en/press/pressinformation/greenhouse-gas-emissions-rose-45-percent-in-2021
○ UBA calculations based on Working Group on Energy Balances, Anwendungsbilanzen (Application balances), as of 09/2021; German Environment Agency, Central Emissions System, as of 10/2022; German Environment Agency, CO_2-Emissionsfaktoren (CO_2 Emission factors, as of 06/2022.
△ Umweltfußabdruck von Gebäuden in Deutschland (Environmental footprint of buildings in Germany), BBSR online publication No. 17/2020 [Attention – GHG possibly with upstream chain (unclear), and for residential buildings incl. household electricity]

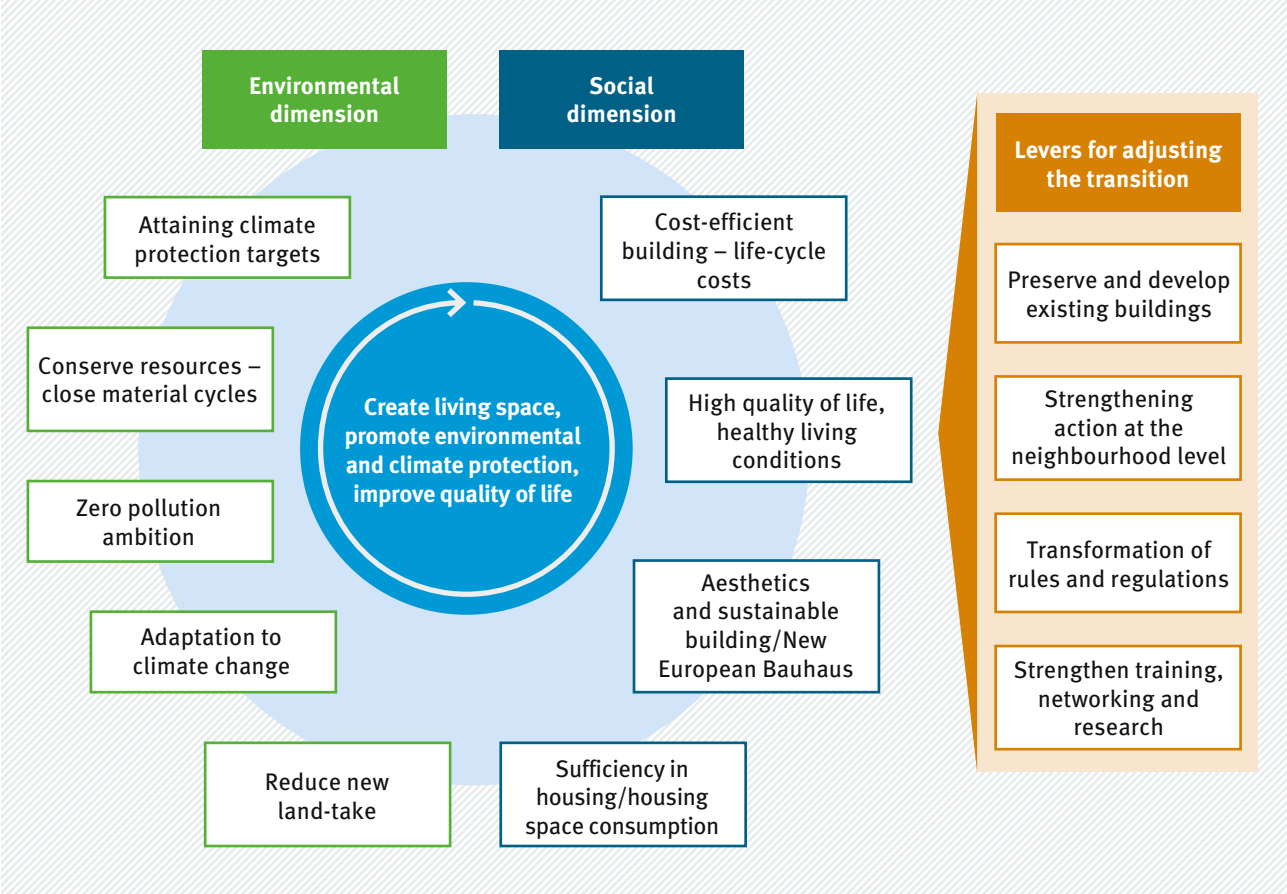
1.3 About This Position Paper

This paper presents key recommendations by the German Environment Agency together with the Sustainable Building Commission (KNBau) at the German Environment Agency on the affordable provision of housing that protects the environment, the climate and resources and is climate-adapted, health-friendly and socially acceptable. The recommendations are primarily addressed to Federal policy-makers in the fields of building and urban development, the environment, climate protection, transport and health. In addition, other stakeholders are addressed such as political decision-makers at EU, state (Länder) and municipal level, associations, planners and the professional public. We intend to contribute to the discussion from the perspective of environmental and climate protection, including the social dimension, to achieve the goals of housing provision in connection with the goals of sustainable and future-oriented urban development.

The structure follows the European Green Deal (EGD) focus points and applies them to the challenges of housing provision: environmental goals for decarbonisation, circularity, zero pollution and preservation of natural capital plus social goals with participation aspects which are considered in accordance with the New European Bauhaus mission statement together with the aspects of cost accuracy and aesthetics. The paper is rounded off by a chapter on the levers for adjusting that lie across other objectives and fields of action and are crucial for transformation.

Figure 2

Overview of the central requirements



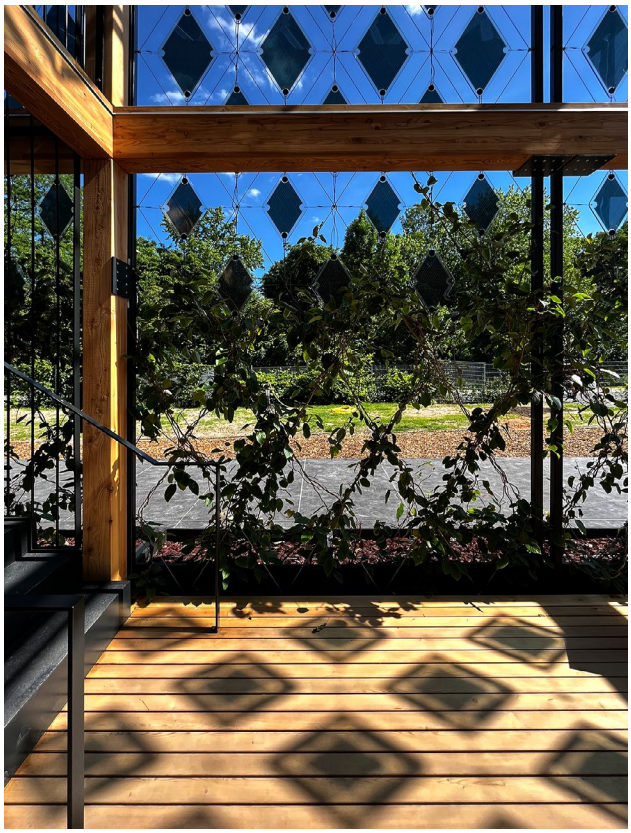
Source: German Environment Agency

2 Environmental Dimension

Urgent challenges of environmental, climate and resource protection must be given high priority during housing provision. German and European goals for climate and resource protection plus the zero-pollutant ambition will only be achieved if we build and renovate differently and use existing buildings sustainably. The necessary adaptation to the consequences of climate change and the sparing use of resources and land put high demands on the design of buildings and on integrated neighbourhood and urban development.

2.1 Attaining Climate Protection Targets – Anticipating Climate Change

The Federal Climate Change Act (KSG) stipulates that direct GHG emissions from existing buildings must drop by 43% from 2020 to 2030 in order for Germany to achieve net GHG neutrality by 2045. According to a 2021 projection report of the Federal Government, current policy will fail to meet these targets. Additional housing that is not fully provided with renewable energy increases GHG emissions from existing buildings.



Combination of PV elements and a façade made of reused wood

In addition to operation, the production of building materials and service utilities, such as heating, ventilation and air conditioning, causes high GHG emissions which, however, must be attributed to industry in the sectoral consideration of the KSG and reduced just as much. Building with renewable raw materials, durable materials and the consistent circular management of building materials have a positive effect on the life cycle balance of new buildings and extensions and reduce these upstream GHG emissions. Climate change exacerbates the situation by leading to hotter summers, which cause cities and indoor spaces to overheat more. This increasingly affects the health of the inhabitants, and the demand for air conditioning and cooling also increases, which counteracts the climate protection goals.

Goals

GHG emissions caused by new housing must be kept to a minimum. However, they are not yet completely avoidable, especially in the production of climate-friendly building materials. According to the state of the art, the use phase can become GHG neutral based on energy efficiency and renewable energies. Where this is not yet possible today, we need approaches that lead safely to GHG neutrality by 2045 and include them in the manufacturing phase. Preventive measures should be taken against the progressive overheating of indoor spaces in summer and urban planning and open space planning measures should facilitate precautions. This should include the use of nature-based solutions such as green façades or roofs.

Key recommendations

- New housing, both in unavoidable new construction and in converted existing buildings, should
  - obtain a level of thermal insulation as specified for the “Efficiency House 40” or the Passive House as an additional criterion,
  - be supplied by heat pumps (cf. Section 4.1) or by renewables (i.e. not locally by fuels) via heat grids,
  - be constructed from building materials that are as climate friendly as possible (see Section 2.2) and
  - be operated as efficiently as envisaged by planning.

- The level of thermal insulation should only be reduced in the case of renovation in individual cases where renovation would otherwise be prevented for technical or, despite the use of subsidies, economic reasons. A new replacement building should only be permitted if its life-cycle greenhouse gas emissions are lower than those of the best possible renovation.
- Summer thermal insulation should be measured against data sets that describe the future warmer climate to prevent overheating in summer in the long term.
- Comprehensive legislative initiatives for climate- and resource-efficient construction and modernisation should be launched, e.g. the introduction of an obligation for solar installation on residential buildings where solar installations can be operated economically.

Climate-Neutral Existing Buildings in 2050

Concepts and available technologies that can transform existing buildings into a nearly climate-neutral state are presented in the UBA publication 'Klimaneutraler Gebäudebestand 2050: Energieeffizienzpotenziale und die Auswirkungen des Klimawandels auf den Gebäudebestand' (Climate-neutral existing buildings 2050: Energy efficiency potentials and the impact of climate change on existing buildings).
▸ https://www.umweltbundesamt.de/en/publikationen/ghg-neutral-eu2050

Wall structure using straw insulation

2.2 Conserve Resources, Avoid Waste, Close Material Cycles

A quarter of GHG emissions associated with buildings over their entire life cycle can be attributed to the upstream supply chains of manufacturing, construction, renovation and direct emissions from the construction industry. At the same time, immense waste streams from the construction sector have testified to wasted resources and inefficient uses for decades. In 2020, for example, building and demolition waste accounted for somewhat more than half of the waste generated in Germany (cf. Box, Chapter 1, p. 4). With available landfill space becoming scarce at the same time, this will foreseeably result in cost increases for depositing building waste in landfills and thus higher construction costs for any future repair or demolition. The supposedly high rates of building waste recycling also include downcycling – closed material cycles without loss of mass or quality are very rare. Direct re-use of old building components and materials is the most effective way to conserve resources. Although raw materials are scarce worldwide, reuse is currently still a niche activity.

Goals

We need a paradigm shift – from the predominantly linear to a circular building industry: The re-use and further use of existing buildings (see Section 4.1), recycling of demolition materials at the highest level and building design for future recycling (RC) must go hand in hand in the future. The foundations must be laid for a long utilisation phase, the options of later conversion and cycle management of the materials used during demolition as early as during the planning of new buildings or renovation.

The production of new energy-intensive building materials and the consumption of finite resources such as metals, sand, gravel or gypsum must be reduced through the use of recyclable products and those based on renewable raw materials and through material-saving construction. The potential of construction as a sink must be clearly identified and exploited in the future. Current calculations indicate that greenhouse gas-neutral construction and long-term maintenance of buildings is possible through intensive use of wood. Greenhouse gas emissions from the necessary concrete components in the construction phase can be reduced by the optimised use of wood[4]. Only fully recyclable construction products or those with at least a high

recyclate content or that are low in pollutants, reusable, durable and repairable should be placed on the market.

Environmentally Friendly Building Products for Sustainable Building:

The Blue Angel database makes it easy to find building products on the German market that meet strict requirements for harmful substances for the environment and health on a daily basis.
▸ www.umweltbundesamt.de/publikationen/klimaneutraler-gebaeudebestand-2050-0 z

Clay plaster on straw insulation

Key recommendations

- Legally binding guidelines on resource-efficient procurement of construction projects, especially by the public sector.
- Create nationwide return options for building components possibly using cost sharing models by the building product manufacturers and clarification of accepting warranty obligations.
- Develop a prospective, knowledge-based material register for existing buildings in the region and an urban mining strategy analogous to the requirement of the Federal Government's Resource Efficiency Programme (ProgRess III).
- Use the powers of the Circular Economy Act (Kreislaufwirtschaftsgesetz) in conjunction with working towards European solutions for resource-efficient construction that make full use of the regulatory framework of the EU Ecodesign Regulation and the EU Construction Products Regulation as a substitute or as a supplement at the Federal level and working towards the corresponding anchoring of resource-efficiency in the state building codes.
- Introduce a "Top Runner Programme" for recyclable, CO_2-reduced products.
- Introduce a primary building materials tax at a market level specifically for the use of gravel, sand and natural gypsum in the building industry to enable non-discriminatory access to regional and local recycling markets for recycled building materials.
- Promote and harmonise timber construction methods and cascade use of timber as a building material with near-natural forest conversion within the scope of availability.
- Low-emission, less climate-damaging alternative building materials (hardwood, clay, loam, straw, etc.) and construction methods (lightweight construction methods), low-tech approaches and research and promote/use the potential of buildings as sinks.
- Check whether the Commercial Waste Ordinance (Acquisition and Separation) and the Bio-Waste Ordinance (Input Materials for Composting) should be adapted in view of a strong increase in the use of compostable building products such as straw, which are suitable for bio-waste recycling.

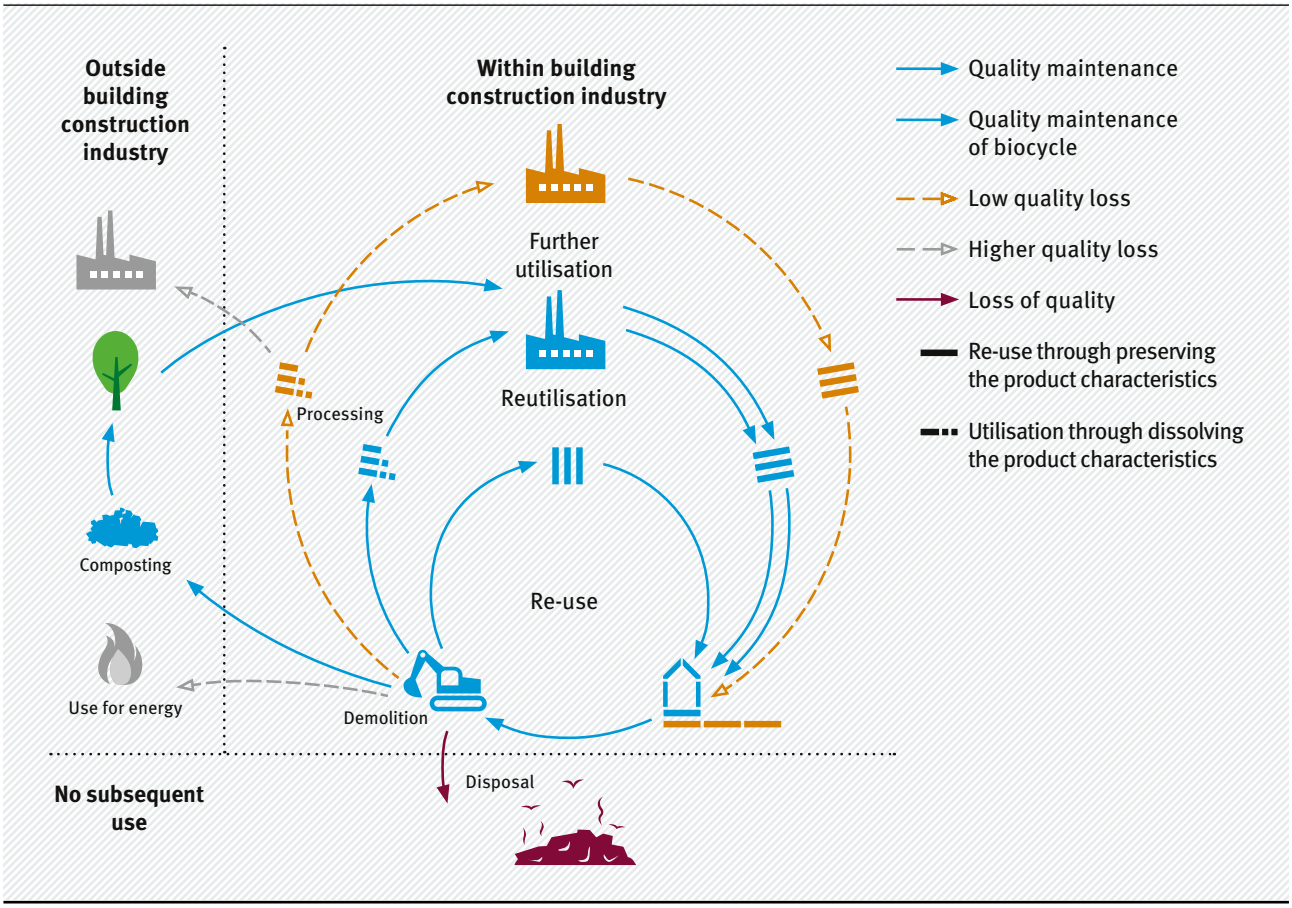
Urban Mining

Information about the options and opportunities of urban mining can be found in the Atlas Recycling[5] and here: ▸ www.urban-mining-design.de (German)

The 'Urban Mining Index' tool enables architects to achieve the highest possible circularity rate of the materials planned and used as early as in the planning stage.
▸ https://urban-mining-index.de/en/

Figure 3

Material cycles in the building industry



Source: Annette Hillebrandt, Petra Riegler-Floors, Anja Rosen, Johanna Seggewies: Atlas Recycling, Edition DETAIL, München 2018

2.3 Achieve the Zero Pollution Ambition in the Construction and Building Sector

As part of the European Green Deal, the European Commission has pronounced the zero pollution ambition for a pollution-free environment (air, water, soil). The construction, operation and demolition of buildings contribute to the pollution of air, water and soil causing related burdens, especially in conurbations. Examples include organic additives that can leach from plasters, façade paints (e.g. biocides Diuron and Terbutryn) or roof waterproofing membranes (e.g. root protection agents Mecoprop and MCPA) and reach concentrations in the rainwater cycle that exceed limiting values for surface waters. Building products are highly significant as a source of indoor pollutants because they are difficult to remove. Waiving building product tests in advance can lead to high demolition costs in the event of damage.

To date, Germany often lacks binding specifications for the release of added pollutants from building products that would allow precautionary measures to be taken before installation. Diffuse pollution from buildings is one reason why attaining the environmental quality targets of the Water Framework Directive, the Surface Water Ordinance and the Groundwater Ordinance in urban areas is at risk. However, careful planning can ensure a non-toxic environment and indoor air that is safe for the occupants' health. The lowest possible pollutant content in building materials is a prerequisite for their cycle management at the end of their use.

Studies indicate that low pollutant building products can reduce operating costs (ventilation) so that higher acquisition costs are compensated for[6].

Goals

Prevent or reduce material pollution of the environment, in particular of water bodies and human health using appropriate selection of building products and applying constructive measures.

Key recommendations

- Sufficient legal basis in the Federal legislation should provide active support to the states (Länder) in establishing a high protection level for precautionary environmental and health protection by applying adequate minimum standards for the release of pollutants incorporated in building products. The states (Länder) should increase the protection level in the state building codes accordingly so that risks due to emissions from building products are prevented.

- Advocate initiating an EU Directive on healthy indoor air at a high level of protection to close the gaps in the EU Construction Products Regulation.

- Transfer de minimis soil and groundwater thresholds from environmental law to building products in building construction, e.g. analogous to the methodology of the Substitute Building Materials Ordinance.

- Specify products without material contamination in plans for housing construction and explicitly demand them in the invitation to tender.

- Enable a non-toxic, healthy environment through design: specify large roof overhangs providing shade to protect against solar radiation and driving rain, façades without biocides, adequate ventilation for healthy indoor air, planting greenery on façades and roofs.

- Ask the European Commission to include the zero-pollutant target in the amendment of the EU Construction Products Regulation[7].

- Rapidly develop the legal framework of the warranty for installation of reused second-hand elements.

2.4 Driving Forward Adaptation to Climate Change

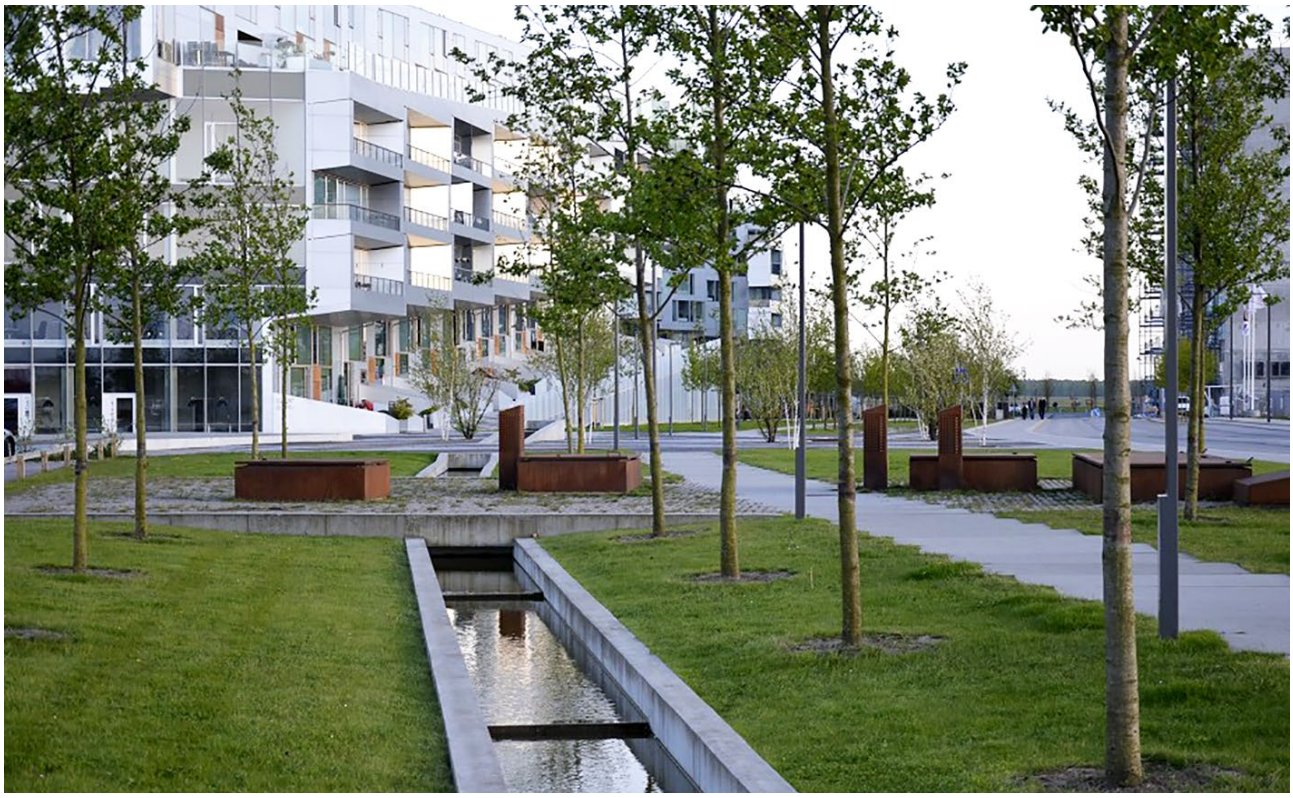
The Federal Government's climate impact and risk analysis shows that Germany's cities and regions are increasingly affected by the consequences of climate change.

Rising maximum temperatures and the lengthening of summer heat waves exacerbate the health risk from urban heat-spot effects, especially for vulnerable population groups such as the elderly and chronically ill. The high surface pressure in cities due to structural development limits the possibilities of expanding urban green space to reduce heat.

More frequent heavy rainfalls and associated combined sewer overflows and floods can cause significant damage to buildings, infrastructure and the environment and endanger human health and lives. Particular attention is also paid to locations at risk of flooding (e.g. in river valleys/along coasts).

Goals

In accordance with the precautionary principle of the German Strategy for Adaptation to Climate Change, future housing provision should be organised in such a way that damage to people and the environment through climate change is avoided or reduced. In cities, this applies in particular to climate risks from heat, drought and heavy rain. New housing construction itself must be protected from climate risks, e.g. through a suitable choice of location and through technical and nature-based measures. In particular, nature-based measures such as green structures, trees and bodies of water for cooling and as retention areas for rainwater as well as green structures on buildings such as roof and façade greening are also essential for existing buildings. On the other hand, the urban climatic effects of new housing development such as the increase in urban temperatures due to additional surface sealing and the reduction of cold air generation, must be avoided, minimised or compensated for as far as possible.



Green and blue infrastructure for climate adaptation

Key recommendations

- Accelerate the implementation of the water-sensitive city/“sponge city“ model, e.g. by specifying the climate protection clause of Section 1a(5) BauGB with regard to necessary precautions for prioritising on-site precipitation infiltration as a component of climate-adapted water retention and for coping with increasing heat stress in cities.

- Encourage and support applicants to make use of the opportunities for climate-adapted construction within the framework of urban development funding, especially for green roofs and green facades as well as combined solar green roofs. Encourage that no funding be granted without a contribution to climate protection and adaptation.

- Improve the planning basis for climate-adapted urban development, in particular by establishing a framework for municipal climate risk analyses in a Federal climate adaptation law and by making it mandatory to draw up municipal heavy rainfall risk maps and heat stress maps.

- Draw up heat action plans based on local climate risk analyses in the communities and take them into account in housing provision and when upgrading existing buildings to cater for the climate (e.g. shading by city trees and external blinds).

- Revision of sub-legislative regulations and standards that oppose the climate-adapted urban design with nature-based solutions (e.g. ‘Directives for the Design of Urban Roads (RASt 06)’, ‘DIN 1998 Placement of service conduits in public circulation areas – Guideline for planning’).

Climate Adaptation Database

The German Environment Agency’s Climate Adaptation Database provides a broad overview of successful climate adaptation implementation projects in various spatial and social contexts and provides inspiration.

▸ www.umweltbundesamt.de/themen/klima-energie/klimafolgen-anpassung/werkzeuge-der-anpassung/tatenbank (German)

2.5 Reduce New Land-Take – Use Existing Potential, Stop Urban Sprawl

In Germany, an average of 54 hectares of land per day was taken up for new settlement and transport areas in 2020 ('land-take') and built on with residential housing, among other things. This means that Germany is still far from the targets it set itself in the German Sustainability Strategy of reducing land-take to less than 30 hectares per day by 2030 and to 'net zero' by 2050.

Due to land-take, open space is lost and is no longer available for important ecosystem services, biodiversity and other uses such as natural climate protection, food production and the expansion of renewable energies.

Especially in shrinking suburban and rural areas, continuing urban sprawl is also unreasonable from an economic perspective. With a stagnating or shrinking population, there are more costs per head for the maintenance and upkeep of existing buildings and infrastructure.

Land Calculator

The German Environment Agency's land calculator enables a simple estimate of what the nationwide target of using less than 30 hectares of land per day in 2030 would mean for land-related planning in communities and regions. ▸ https://aktion-flaeche.de/flaechenrechner-neuem-gewand (German)

Goals

Housing provision and land saving must be considered together. The Federal Government and the states (Länder) must provide instruments and show exemplary solutions on how the unavoidable construction of new housing can be realised primarily through the existing inner urban development potential in the cities and municipalities, and how the potential in existing building stock can be mobilised and used to a greater extent for housing provision. The existing settlement density in cities and municipalities must be at least maintained, and if possible even increased. Housing provision must not lead to further new land-take for settlement and transport purposes as there is sufficient existing land potential in Germany to achieve the housing policy goals.

Key recommendations

- Specify a concrete roadmap towards 'net zero' land-take by 2050, i.e.
  - Concretise the Federal Government's '30 hectares minus X' land use target and set linearly decreasing concrete interim targets until 2050 as well as agree on regional land use targets with the Federal States (Länder) and implement them in a legally binding manner,
  - Immediately implement 'net zero' land-take for new housing construction by using existing land potential (for qualities in inner urban development, see Chapter 3.1),
  - Develop realisation concepts for a circular land management ('net zero'), identify concrete measures and implement them promptly.
- Promote inner development, e.g. by identifying and developing land reserves, taking GHG emissions and follow-up costs into account when developing building land.
- Reduce the applicability of subsidy instruments for land-intensive small housing developments (e.g. KfW (Reconstruction Credit Institute) programmes, children building allowance, municipal family building land subsidies).
- Tighten up the BauGB for land-saving urban land use planning in outdoor areas, e.g. adapt Section 1(3) BauGB, Section 1a(2) BauGB and Section 35 BauGB and abolish Section 13b BauGB.
- Establish a municipal funding programme 'brownfield recycling for housing and the trend towards urban green infrastructure', especially for the conversion and re-use of brownfield sites.
- Disseminate good examples and initiate competitions for compact, multi-storey housing, also in suburban areas, and for space-saving and compact commercial buildings.

Environmental Impact of Compact vs. Small-Scale Building Types

The construction of small-scale housing such as detached (single family) and semi-detached (two family) houses, requires about twice the heating and cooling energy demand compared to compact building types[8]. Detached houses also cause more greenhouse gases and resource demand (cumulative energy demand) per m² in their life cycle than multi-family houses[9].

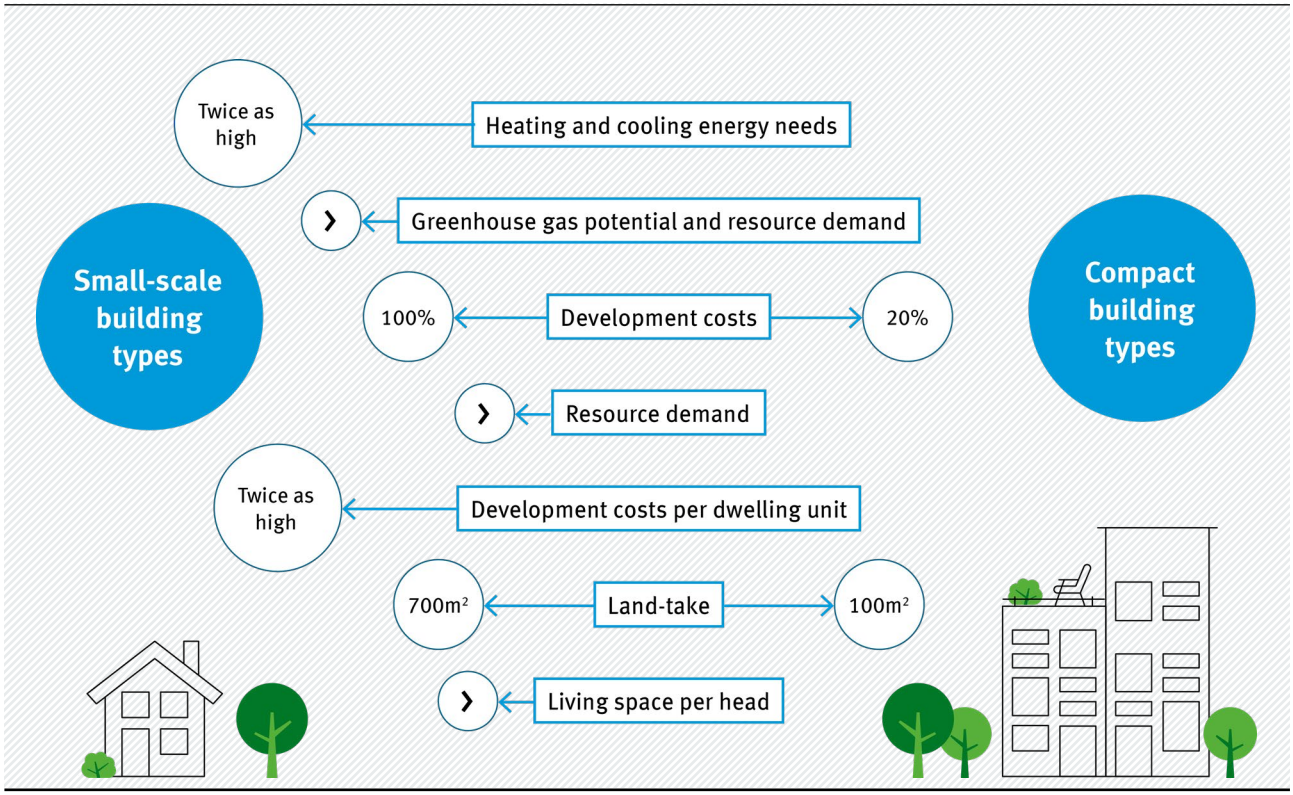
The negative balance also applies to development costs. If small-scale building types are set at 100% of the costs, for compact building types (open multi-storey rows, perimeter block development)[10]this should be set at around 20%. This also applies to the resulting resource requirements.

The technical servicing takes place independently of the settlement density, so expenditure increases disproportionately in relation to the decreasing development density. Based on this, the rule of thumb that 'half the density = twice the development costs per housing unit' can be formulated[11].

The same applies to land-take. Small-scale residential housing requires an area of about 700m² per dwelling, while compact building types only need about 100m² per dwelling[12]. The living space per head is also generally higher in detached and semi-detached houses than in more compact building designs. The low density of the small-scale buildings also makes it more difficult to access them by means of public transport and thus favours a dominance of motorised private transport.

Figure 4

Environmental impact of compact vs. small-scale building types



Source: German Environment Agency and KNBau

3 Social Dimension

Housing is a basic need and a central task of public utilities and services. Housing is an important social issue in many communities in Germany – the costs of building and housing are often at the forefront of discussion and must be considered together with ecological requirements. Housing provision has an impact on the quality of the built environment and the way people live together.

3.1 Creating High Quality of Life, Healthy Living Conditions, Green and Low-Emission Cities

In addition to attractive urban development, quality of life in urban areas requires public spaces with high amenity qualities in which people from different social backgrounds can meet and which encourage them to linger and take on stewardship. Quality of life is created in diverse spaces where people can go about their daily lives within the local area (living, working, day care, shopping, leisure) that can be experienced on foot and is not dominated by motorised private transport (see also Section 4.3). In addition to social security, an intact environment promotes the healthy personal development and is an important prerequisite for a good quality of life. The reduction of environmental pollution such as pollutants in building materials, fine dust or noise are important issues for sustainable housing, neighbourhood and urban development, both in new construction and in the further development of existing buildings.

The impacts of global warming on human health and the resulting need for adaptation are of great importance. Questions of social (unequal) distribution of environmental burdens and environmental equality play a central role in this context. Income level is a crucial factor for housing conditions - people with high incomes more frequently live in locations with good environmental qualities (green, low noise), while people with lower incomes more frequently live in locations with multiple burdens. Against this background the importance of constructing social housing is crucial, which at the same time creates healthy living conditions through both good environmental standards in the building and the living environment (See also Section 3.2).

Biological diversity is an important part of an intact urban environment. Urban areas offer a variety of habitats for animal and plant species in a small space. At the same time, urbanisation, sealing of surfaces and the unchecked growth of cities continue to be one of the main threats to biodiversity.

Environmental Equality Toolbox

The web-based 'Environmental Equality Toolbox' offers stakeholders from local government and politics information and tips on the subject of environmental equality. Interested parties can find arguments for a community's commitment to environmental equality and practical information, e.g. on how the topic can be integrated into urban development concepts. Practical examples and checklists are also available.
▸ https://toolbox-umweltgerechtigkeit.de/ (German)

Goals

Environmentally and socially compatible housing provision must be linked to ambitious environmental quality goals, and healthy living in cities and municipalities must be given high priority. A key issue of sustainable urban development is a new way of dealing with the scarce resource of land, both in terms of building types and with regard to transport, open and green spaces. The model of triple inner urban development offers an approach to a new urban division of land, which aims to understand and develop built spaces, open spaces and mobility options in cities in the spatial networks and content-related links as a basic framework for sustainable urban and neighbourhood development. Lastly, in the course of housing provision, it is important to strengthen the protection and promotion of animal species that live in buildings in the sense of 'living buildings' and the development of biodiversity in the living environment.

Green living environment design and quality of life in the Vienna Aspern district

Key recommendations

- Strengthen environmental protection, climate adaptation, environmental equality and biodiversity in inner urban development, for example through further developments in building law, Section 13a, Section 34 and Section 176a BauGB.
- Expand the model of dual inner urban development to a model of triple inner urban development: new ways of dealing with land as a resource and linking climate-adapted and sustainable building, blue-green infrastructure and mobility transition in urban areas.
- Strengthen environmental and social concerns in urban development funding through award criteria such as high demands for climate-friendly neighbourhood design, innovative mobility solutions, multi-functional public spaces and the improvement of environmental equality.
- Strengthen green space planning and introduce mandatory open space design plans for building applications to bundle the concerns of climate adaptation, recreation, quality of life and biodiversity also in the unplanned inner areas.

Definition of the Model of Triple Inner Urban Development

The German Environment Agency has presented a definition of a “triple inner urban development” planning model and a classification of the background for actions and the opportunities from the perspective of environmentally oriented urban development:
▸ https://www.umweltbundesamt.de/publikationen/triple-inner-urban-development-definition-tasks

3.2 Cost-Saving Construction – Assess Total Life Cycle Costs

By 2015, the Building Cost Reduction Commission had developed proposals on how stakeholders can contribute to reducing building costs on all levels[13]. Environmental and climate protection were not explicit objectives in the proposals, but the recommendations were based on current building standards while not softening them per se. A large part of these suggestions has still not been implemented. There is also a whole range of cost-saving approaches that reduce building costs without compromising building quality (see box below). These include serial building and renovation with high standards and desirable aesthetics.

Cost Saving in Housing Construction

In 2017, the ABG Frankfurt Housing Company built a highly standardised type of residential building whose energy standard nevertheless almost reaches passive house quality. The concept focuses on volume-optimised cubature, access via staircases in front of the façade, optimised structural calculations with targeted load transfer via a small number of components, masonry sections adapted to the brick size, and the relocation of building services to a small number of engineering shafts. The construction costs for building construction and plant engineering amounted to only 1,090 euros per square metre, which is 36% less than those for new buildings constructed at the same time but having a lower energy standard[14].

Life cycle costs over the decades of a building's use phase however are even more relevant than the building costs themselves. In view of the currently skyrocketing energy prices, which are expected to remain high in the future, energy requirements are all the more important. New buildings constructed from 2023 onwards must achieve the lower primary energy requirement of an "Efficiency house 55" (Gebäudeenergiegesetz - GEG). According to current studies, this would in most cases be economical if heat pumps were used[15] in combination with an improved building envelope.

A narrow vision of low building costs ignores the fact that supposedly cheap solutions can turn out to be expensive in retrospect. The installation of cheap building products, for example, later lead to expensive remediation cases due to the pollutants such as PCBs that they contained. Sustainable building methods avoid such renovation costs from the outset, as they may become necessary in the future for other building materials (Chapter 2.3) or the subsequent reduction of CO_2 emissions.

Goals

Sustainability requirements to be generated for new housing should not be postponed because of (feared) increases in construction costs. Rather, the aim is to create sustainable housing at the lowest possible life cycle costs. Following a principle of precaution, the prevention of future cases of damage through sustainability requirements should also play a role. These goals can be implemented by establishing an exchange of practice between planners and clients.

Key recommendations

- Implement the Building Cost Reduction Commission's recommendations, e.g. standardisation of building law across the states (Länder) and the reduction or elimination of parking space obligations.
- Abolish support for new buildings 'on greenfield sites' with subsidies such as the housing construction bonus, the home owner pension and the KfW housing construction programme, and link financial aid for social housing construction more closely with climate-friendly requirements[16].
- Include CO_2 shadow prices in building investments, especially in decisions about demolition versus new construction.
- Ambitiously implement CO_2 pricing in the building sector through national emissions trading and make it socially acceptable, for example through a climate bonus and specific support programmes, to reduce energy costs for low-income and vulnerable households through energy efficiency measures or by switching to non-fossil energy sources.
- Promote the exchange of experience about cost-effective and sustainable building methods.

- Use social housing construction and public buildings (e.g. cultural buildings, museums, monuments) as demonstration projects for cost-saving and at the same time environmentally and climate-friendly building methods.

- Strengthen compact building structures in small-scale housing construction: terrace houses, semi-detached houses, courtyard houses and town houses instead of detached houses (cf. also Figure 4 Environmental impact of compact vs. small-scale building types, p. 18).

3.3 Interplay between Aesthetics and Sustainable Building – Strengthening the New European Bauhaus

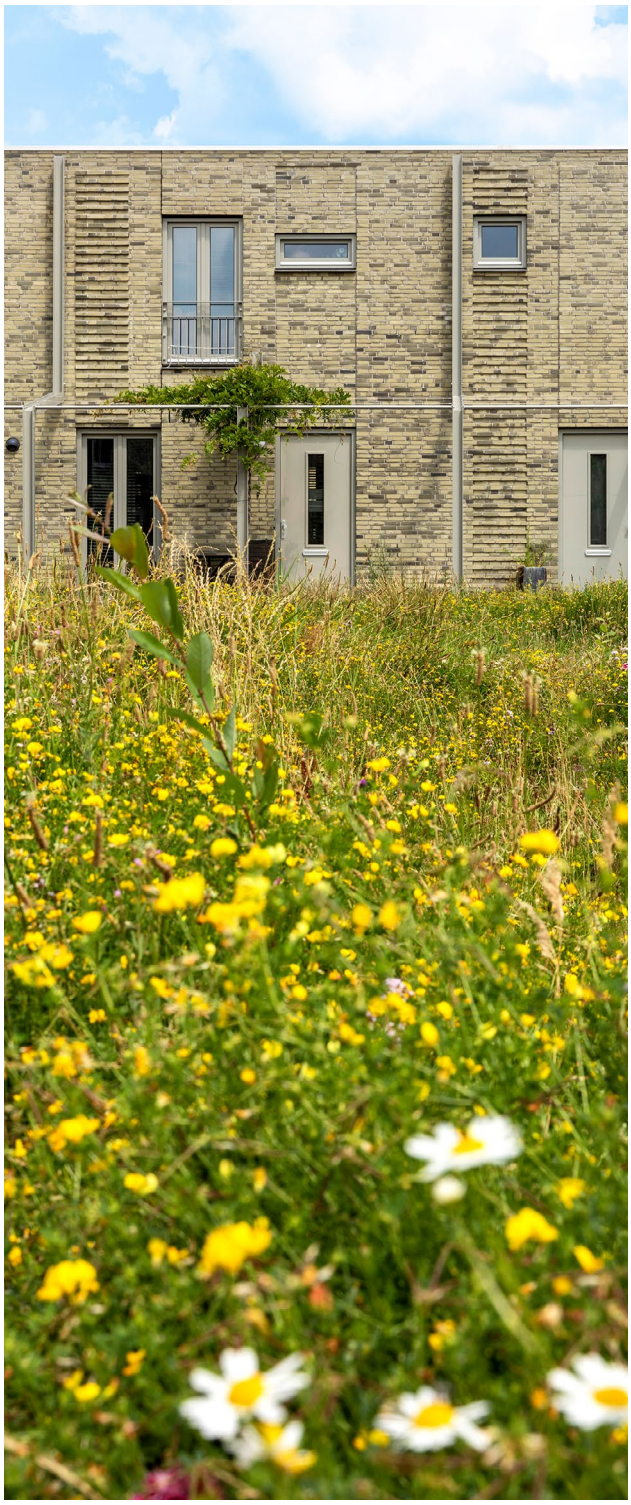
The role of aesthetics is often neglected in the discussion about sustainable building and housing. Yet aesthetic considerations can have an important influence on building-related behaviour and thus on sustainability aspects such as the decision for or against energy-efficient renovation or urban redensification. Subjective perception of aesthetics plays a major role in building decisions and repeatedly pushes the objectively assessable criteria of the sustainability of buildings into the background.

On the other hand, a holistic, sustainable aesthetics can lead to recognition, appreciation and care for the environment and a better quality of life. “Biophilic design” promotes the use of natural elements and processes (natural light, water, fresh air, plants and the like) as an inspiration in the built environment, and these elements can have a positive effect on people’s mental and physical health. All these aspects emphasise why aesthetics is seen in the ‘New European Bauhaus’ together with sustainability and social inclusion as one of the three basic pillars of a future-oriented and healthy lifestyle.

Goals

Social acceptance for sustainable building is a key prerequisite for overcoming the diverse challenges we face in the building sector. This includes the willingness to invest in the associated change. The aesthetic perception of buildings and neighbourhoods essentially determines the citizens’ quality of life. Aesthetics must be understood as an essential element for a good quality of life. All stakeholders must take aesthetics of the built environment into account more strongly than before for the social acceptance of new, ecological solutions in building and renovation.

The impacts and interplay with mental and physical health need to be further researched to be able to integrate natural elements or sustainable aesthetics in general into future building projects with regard to healthy lifestyles on a science-based basis.



Biophile design, the Netherlands

Key recommendations

- Initiate dialogue on 'sustainable aesthetics' and education on the environmental impacts of building in architecture and society.
- Include the aesthetic needs of residents in building projects and thus in the design of their environment.
- Promote research into the impacts of perceived aesthetics and quality of life features in the built environment as important aspects of sustainability.
- Disseminate successful demonstration projects, e.g. through the continuation of the Federal Award 'UMWELT & BAUEN'.
- Raise awareness of the consequences of individual housing and lifestyles to achieve quality of life, environmental and climate goals through public campaigns and experimental spaces for sustainable building and housing.

3.4 Sufficiency in Housing: Addressing Living Space Consumption as an Aspect of a Sustainable Lifestyle

In Germany, the amount of space used for housing (i.e. living space per capita) has significantly increased in recent decades. While the living space per capita was 22.3m² in 1965, it rose to 39.3m² per person by 1998[17] and kept on increasing to 47.7m² per person by 2020. The reasons for this increase are the growing proportion of one- and two-person households and households where large living spaces are used after the children have moved out, plus the overall trend towards larger living spaces per housing unit, including in detached and semi-detached houses (cf. Figure 4 Environmental impact of compact vs. small-scale building types, p. 18).

The trend towards increasing per-capita living space is very problematic from the perspective of climate and environmental protection. The UBA study 'Resource-Efficient Pathways towards Greenhouse-Gas-Neutrality (RESCUE)' considers a reduction in per-capita living space consumption to a maximum of around 41m² per person necessary in the medium term to achieve environmental, climate and resource policy goals[18]. The growing demand for increasing living space will make efficiency gains from energy-efficient renovation partially obsolete, and energy demand, resource use and land-take will develop in the wrong direction if unabated. In addition, there are social and economic consequences such as high additional costs, especially in view of the current readjustment of energy supply and the rising energy costs.

However, living space use is strongly determined by private situations and only follows a conscious consumption decision to a limited extent. It results from the biographical life phase (e.g. older people who are left alone in a large house after the children have moved out) or from economic conditions (e.g. families who cannot acquire adequate living space in tight housing markets, although they would like to). At the same time, there is the option of taking living space into account as a decision criterion more consciously when deciding about a relocation. The growing per-capita living space is therefore a field of action that needs to be differentiated both spatially and socially and can only be touched upon here. Despite this complexity, innovative sufficiency approaches in the context of sustainable housing must be pursued much more rigorously and the action field must also be addressed more strongly by policy and encourage people to thoroughly consider their decisions about when they move from one house/apartment to another where the framework conditions allow. Solutions and offers for a more flexible use of the housing stock, e.g. easy-to-divide flats, support for exchange of flats or communal forms of living, have so far been a niche phenomenon.

Goals

It is necessary to create sensitivity for the ecological relevance of the per-capita living space consumption in politics and society. To this end, measures must be taken to make it easier to move out of flats that are too large and to overcome possible "lock-in effects". Also, concepts for space sharing must be tested and promoted, for example implementing new architectural ideas such as cluster flats, which can reduce the individual floor space of individual flats and in return provide more communal areas. It is crucial to not create additional space, but reduce the size of individual flats to a relevant extent and at the same time establish advantageous circumstances for social life in the neighbourhood. What is also needed is greater flexibility in apartments floor plan design with a view to different phases of life and with more attention paid

to quality, rather than quantity, of space for individual housing needs. The continuing trend towards home office underlines the demand for more flexibility in housing layouts and design.

Key recommendations

- Raising awareness of, and conducting information campaigns about, sufficiency-oriented building and housing, e.g. dissemination of good examples of innovative floor plan solutions with flexibly usable and easy to divide rooms in the respective phases of life and use, especially in small-scale housing construction (e.g. dividing detached and semi-detached houses).

- Develop know-how for the conversion of single-family house areas into multi-generation residential areas through conversion, densification and the addition of utilisation modules.

- Promote flexible and neutral use of housing such as cluster housing by taking them into account in housing subsidies.

- Support moving between flats by
  - establishing digital housing markets for exchanges between living arrangements,
  - supportive moving services at municipal housing associations and housing cooperatives plus municipal action and advice centres for efficient housing use.

Sufficiency in Building and Housing

UBA is working with partners on the development of indicators based on the sufficiency approach in the scientific cross-sectional project within the BMBF Research Programme 'Stadt-Land-Plus' (Urban-Rural-Plus). Housing and land are important topics requiring further research.

▸ www.zukunftsstadt-stadtlandplus.de/news-details/dokumentation-online-synthese-workshop-indikatoren-aufbauend-auf-dem-suffizienzansatz.html (German)

Model project for cooperative urban development and further use of an existing property in central Berlin

4 Levers for Adjusting the Transition

The following adjustments are particularly important for achieving the housing provision's ambitious goals and environmental and climate compatibility combined with the goals of improved quality of life for all citizens. They are important in each of the dimensions mentioned above. They reflect the urgent tasks and mark a change of perspective that is crucial for achieving the goals described above.

4.1 Preserving, Developing, Renovating and Converting Existing Buildings

A new approach to existing buildings is essential to achieve the above environmental and social dimensions of sustainable housing provision. Germany's existing buildings comprise over 19 million residential buildings with a total of more than 42 million flats and over 1.5 million non-residential buildings[19]. Currently, more than 100,000 residential buildings are added annually. Longer use of existing buildings through re-use or conversion has the greatest effect on the prevention of new environmental pollution. Renovation of existing buildings can prevent excessive energy and source streams which can otherwise arise especially when constructing the new building's shell. At the same time, the potential for creating new flats in existing buildings is enormous: the vertical extension of existing residential buildings can make 1.1 to 1.5 million flats possible[20], and conversion or vertical extension of non-residential buildings can create another 2.3 to 2.7 million flats in the existing stock[21].

Almost two-thirds of existing buildings were built before the first Thermal Insulation Ordinance (Wärmeschutzverordnung) of 1977 was enacted. Therefore, energy modernisation in the case of further use and conversion is an essential prerequisite for achieving the Federal Government's climate protection goals. For this, the average annual renovation rate must increase to 2.5% by 2030 and to 3.9% by 2050[22]. Procedures for cost-effective and rapid serial renovations must be applied to achieve this goal.

A particular challenge will be to heat existing buildings without fuels that pollute the climate (natural gas, heating oil), impair air quality and health (wood) or are foreseeably unavailable or very expensive (hydrogen). Wherever possible, heat pumps should therefore be installed in existing buildings. Where this is not yet possible, the buildings should first be made suitable for heat pumps by replacing radiators and individual partial renovations, so that the whole variety of ambient heat sources and waste heat can be tapped by suitable, efficient heat pump concepts for individual houses or heat networks. All heat pumps must function at low noise levels. Around 6 million heat pumps must be put into operation to achieve the climate protection targets by 2030, and alone this task is a huge challenge.

Change of perspective: focus on existing buildings

Promoting building activity in existing buildings will enable a more efficient and purposeful use of those buildings and prevent excessive energy and source streams as well as additional land-take. Regulations must be adapted to the aspects of the conversion and further development of existing buildings (keywords 'conversion law/conversion regulations').

Wherever possible, existing buildings must be refurbished to make them suitable for heat pumps and they must be equipped with heat pumps. In addition, innovative building methods must be established with the aim of long utilisation times, flexible adaptation options, possibilities for reducing the per-capita living space and, as far as possible, full capability for demolition. Further development of existing urban structures must create the conditions for climate-adapted urban spaces with a high quality of life whenever possible.

Compact residential district with a high quality of life

Approach for realignment

- The designation of new building areas on greenfield sites should be largely avoided in line with the German Sustainable Development Strategy objectives.
- In the run-up to each building project, the type of project required should be checked along a decision cascade. Options may be: Stage 1: Preservation and renewal of existing buildings. Stage 2: Vertical extension of existing buildings. Stage 3: New buildings. This must be embedded in the state building regulations.
- Use of urban development measures as instruments (Section 165 et seqq. BauGB) in areas of a tight housing market, e.g. transforming small housing areas into compact neighbourhoods with higher density through additions and vertical extensions, side wings, supplementary or replacement buildings.
- Consistent use of the potential for housing development in existing buildings through conversion and vertical extension before new construction by strengthening the conversion aspects in the legislation (cf. Section 4.2).
- Prioritise renovation of those existing buildings that have the highest heat consumption thus the highest energy saving potentials (as done in Federal funding for efficient buildings since September 2022) and provide adequate State funding.
- Conversion and new construction projects should set their objective to aim at a long utilisation phase and the options of multiple uses and later conversion starting in the planning stage, and provide for a flexible, modular, revision and repair friendly building methods that make the adaptation of flats and the associated common rooms possible in the long term.
- Expand the promotion of suburban and rural areas with the aim of preserving and re-using or revitalising existing buildings (strengthen digital and public transport infrastructure and utilising new home office options[23]).

EXURB Environmental

In its publication "EXURB Environmental – Sustainable Interlinking of Housing, Work, Recreation and Mobility", the German Environment Agency has presented concrete recommendations on how spatial development can be made more sustainable in the interplay between the surrounding area and the city and how people can live and work, recreate and be mobile in the surrounding area around (large) cities in a way that is more environmentally and climate-friendly.
▸ https://www.umweltbundesamt.de/publikationen/exurb-environmental-sustainable-interlinking-of

4.2 Checking the Framework Conditions and Transformation of the Regulations

The regulations such as BauGB (Building Code), Bauordnungen (Building regulations), GEG (Building Energy Act) and the institutionalised framework conditions (e.g. Honorarordnung für Architekten und Ingenieure (Fee Regulation for Architects and Engineers)/HOAI) of urban development are empirical knowledge cast in standards, but they are essentially still based on past planning tasks such as the rapid reconstruction of the destroyed buildings in post-war Germany. However, the regulations became increasingly complex and sometimes overly complex while they were being further developed over the decades. The question now arises whether they can still effectively cope with the challenges of the 21st century for sustainable urban and housing development (climate and environmental protection, climate adaptation, resource protection, land conservation, conversion of existing buildings, etc.) in their previous basic alignment as "reconstruction laws". Therefore, a fundamental transformation of the regulations should be considered and implemented. The above dimensions describe these tasks in a number of specific places where the instruments need to be adjusted, while this major task is a field of transformation in its own right.

Change of perspective: consistent environmental, climate and resource protection in the regulations

It is necessary to question the basic assumptions underlying the standards and regulations such as the focus on new development/new building instead of conversion/preservation and its upgrading to be able to transform the legal framework towards enhanced

climate and resource protection. It is necessary to embed the urgent issues of climate protection and resource conservation in the framework conditions and regulations across all fields of action. The task is not to complicate urban development and construction and make them more expensive by adding environmental and climate protection as additional aspects, but rather to realign the regulation core towards sustainability. Environmentally friendly solutions such as the use of alternative building materials plus conversion and reuse of existing buildings must be simplified and their use must become much more attractive than conventional solutions that are more harmful to the climate and resources.

Approach for realignment

- Review standards that hinder climate protection goals, complicate climate protection and make climate change adaptation more difficult. Investigate possibilities to suspend or revise regulations and standards (for example: create new calculation rules for building using recycled concrete; review the law on the protection of historical monuments).

- Revision of the Model Building Code (Musterbauverordnung) as a basis for the amendment of the state (Land) building codes, e.g.

  - relying on ambitious sustainability criteria (e.g. BauO Berlin (Berlin Building Ordinance)),
  - reduce the current strong preference for free-standing buildings and setback regulations to neighbouring buildings. Strengthen the options for closed-method building processes (bordered buildings, courtyards) for social reasons and for emission-reducing effects, enable higher densities including urban development solutions that include climate adaptation requirements,
  - supplementing it by favouring existing buildings, extension of protection for existing buildings, extended options to allow deviations from regulations of the BauO (e.g. with regard to distance areas),
  - clarification that heat pumps and their externally installed components do not fall under the regulation for minimum distances to a property boundary as long as, for example, the permissible noise emissions are not exceeded,
  - clarification that the minimum distances for PV roof systems should be further reduced or abolished (deletion of Section 32(5)(2)(2)),
  - add the sustainable use of natural resources in buildings and hazard prevention for the protection of health and the environment as a parent act for building law in Section 3,
  - introduce of regulatory permitting processes for demolition of existing buildings and only allow it as an exception or preferably as “selective demolition”.

- Improving the options in district level law for the greening property boundaries, also for reasons of climate adaptation.

- Establishing mandatory municipal heat planning which may create the basis for balancing renewable heat sources with local heat demand.

- Further testing and broader use of informal instruments accompanying land-use plans.

Informal Instruments

”RessourcenPlan (ResourcePlan)“ was developed within the BMBF Integrated Research Project „RessourcenPlan im Quartier“ (Neighbourhood ResourcePlan - R2Q). This initially informal instrument serves to integrate resource protection more efficiently in municipal planning and decision-making processes. As an application-oriented planning instrument, it enables a more efficient management of resources (land/space, water, building materials, energy, etc.) in a district. The systemic approach of localised functional assessment and development of areas on the district level developed for this purpose goes beyond the quantitative development of anthropogenic use. It equally includes the natural functions of land and can be used from the analysis of existing functions in the neighbourhood up to the concrete measure for the process of resource-efficient transformation of neighbourhoods.

▸ www.fh-muenster.de/forschungskooperationen/r2q/produkte/gemeinsame-produkte/gemeinsame-produkte.php (German)

4.3 Strengthen the District as a Level of Action

Neighbourhoods allow for people to experience living conditions in a tangible way. Measuring the characteristics of the neighbourhood and district leads to important conclusions on the quality of life and housing. Compact, space creating and green neighbourhoods rich in social, cultural and precautionary infrastructure, space which offer space for different milieus and provide an identity based upon the history of the district have a clear advantage over neighbourhoods lacking such features. All planning and design activities should be required to commit to this.

Integrated Neighbourhood Approach in Existing Buildings

The project 'Creating NEBhourhoods together' in Munich-Neuperlach is an exemplary project for a strong neighbourhood approach that has been selected as a lighthouse project of the EU 'New European Bauhaus' initiative. The transformation of an existing neighbourhood is systemically addressed here, based on the specific strengths and tasks of the residential location in an urban periphery – with goals for qualifying the built environment, circular economy, green infrastructure, mobility and energy, but also social issues such as integration and education.

The design of new urban districts should be committed to the principle of compact, space saving, community-promoting building forms. The building form of a detached single-family house is the most climate-damaging and monofunctional form and it proves to be inferior compared to all other housing structures: semi-detached, terraced, courtyard, town and family houses (cf. Figure 4 Space requirements for compact vs. small-scale building types, p. 18).

Change of perspective: district as a level of action

The district is considered a promising level of action for sustainable urban development and urban environmental protection. The spatial level of the district offers greater synergy effects compared to the individual building and is at the same time less heterogeneous and complex than the cross-city level. The aim should therefore be to strengthen the district as a level of action and to assess and integrate measures for the creation of living space, environmental and climate protection and the improvement of the quality of life at this level.

District action space

Approach for realignment

- Development and implementation of cross-sectoral concepts for compact, mixed-use, energy-efficient, climate-adapted structures at neighbourhood level such as within the context of the New European Bauhaus (NEB) lighthouses, the International Building Exhibitions (IBA) and similar exemplary formats and projects.
- Traffic avoidance by improving the immediate residential environment thus enabling local recreation by providing semi-public and private spaces such as front gardens, back gardens and green courtyards.
- Develop funding for municipal sustainability managers, neighbourhood managers and climate protection and climate adaptation managers.
- Enable appropriation of public space and create options for activation and participation of residents, e.g. recovering street space by pushing back parked and moving traffic to establish places to linger and play, and enable greening.

4.4 Strengthen Networking, Training, Education and Research

Promoting the urgent housing provision of environmental, climate and resource-efficiently, and in a health and socially compatible manner, requires, in addition to adjustments to the legal framework conditions, a more intensive networking of the various stakeholders, a stronger focus on recruiting and securing skilled workers, training and education, and a deep commitment towards research.

Change of perspective: create and disseminate knowledge

Measures to implement environmentally, socially and climate-compatible housing provision must be better integrated and, where necessary, consolidate the knowledge base using demonstration and research projects. Innovative and cross-cutting solutions must be found that can overcome sectoral policy separation and integrate actions at different levels and promote social dialogue on issues of environmentally and socially sound housing provision and housing at the same time.

Approach for realignment

- Networking
  - Strengthen cooperation between the departments of urban development and building, environment, climate, transport and health, e.g. within the 'Alliance for Affordable Housing' and by close cooperation between the ministries and subordinate authorities.
  - Initiate a dialogue within the society on housing, sustainable urban development and quality of life, e.g. by a joint conference series of the German Environment Agency and Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR).
  - Make targeted use of the New European Bauhaus initiative and continue it by strengthening the role of the National Focal Point at the Federal Ministry for Housing, Urban Development and Building (BMWSB) and by promoting further integrated research projects such as the German Environment Agency's own research project Advancing the New European Bauhaus (AdNEB).

- Training and further education, securing skilled workers
  - Build environmental planning competence in urban planning, architecture, building industry and craft with a stronger focus on 'conversion of existing buildings'.
  - Strengthen the role model effect of the Federal Government, the states (Länder) and municipalities through training and education on the Sustainable Building Rating System (BNB), the 'Quality Seal for Sustainable Buildings' (QNG) and on options for implementing sustainable public procurement in the building sector at all levels of practice.
  - Develop an overall strategy for securing skilled labour for the socio-ecological transformation of urban areas across all departments including universities and social partners.

- Demonstration projects and research
  - Promote, accompany and evaluate demonstration projects, e.g. exemplarily use of public property (e.g. within a GHG-neutral Federal administration) and in social housing construction (cf. Section 3.2).
  - Implement strategies for triple inner urban development (cf. Chapter 3.1), analyse and disseminate best practice.
  - Strengthen research at the interface of sustainable housing provision, sufficiency in housing supply, natural climate protection, climate adaptation and resilience in urban areas.
  - Promote research and knowledge transfer on readily available and widely usable, climate-friendly, resource-friendly and low-pollutant building materials, including recycling options for demolition materials as a component for achieving circularity in the building sector (cf. Section 2.2) and for sustainable land use[24].

Advancing the New European Bauhaus – AdNEB

Within German Environment Agency's own research project 'Advancing the New European Bauhaus: Sustainable Mobility and Resilient Urban Spaces (AdNEB)', contributions are being developed for the implementation of the New European Bauhaus that go beyond the building level and consider building transition in the context of sustainable urban and neighbourhood development, mobility transition, climate adaptation and health.
▸ https://www.umweltbundesamt.de/en/research-project-adneb-advancing-the-new-european

Endnotes

Listed below are sources, references and additional information referenced earlier in the text.

1 Cf. https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikatio nen/190819_uba_pos_primarbaustoffsteuer_bf.pdf

2 Cf. https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/2021-11-23_texte_151-2021_rebaupro_0.pdf

3 Cf. https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Umwelt/Abfallwirtschaft/Tabellen/liste-abfallbilanz-kurzuebersicht.html;jsessionid=1F975935F6B78FD862918C46A04B8785.live742

4 Roswag-Klinge, E.; Neumann, E. & Klinge, A. 2022: Climate impacts of wood/ timber as a building material – investigated on three urban quarters in Germany (CIW). IOP Conference Series: Earth and Environmental Science 1078, 012029. https://doi.org/10.1088/1755-1315/1078/1/012029.

5 Hillebrandt, A.; Riegler-Floors, P.; Rosen, A. 2018: Atlas Recycling, Gebäude als Materialressource (Buildings as a material resource). Edition Detail, München.

6 Babich et al. 2020: Low Polluting Building Materials and Ventilation for Good Air Quality in Residential Buildings: A Cost–Benefit Study, Atmosphere 2020, 11(1), 102; https://doi.org/10.3390/atmos11010102

7 Cf. https://ec.europa.eu/docsroom/documents/49315

8 Moewes G. 1995: Weder Hütten noch Paläste (Neither huts nor palaces), Nomen Verlag.

9 Mahler et al. 2019: Mögliche Optionen für eine Berücksichtigung von grauer Energie im Ordnungsrecht oder im Bereich der Förderung, Graue Energie im Ordnungsrecht/Förderung (Potential options for including grey energy in regulatory law or in the area of subsidies, Grey energy in regulatory law/subsidies) (bund.de)

10 Stadt Jena 2017/2018: Neues Wohnen in Jena Zwätzen (New housing in Jena Zwätzen), Broschüre (Brochure) Jena Zwätzen web 10-12-18.pdf, und Broschüre (Brochure) Neues Wohnen Zwätzen.pdf (am-oelste.de)

11 Schiller et al. 2009: Von der Außen- zur Innenentwicklung in Städten und Gemeinden (From outdoor to inner urban development in cities and communities), UBA Texte (UBA Texts) 21-2009

12 Stadt Jena 2017/2018: Neues Wohnen in Jena Zwätzen (New housing in Jena Zwätzen), Broschüre Jena Zwätzen web 10-12-18.pdf, und Broschüre Neues Wohnen Zwätzen.pdf (am-oelste.de) (Brochure New housing in Zwätzen)

13 Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit (Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety). BMUB 2015: Bericht der Baukostensenkungskommission im Rahmen des Bündnisses für bezahlbares Wohnen und Bauen (Report of the Building Cost Reduction Commission within the framework of the Alliance for Affordable Housing and Building), November 2015

14 Enbausa 2017: Schlaue Planung macht Effizienz preiswert (Smart planning makes efficiency value for money), https://www.enbausa.de/finanzierung/aktuelles/artikel/schlaue-planung-macht-effizienz-preiswert-5627.html, zum Vergleich Statistisches Bundesamt: Baugenehmigungen, Baufertigstellungen – Baukosten – Lange Reihen bis 2021 (Cf. Federal Statistical Office: Building permits, building completions – Building costs – Long series up to 2021)

15 Although fundamentally the least space and resource efficient, it was confirmed for detached single-family houses that more efficient building methods pay off even under the current rising building costs and higher energy prices. Optimisation potentials are likely with more compact building forms; Deneff 2022: Gutachten für den Verbraucherzentrale Bundesverband: „Spezifische Kosten für die energietechnische Modernisierung im Gebäudebestand in Abhängigkeit des Effizienzstandards“ – Aktualisierte Kurzfassung der Studie angesichts globaler Entwicklungen (Expert opinion for the Federation of German Consumer Organisations: “Specific costs for energy-related modernisation in existing buildings depending on the efficiency standard” – Updated abridged version of the study in view of global developments), Darmstadt 2022, https://deneff.org/wp-content/uploads/2022/04/220427_Akt-Zsf_Studie_Modernisierung_EFH_wirtschaftlich_final-1.pdf

16 Vergleiche https://www.umweltbundesamt.de/publikationen/umweltschaedliche-subventionen-in-deutschland-0

17 Statistisches Bundesamt 2000 (Federal Statistical Office 2000): 50 Jahre Wohnen in Deutschland (50 years of housing in Germany), p. 69; UBA 2021: Wohnfläche, Wohnfläche | Umweltbundesamt (Living space, living space | German Environment Agency)

18 Wege in eine ressourcenschonende Treibhausgas-neutralität – RESCUE, Kurzfassung, 2019 (Resource-Efficient Pathways towards Greenhouse-Gas-Neutrality, Executive Summary, 2019), p. 36, Wege in eine ressourcenschonende Treibhausgasneutralität – RESCUE, (Pathways to resource-efficient greenhouse gas neutrality – RESCUE.) (umweltbundesamt.de)

19 Cf. https://www.dena.de/fileadmin/dena/Publikationen/PDFs/2021/dena-Gebaeudereport_2022.pdf https://de.statista.com/statistik/daten/studie/70094/umfrage/wohngebaeude-bestand-in-deutschland-seit-1994/

20 Cf. Deutschlandstudie2015_160229_intern.pdf (tu-darmstadt.de)

21 Cf. https://www.twe.architektur.tu-darmstadt.de/media/twe/publikationen_13/Deutschlandstudie_2019.pdf

22 Wege in eine ressourcenschonende Treibhausgasneutralität – RESCUE, Kurzfassung, 2019 (Resource-Efficient Pathways towards Greenhouse-Gas-Neutrality, Executive Summary, 2019), p. 40, Wege in eine ressourcenschonende Treibhausgasneutralität – RESCUE (Pathways to resource-efficient greenhouse gas neutrality – RESCUE.) (umweltbundesamt.de)

23 UBA 2021: Umlandstadt umweltschonend, Nachhaltige Verflechtung von Wohnen, Arbeiten, Erholung und Mobilität (EXURB Environmental – Sustainable Interlinking of Housing, Work, Recreation and Mobility)

24 Nathanail C.P., Boekhold A.E., Grimski, D. and Bartke, S. 2018: The Europeans' Strategic Research Agenda for Integrated Spatial Planning, Land Use and Soil Management. Final public version of Deliverable D4.3 of the HORIZON 2020 project INSPIRATION. EC Grant agreement no: 642372, UBA: Dessau-Roßlau, Germany; online at: http://www.inspiration-agenda.eu/files/inspiration/pdf/2018_inspiration_sra.pdf

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