THE ZERO CARBON AND CIRCULAR ECONOMY CHALLENGE IN THE BUILT ENVIRONMENT

POLICY OPTIONS FOR THE EUROPEAN UNION AND ITS MEMBER STATES

Contents

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Getting on track to limit global temperature increase to 1.5°C would not just be good for our climate, but first and foremost for all citizens. What changes to the European policy framework and new initiatives could be prepared and implemented in the coming years?

Why this paper?

The built environment sits at the crossroads of promising pathways to mitigate climate change and to adapt to its unavoidable impacts. Changing how we construct, heat and cool our buildings will trigger positive change in many neighbouring sectors, including energy and heavy industry, but also in sectors which at first sight may seem less connected, such as health and education [1].

Getting on track to limit global temperature increase to 1.5°C, as was agreed in Paris back in 2015 [2], would not just be good for our climate, but first and foremost for all citizens. What changes to the European policy framework and new initiatives could be prepared and implemented in the coming years?

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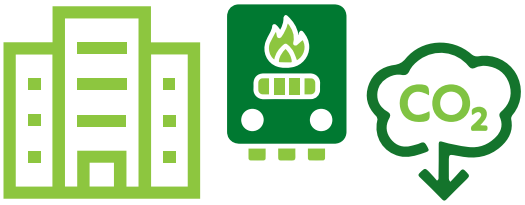


Introduction

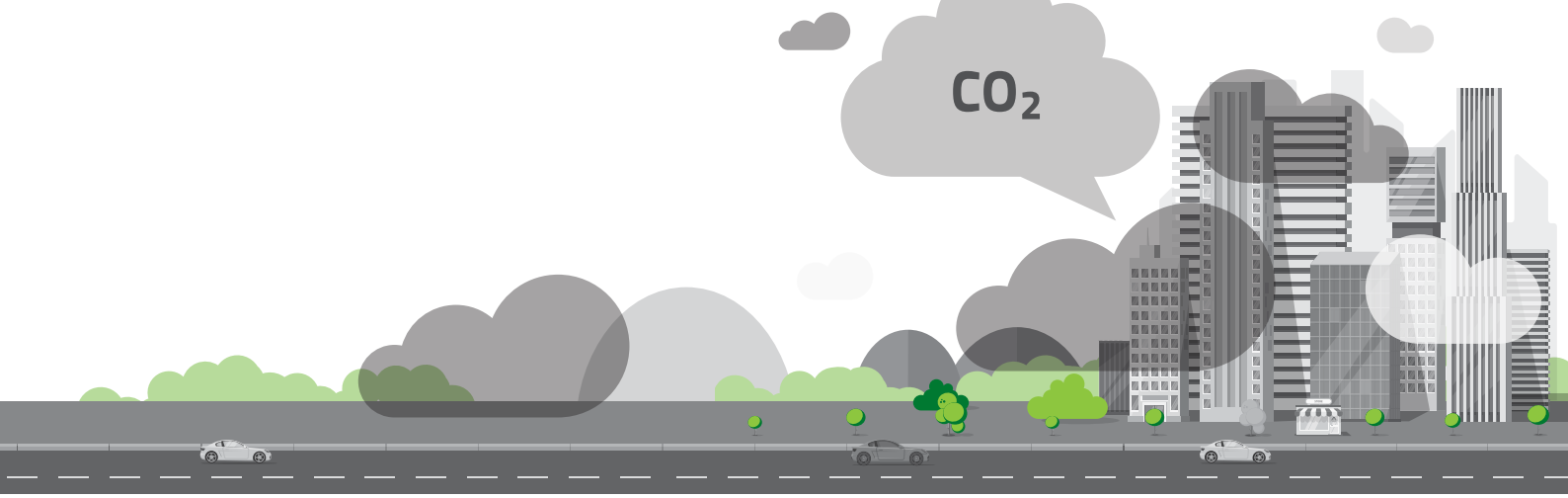
The built environment is the direct and indirect cause of close to 40% of global CO_2 emissions, which are still on an upward trend [3]. These emissions are caused by the burning of fossil fuels either in power stations or in heating systems in buildings, or are associated with the production of building components and construction materials which is often very energy intensive.

Equally, the built environment, the space in which we all move, live, work, rest and play, is the backbone of our economy and society. A dysfunctional built environment creates threats for people, can cause energy poverty, results in lower productivity and leads to missed opportunities for societal development. It is therefore essential that the built environment is "fit for purpose", so that it can provide the services and functions we expect from it.

With its central function in our society, it is no surprise that the building sector is exposed to a range of external effects which influence its performance and which require a response. These external effects include environmental, societal and economic drivers, such as the reality of climate change, the trend towards increased urbanisation, demographic change, air pollution, and cost pressure related to construction costs, real estate price development and rent affordability. Both climate change mitigation and adaptation to the impacts of climate change pose challenges with potential trade-offs and synergies.

The sector will have to respond to all these drivers in an effective, consistent and long-term manner. The sectoral value chain is fragmented, putting responsibility to act on many different entities and actors who may have competing interests. However, addressing this characteristic of the value chain provides an opportunity to align the expertise and contributions of individual actors and common interest groups, resulting in synergies and more effective ways to implement solutions.

Under normal circumstances, buildings have a lifespan from several decades to several centuries, depending on the building type. Commercial buildings often have a shorter lifespan and show a higher demolition rate than residential buildings. Changes in our economy and society require the continuous adaptation of our building stock so that it can serve the changing demands of occupants. The continuing trend of urbanisation, changing work patterns, an increase in the number of single-person households and an aging society, with elderly citizens living in their own homes significantly longer than before, require adaptive



Putting the principles of sustainability and circularity at the core of a strategy for the buildings and construction sector will be essential to retain and increase its value for society.

buildings which can be easily reconfigured. A change in societal stratification leads to changes in purchasing power. A larger number of citizens above pension age means that more people may have a lower purchasing power than today, while requiring housing which will meet their changing needs in later life, such as living comfort, accessibility, nearness to service facilities and so on.

The buildings and construction sector therefore faces a diverse range of challenges in the coming decades. Putting the principles of sustainability and circularity at the core of its strategy will be essential to retain and increase its value for society. The sector has yet to define its long-term vision, sketch out how our built environment could look and perform in the future and how respective objectives can be achieved.

The EU and its Member States defined the objective for the building stock to be highly energy efficient and decarbonised by 2050 [4]. While a clear definition of the meaning of "decarbonised" is currently lacking, the ambition level is clear. A transformation of the built environment will be essential to achieve this objective. The term "transformation" may have been overused in recent times; however, it does describe the level of change which is needed.

Establishing a circular economy is proposed by many as an essential building block of the move to a zero-carbon economy. An obvious challenge for the built environment is the enormous amount of material used and the associated construction and demolition waste. Of the 93 billion tonnes of resources extracted globally each year, over 40 billion tonnes are put into housing, and less than 10% of the global resource input is circular [5]. While this issue will have to be addressed, the central position of the built environment in our energy and economic system allows it to become a catalyst for circular solutions in many other sectors. Given the fragmentation of the sector it can be expected that this will not be an easy task. However, there are many promising technological and other developments which will have to be accelerated and scaled up to drive the required transformation towards a circular, zero-carbon building and construction sector in Europe.

This paper intends to describe these opportunities and proposes policy solutions which could form the core of a reinvigorated European initiative to tie the circular economy closely to achieving Europe's zero-carbon building stock. It also repeatedly makes recommendations for actions by actors in the construction sector value chain. As such, the paper is rather a contribution to the debate than a verified description of a transformational pathway.

Buildings in society

Buildings are an important element of the fabric of our society; they can act as a glue binding citizens together. Equally, if buildings and neighbourhoods are neglected or poorly designed, social communities can be distorted and disrupted. The built environment plays an important role in supporting a fair society in which affordable space is available for all citizens of different ages and income classes, as well as companies of different sizes. The transition to a zero-carbon building stock should be just and fair, resulting in liveable cities and rural areas which encourage sustainable behaviour by their citizens and entrepreneurs.

Circular economy principles need to be applied throughout the full lifecycle of buildings, including during the initial spatial planning phase. This will allow citizens to lead a lifestyle with a drastically reduced environmental footprint. Spatial planning for circular economy measures should, for example, support buildings which integrate rooftop gardens for urban food projects, promote non-motorised journeys and short distances to all necessary daily services, and allow for circular treatment of residues. Urban and regional planners have an essential role to play in designing spaces which support individual circular behaviour.

The current approach to cost-benefit analysis for building renovation does not take the societal benefits of energy renovation and building upgrades into account. We should rather evolve the valuation of building investments towards a systemic valuation of all benefits.

The current situation of low interest rates in most EU countries and increasing movement of people to cities has triggered a spiral of cost increases for housing which creates shortage and social tensions in many cases. We therefore need to make sure that the necessary deep renovation of the building stock does not exacerbate the cost burden for vulnerable groups. Policies which stimulate sufficient supply of affordable and zero-carbon housing will be essential to support a fair transition. At the same time, a revision of the way investments are decided will be essential to speed up the transformation of our built environment.

While cost increases can be a barrier for investments in renovation, the way in which cost-benefit analysis of building upgrades is currently conducted results in a distorted picture. The current narrow approach to calculation usually does not take the societal benefits of energy renovation and building upgrades into account. It is true that these benefits are often hard to measure, are dispersed across many beneficiaries and often materialise in an invisible way and over different timescales. However, this does not mean that they can be neglected. Instead we should rather evolve the valuation of building investments towards a systemic valuation of all benefits. In fact, upgrading of individual buildings and neighbourhoods improves societal capital. A recent BPIE analysis came to the conclusion that the upgrade of European office buildings could increase productivity of office workers by 12%, resulting in €500 billion of added value. Similar positive impacts can be found in schools and hospitals [6].

RECOMMENDATIONS FOR ACTION

Spatial planning should satisfy societal needs in a sustainable way and be aligned with building regulations for a highly energy efficient and zero-carbon building stock:

Governments and public authorities at all levels can be in full control of spatial planning if they decide to. Rules and regulations controlling building permits should support a people-oriented architecture at a human scale. The EU could define principles of spatial planning which would support sustainable and zero-carbon spaces, with a strong focus on revitalisation of neglected areas using urban and rural regeneration action plans. European financial support programmes should concentrate on upgrading buildings applying circularity and zero-carbon principles.

Effective affordability initiatives should ensure enough supply of housing:

A circular and zero-carbon building stock should be achieved in a fair and just transition. Healthy and energy-efficient homes should be accessible for all parts of society. Governments should ensure that regulation prevents excessive speculation and price increases which put people out of the rental market. The EU should ensure that public funds are used to support affordable and sustainable zero-carbon buildings and should monitor sufficient supply of affordable housing. Funding initiatives could in particular focus on rental accommodation lower than energy performance class B to allow for cost-neutral renovation for the benefit of tenants.

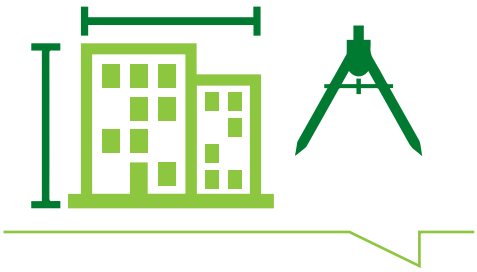
Performance standards should ensure future-proof quality of the built environment:

Clear requirements for minimum performance standards to be achieved over time would provide planning and investment certainty for building owners. Mandatory renovation of buildings in the worst-performing building efficiency classes would send clear market signals. Some European countries have introduced regulation which makes it illegal to rent space that does not meet a minimum performance standard. This approach could be implemented on an EU-wide scale.

Investments for mitigation and adaptation should be increased and facilitated:

Renovation requirements could be supported by financing models that allow third parties to invest. The well-tested business model of energy service companies (ESCOs) could be expanded to comprehensive renovation investment service offers which would be accessible also to owners with limited financial means. The EU could support financial regulation which creates a market for deep renovation ESCOs. These offers could go beyond the individual building to cover urban quarters. National renovation strategies should include attractive, new service offers that could stimulate demand and thus result in increased energy renovation activity. The InvestEU initiative should ensure that energy efficiency and buildings renovation play an increasing role and should implement a respective monitoring and reporting system.

Adapting the built environment to climate change is an investment need which should be linked with mitigation investments. The project Urbansis is providing impact indicators to support mitigation and adaptation strategy development, e.g. in urban infrastructure and the health sector [7].



Building design and design for communities

Design of buildings, as well as spatial planning defining groups of buildings and urban quarters, influences the carbon footprint of the built environment and its users. An environment which encourages the use of common public spaces and sharing-economy behaviour can result in lower emissions while giving access to space and services for all citizens. The physical transformation of a building and a neighbourhood can have a positive impact on citizens. A balanced process needs to combine physical and social measures in a harmonised manner.

The EU recognised in its Public Procurement Strategy in 2017 that procurement should take "innovative, green and social criteria" into account. Municipal decision-makers have the opportunity to define public procurement rules which are aligned with a circular zero-carbon vision. Public procurement which encourages building developer and contractor collaboration can avoid "adversarial design" of buildings and move towards integrated concepts for groups of buildings. Such procurement rules need clear objectives and transparent indicators. These rules would also help to get rid of underperforming products and designs.

The increasing digitalisation of our society offers unique opportunities as use of space can be tracked and analysed. Mobile movement data collected by the telecommunication industry could be used to plan space and built environment infrastructure in an optimised and carbon-lean way. Data privacy concerns will have to be respected through a clearly defined industry standard, allowing planners and developers to site and design buildings combining zero-carbon approaches with appropriate design for users in mind.

Buildings allowing adaptation to changing use patterns are aligned with circular economy principles.

Buildings allowing adaptation to changing use patterns are aligned with circular economy principles. Adaptive buildings have characteristics which support in-situ circularity, meaning that a building's purpose can be redefined without major interventions. Implementing such characteristics would avoid people having to live in buildings which are not responsive to their needs and to changes in their lives. Adaptive buildings will result in a reduction of material throughput associated with major renovations. Adaptive space allocation for an aging society would result in lower average square metre occupation and reduced per capita energy consumption. An adaptive building design would allow commercial and public buildings to be modified with respect to developments in indoor environmental quality standards, having a positive impact on workplace performance.

Adaptive buildings will require less resource input when being changed, and will see lower demolition rates, resulting in less end-of-life challenges for building materials.

Occupants of buildings should be encouraged to live and work following circular economy principles through the spaces and places in which they spend most of their time. Buildings can support people in this endeavour by giving them access to renewable energy, by closing loops for water consumption, by mimicking the natural environment and so on.

Building developers should reflect these needs and opportunities when designing and investing in buildings, both for new construction and for renovation. Modular concepts, easy-to-change façades allowing for changes in building functionality and appearance and plug-and-play technical installations will allow for increased adaptability, resulting in a reduced need to demolish and avoiding a considerable amount of construction waste.

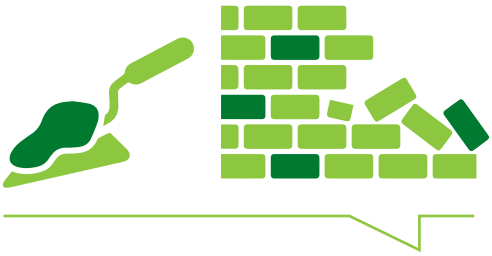
RECOMMENDATIONS FOR ACTION

A regulatory framework for procurement supporting circularity, zero-carbon and climate-resilience goals for the built environment should be created:

The EU could go beyond its current approach of supporting voluntary initiatives in Member States with its publication of guidance notes for public procurement, and instead develop a regulatory framework for procurement which supports circularity and zero-carbon and climate-resilience goals for the built environment.

A regulatory framework to use telecommunication data for spatial planning and building design could support the transformation of the building stock in the EU, while respecting data privacy concerns.

Future regulatory initiatives addressing buildings should encourage the construction of adaptative buildings and ensure that major renovations take adaptability into account. The EU could focus a share of its research funding on this specific aspect.



The construction materials challenge

The production of building materials is often associated with high energy demand, mostly provided by carbon-intensive energy sources (for example in the production of cement or bricks, or in the chemical industry). Production-related process emissions releasing greenhouse gases, as in the cement industry, are another cause of concern. Furthermore, the high negative impacts on and in the natural environment caused by raw material extraction activities have also to be accounted for: deforestation, for instance, results in increased greenhouse gas emissions and biodiversity losses. The high volumes of material used in the construction sector make it essential that these resources are carefully managed so that production waste as well as end-of-life waste is minimised.

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There is a wealth of reports covering the circularity challenge regarding construction materials [8]. Materials used for construction and composite building components such as steel, plastics, aluminium and cement cause a high share of greenhouse gas emissions and pose a serious challenge to achieving a zero-carbon European economy by 2050. Following circularity strategies on the demand side to change the use of these products could more than halve the associated greenhouse gas emissions [9]. Without changes in the buildings and construction sector this will not be achieved.

The sector is in a unique position to support the mitigation efforts from three angles:

PRODUCTION OF BUILDING COMPONENTS

Building components should be planned, produced and installed with resource conservation as a guiding principle. The off-site prefabrication of building components such as walls and roofs would simplify this and would allow circular economy principles to be applied to the fullest extent, as prefabrication allows better control over resource use. Off-site production could be organised in a more resource-efficient way, giving priority to reuse of materials and components [10].

Processes on construction sites should be designed to avoid wasteful use of resources. A comprehensive waste avoidance system onsite would enable reuse and recycling of materials and any residual waste. The EU's Construction and Demolition (C&D) Waste Management Protocol provides guidance with the aim to "increase confidence in the C&D waste management process and the trust in the quality of C&D recycled materials" [11]. However, it does not cover the avoidance of waste in the first place.

Ensuring, as far as possible, that locally-sourced materials are used in a project and that they are transported using low-carbon transport systems can reduce embedded carbon significantly.

Building materials can have a second life if they are designed for that purpose from the beginning.

The design of building materials, in particular composite materials, should consider their reusability at the end of their first-use phase. Building materials can have a second life if they are designed for that purpose from the beginning. This would avoid the production and associated environmental impacts of new materials while extending the economic value and lifetime of materials already in their use phase.

If reusability is not an option for specific building components, component design should avoid inseparable composite construction elements and should plan for disassembly after a specific period. Building material suppliers should develop an end-of-life strategy for their products which takes landfills out of the equation. Deconstructed building materials could be used as secondary raw materials for next-generation buildings.

Energy performance certificates could evolve to include information about the lifecycle climate change impact of a building.

Market guidance will be essential to move towards low-carbon and circular materials. Performance labels have proven to be an effective policy instrument to change purchasing and investment behaviour in some sectors. Existing lifecycle analysis studies on embedded carbon in building materials show that the choice of building materials has a significant influence on the climate change impact of a given building. At this point in time, there is no system which would provide guidance on this topic in a comprehensive way. Some national energy performance certificates include information on CO_2 emissions associated with the use phase of a building. However, moving to a decarbonised building stock by 2050 requires more transparency and information about the climate impact of buildings and the materials and energy systems used in them. It will therefore be necessary to evolve the regulatory framework in Member States and at EU level to reflect both the energy performance of a building in its use phase as well as the climate performance of its construction. The Construction Product Regulation of the EU [12] and its associated Declaration of Performance could evolve to integrate information concerning the climate impact of a given product. Energy performance certificates could evolve to include information about the lifecycle climate change impact of a building.

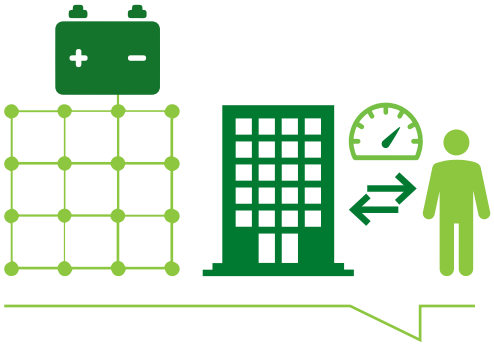
RECOMMENDATIONS FOR ACTION

The sustainability performance of buildings should be comprehensively evaluated:

Moving towards a comprehensive evaluation of the climate change impact of buildings during their construction and use phase will be essential to support a climate-neutral European economy and society. The Energy Performance of Buildings Directive (EPBD, 2018/844) sets a goal to achieve a decarbonised building stock by 2050. A system and indicators to measure and monitor the climate impact of buildings will have to be the next step in the evolution of the regulatory framework.

The EU could implement its current voluntary reporting initiative Level(s) as a comprehensive assessment system of the sustainability performance of buildings, including the already present focus on climate change over the lifecycle. The implementation will trigger demand for product-specific carbon footprint information on construction materials. A building passport or logbook documenting the use of materials would support awareness and choice for products leading to a building with the lowest carbon footprint over its lifecycle.

The EU, through R&D funding, could support a comprehensive data collection exercise on the lifecycle carbon emissions of buildings, analysing embedded carbon and grey energy in building materials and technologies, and the carbon emissions associated with the use phase.



Buildings in the energy system

The strategic and smart integration of buildings in the energy system is a cornerstone of the transition to a zero-carbon energy supply. The growth of distributed energy sources, renewables and storage and the growing peak demand for electricity will drive the need for increased flexibility, demand-response capabilities and consumer empowerment [13]. A high energy-efficiency level of the building stock is a precondition to achieve the full decarbonisation of the energy system, as demand response and energy storage requirements will increase with the growth of intermittent renewable energy sources.

The strategic and smart integration of buildings in the energy system is a cornerstone of the transition to a zero-carbon energy supply.

The European Member States agreed a comprehensive set of regulations with the Clean Energy for All Europeans package. They will now have to transpose the package into national rules and regulations. The effective implementation [14] and regular monitoring of that implementation will be essential to stimulate the market, to support innovative business offers from the energy and construction industry and to deliver the intended benefits for European citizens.

In particular, Member States will have to increase their efforts to renovate their building stock to a highly efficient level and will have to become more ambitious with developing and implementing their national renovation strategies. According to a recent analysis by the European Commission [15], "a weak part of the [renovation] strategies remains the evaluation and monitoring of implemented policies." Without comprehensive monitoring, it will not be possible to measure the progress on the goals to which European Member States committed. It will therefore be necessary to consistently collect specific monitoring indicators which allow the tracking of the improvement of buildings within the EU.

The goal of a fully decarbonised building stock which meets the needs of European citizens can only be achieved with buildings that are highly energy efficient and cover their very low energy demand to a large extent by onsite or district-system-based renewable energy sources. Such buildings stabilise and drive a faster decarbonisation of the energy system through energy storage and demand-side flexibility and empower users and occupants with control over the energy flows. User-centric buildings recognise and react to users' and occupants' needs regarding comfort, health, indoor air quality and safety as well as operational requirements [16].

RECOMMENDATIONS FOR ACTION

A comprehensive monitoring and verification system to track progress regarding the transformation of the building stock and the state of national long-term renovation strategies should be introduced:

The European Commission should, in collaboration with Member States, launch a comprehensive monitoring and verification system to track progress regarding the transformation of the building stock and the preparation and implementation of national long-term renovation strategies. The European Building Stock Observatory and its dataset provides a relevant starting point and could be expanded with specific indicators tracking change.

The experience from the Observatory shows that respective data gathering across Europe is inconsistent and incomplete. A new initiative by the EU's statistical office Eurostat should work with national governments to provide a complete and meaningful supply of data about European buildings to enable effective policy monitoring and implementation.

The forthcoming Multiannual Financial Framework (MFF) 2021-2027 should allocate sufficient funding for technical assistance for Member States, for financial support programmes to renovate the building stock and for capacity building and awareness raising. The MFF should also provide the means to support new third-party financing models.

The energy system benefits of highly efficient and smart buildings should increasingly be taken into account for cost-benefit analysis providing the basis for policy-making.

Urban biodiversity and nature-based solutions

Bringing nature back into cities and increasing biodiversity in densely populated areas is important to address some of the challenges in a dense urban built environment. Nature-based solutions for cities can help reduce urban greenhouse gas emissions while also increasing resilience of cities to climate change impacts. Renaturing cities delivers on both mitigation and adaptation to climate change.

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Support for nature-based solutions and an increase in urban biodiversity could be fostered by taking respective design criteria for buildings and spatial planning principles into account. This would help address urban challenges such as air pollution, flooding, increasing heat island effects and health problems [17].

Buildings which are designed to integrate green spaces would increase the absorption of extreme precipitation, could provide natural water purification and could help modulate temperature changes. Multifunctional buildings could encourage small-scale agricultural production in rooftop gardens, encouraging and enabling more sustainable food consumption patterns among citizens.

Local and regional governments have the opportunity to implement projects to "green" their cities, resulting in environmental, social and economic benefits. Planning and design of new buildings and the renovation of existing buildings could procure nature-based solutions. Spatial planning for green spaces can help natural ventilation and cooling in urban spaces and decrease heat island effects, which in turn reduces cooling needs (and hence energy demand) for buildings. Such solutions would require a changing approach to defining building performance requirements in connection with spatial planning in cities. This would provide new investment opportunities which could be offered by municipal governments.

RECOMMENDATIONS FOR ACTION

Governments should implement nature-based solutions in the built environment:

An Urban Biodiversity Directive could support the cross-sectoral integration of nature-based solutions. Such an initiative could be delivered as part of a revision of the EU's Biodiversity Strategy which sets targets for 2020. A mid-term review by the EU regarding the progress showed a lack of achievements in almost all categories. Increasing biodiversity by respective measures in the built environment could have a positive impact.

Governments at national and local level could take broad initiatives to implement nature-based solutions through building codes and spatial planning which would combine climate change mitigation and adaptation objectives.

Adaptation to climate change impacts

The EU estimates that the climate change-related damage to infrastructure could grow tenfold under a business-as-usual scenario.

Impacts of climate change on the built environment are expected to increase in the coming decades, notwithstanding efforts to mitigate climate change. The EU estimates that the climate change-related damage to infrastructure could grow tenfold under a business-as-usual scenario [18].

In order to minimise losses, the buildings and construction sector will have to implement strategies that make the sector more resilient. The Intergovernmental Panel on Climate Change defines adaptation as "actions taken to manage impacts of climate change by reducing vulnerability and exposure to its harmful effects and exploiting any potential benefits." [19].

Increasing heatwaves are expected to exacerbate the urban heat island effect, which can cause a temperature difference of up to 10°C with surrounding rural areas [20]. The effect carries a large burden at night when thermal discomfort creates negative impacts on health and sleep patterns. Keeping heat out of buildings and providing effective and efficient means of cooling are important strategies to adapt to climate change while also creating synergies with measures which reduce energy consumption.

While the EU agreed an adaptation strategy in 2013, there is no specific strategy in place which would cover the built environment, even though this is the biggest infrastructure asset in Europe.

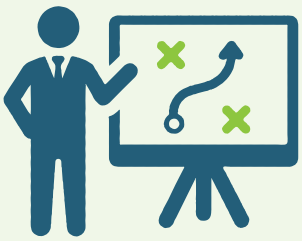
The EU Adaptation Strategy requires that climate resilience is taken into account for long-term infrastructure investments. This could be achieved by climate-proofing any infrastructure funded by the EU. Operational programmes agreed in the European Structural and Investment Funds should reflect this. The European standardisation group CEN/CENELEC issued a guidance document on how to address adaptation in standards; however, the buildings sector is covered only marginally at this point in time.

Many strategies to mitigate climate change, such as increased building energy efficiency with better-insulated building envelopes, are also appropriate adaptation strategies.

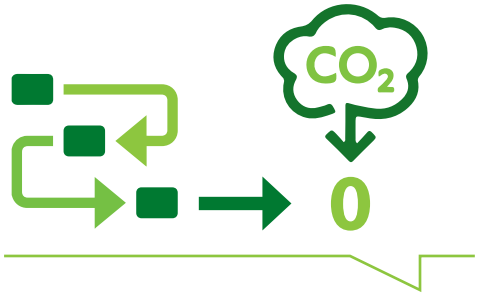
According to recent analysis of national adaptation plans by the Global Alliance for Buildings and Construction, developed countries are mainly concerned about the impacts of flooding and extreme weather on cities, and the ability of existing buildings to cope with increased temperatures [21]. However, while some governments are starting to address the issue, the buildings and construction sector itself does not seem to pay a lot of attention to the topic. Many strategies to mitigate climate change, such as increased building energy efficiency with better-insulated building envelopes, are also appropriate adaptation strategies. Service offers providing data are being developed in support of respective strategies [22]. Well-insulated buildings with effective (passive or active) cooling and ventilation solutions are better equipped to deal with extreme temperatures. Nature-based solutions and strategies to green densely populated areas will provide synergies with mitigation measures in the built environment. However, a comprehensive approach is missing.

RECOMMENDATIONS FOR ACTION

A European adaptation strategy for the built environment should be developed:



A European initiative to develop a comprehensive adaptation strategy for the built environment is urgently needed. It requires the collaboration of the private sector, local, regional and national agencies and EU institutions. Failing buildings infrastructure due to climate change impacts represents a significant threat to citizens' health, comfort and safety, and societal stability and cohesion. Urgent action is required. The European Commission should facilitate and moderate the development of an adaptation strategy for the built environment.



Conclusion:
Steps towards a zero-carbon and circular built environment

The vision of a zero-carbon and sustainable building stock will be achieved via many different pathways. Each community of actors will have to develop its solutions reflecting its innovation potential, its climate impact and its sphere of influence. In order to support the building and construction community in its transformation process, the European Union, its institutions and its Member States should evolve the policy framework, providing clarity about the future direction and guiding the sector in its transformation. Activities in the building and construction sector are currently regulated by a large number of Directives and Regulations. A comprehensive mapping of the current regulatory framework based on existing analysis [23] would highlight gaps and opportunities for refining the regulatory ecosystem to react to the challenges described in this paper.

AN INITIATIVE FOR A TRANSFORMATION OF THE BUILDINGS AND CONSTRUCTION SECTOR

Without pre-empting the results of such a wider analysis, the next European Parliament legislature together with a newly appointed European Commission should include an initiative to launch and support a transformation of the buildings and construction sector.

This could include an evolution from the Energy Performance of Buildings Directive to a Sustainable Design and Performance of Buildings Directive. This more comprehensive Directive would include a lifecycle perspective, without neglecting the energy performance of buildings and the large potential to reduce energy consumption in the sector.

A SUSTAINABLE DESIGN AND PERFORMANCE OF BUILDING DIRECTIVE

A URBAN BIODIVERSITY DIRECTIVE

In order to move towards truly sustainable cities, a regulatory initiative supporting nature-based solutions for both mitigation and adaptation could support a comprehensive solution strategy for the built environment. A Urban Biodiversity Directive could be an element of such a framework, supporting concepts such as urban farming, renaturing cities and an overall increase of quality of urban design for liveability.

PROGRAMMES TO SPEED UP INNOVATION IN THE CONSTRUCTION SECTOR

Driving innovation and increasing productivity in the construction sector requires significant support, in particular for the large number of SMEs. The sector is not keeping step with the digitalisation and productivity developments observed in many other economic sectors. The EU should launch well-targeted programmes to speed up innovation in the construction sector.

A "CIRCULAR BUILDINGS AND CONSTRUCTION" APPROACH

In order to make the principles of a circular economy operational in the buildings and construction sector beyond the topic of the construction materials stream, it would be necessary to develop a "circular buildings and construction" approach which is embedded in other policy fields. These policy fields could include public procurement rules, the EU's budget and associated policies like the Cohesion Policy, the Construction Products Regulation, and national spatial planning regulations.

A CONSISTENT DATA AND KNOWLEDGE MANAGEMENT APPROACH

Effective policy design will require improved knowledge on a range of indicators relevant for buildings and construction. While initiatives are ongoing to increase data availability related to buildings and construction, such as the EU Building Stock Observatory, the European Construction Sector Observatory, the EU Energy Poverty Observatory and studies on specific topics, gaps remain regarding comprehensive data on topics such as embedded carbon. Various data and knowledge initiatives currently form a patchwork in the EU and its Member States which would benefit from a consistent knowledge management approach to inform policy-making in the next legislative period.

A CIRCULARITY STRATEGY FOR THE BUILT ENVIRONMENT

While the EU recently reported completion of its Circular Economy Action Plan, it should produce a second edition of this plan to include a circularity strategy for the built environment. This strategy should go beyond the issue of construction and demolition waste and building materials circularity, as described in this paper.

Summary of recommendations

Spatial planning should satisfy societal needs in a sustainable way and be aligned with building regulations for a highly energy efficient and zero-carbon building stock. The EU could define principles of spatial planning that support sustainable and zero-carbon spaces, with a strong focus on revitalisation of neglected areas using urban and rural regeneration action plans.

A circular and zero-carbon building stock should be achieved in a fair and just transition. Healthy and energy-efficient homes should be accessible for all parts of society. Public funds should be used to support affordable and sustainable zero-carbon buildings, with a particular focus on rental accommodation lower than energy performance class B to allow for cost-neutral renovation for the benefit of tenants.

Performance standards should ensure future-proof quality of the built environment. Clear requirements for minimum performance standards provide planning and investment certainty for building owners. Mandatory renovation of buildings in the worst-performing building efficiency classes would send clear market signals.

The InvestEU initiative should ensure that energy efficiency and buildings renovation play an increasing role and should implement a respective monitoring and reporting system.

Adapting the built environment to climate change is an investment need which should be linked with mitigation investments. Increasing and facilitating investments for mitigation and adaptation in buildings could be supported by financing models that allow third parties to invest.

A regulatory framework to use telecommunication data for spatial planning and building design could support the transformation of the building stock in the EU, while respecting data privacy concerns.

Future regulatory initiatives addressing buildings should encourage the construction of adaptative buildings and ensure that major renovations take adaptability into account. The EU could focus a share of its research funding on this specific aspect.

The EU could develop a regulatory framework for procurement which supports circularity and zero-carbon and climate-resilience goals for the built environment.

CONSTRUCTION MATERIALS

Moving towards a comprehensive evaluation of the climate change impact of buildings during their construction and use phase will be essential to support a zero-carbon European economy and society. A system and indicators to measure and monitor the full climate impact of buildings should be established.

The EU could implement its current voluntary reporting initiative Level(s) as a comprehensive assessment system of the sustainability performance of buildings, including the already present focus on climate change over the lifecycle. A building passport or logbook documenting the use of materials would support awareness and choice for products leading to a building with the lowest carbon footprint over its lifecycle.

The EU, through R&D funding, could support a comprehensive data collection exercise on the lifecycle carbon emissions of buildings.

BUILDINGS IN THE ENERGY SYSTEM

The European Commission should, in collaboration with Member States, launch a comprehensive monitoring and verification system to track progress regarding the transformation of the building stock, and national long-term renovation strategies. A new initiative by Eurostat should work with national governments to provide complete data about European buildings to enable effective policy monitoring and implementation.

The forthcoming Multiannual Financial Framework (MFF) 2021-2027 should allocate sufficient funding for technical assistance for Member States, for financial support programmes to renovate the building stock and for capacity building and awareness raising. The MFF should also provide the means to support new third-party financing models.

The energy system benefits of highly efficient and smart buildings should increasingly be taken into account for cost-benefit analysis providing the basis for policy-making.

URBAN BIODIVERSITY AND NATURE-BASED SOLUTIONS

An Urban Biodiversity Directive could support the cross-sectoral integration of nature-based solutions. Such an initiative could be delivered as part of a revision of the EU's Biodiversity Strategy which set targets for 2020.

Governments at national and local level could take broad initiatives to implement nature-based solutions through building codes and spatial planning which would combine climate change mitigation and adaptation objectives.

ADAPTATION TO CLIMATE CHANGE IMPACTS

A European initiative to develop a comprehensive adaptation strategy for the built environment is urgently needed. Failing buildings infrastructure due to climate change impacts represents a significant threat to citizens' health, comfort and safety, and societal stability and cohesion. The European Commission should facilitate and moderate the development of an adaptation strategy for the built environment.

End-notes

[1] For an overview and quantification of renovation benefits in business, health and education sectors see BPIE 2018: Building 4 People: Quantifying the impact of a better indoor environment in schools, hospitals and offices.
[2] The Paris Agreement is an official decision reached at COP21 in 2015, accessible here.
[3] Global Alliance for Buildings and Construction: 2018 Global Status Report.
[4] Energy Performance of Buildings Directive (EU) 2018/844
[5] Circle Economy: The Circularity Gap Report 2019.
[6] BPIE 2018: Building 4 People: Quantifying the benefits of energy renovation investments in schools, offices and hospitals. Methodology and results.
[7] For more details see the Urbansis website.
[8] For an overview of current literature see Adams, K.T. et al (2017): Circular economy in construction: current awareness, challenges and enablers. In: Waste and Resource Management (February 2017), available at ResearchGate.
[9] Material Economics 2018: The Circular Economy. A powerful force for climate mitigation.
[10] EU-funded projects such as www.re4.eu, innowee.eu and others are developing solutions.
[11] European Commission 2016: EU Construction and Demolition Waste Management Protocol.
[12] Regulation (EU) No 305/2011.
[13] BPIE 2017: Opening the doors to smart buildings.
[14] For guidance on implementation of the EPBD see e.g. BPIE 2019: Future-proof buildings for all Europeans – a guide to implement the Energy Performance of Buildings Directive, and guidance document on the website of DG Energy.
[15] Castellazzi, L. et al. 2019: Assessment of second long-term renovation strategies under the Energy Efficiency Directive. JRC Science for Policy Report.
[16] BPIE 2017: Smart Buildings Decoded.
[17] IUCN Global Alliance for Greener Cities.
[18] COM(2018) 738: Report From The Commission To The European Parliament And The Council on the implementation of the EU Strategy on adaptation to climate change.
[19] IPCC 2018 Special Report: Global Warming of 1.5°C.
[20] European Environment Agency 2017: Climate change, impacts and vulnerability in Europe 2016. EEA Report 1/2017
[21] Global Alliance for Buildings and Construction 2018: Global ABC thematic background paper: National adaptation plans for the buildings sector.
[22] See urbansis.climate.copernicus.eu.
[23] Such as the DG Grow 2016 "Supporting Study for the Fitness Check on the Construction Industry in the policy areas of Internal Market and Energy Efficiency".

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