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TOWARDS A CLIMATE-RESILIENT BUILT ENVIRONMENT

A DISCUSSION PAPER ON OPPORTUNITIES AND PRIORITIES FOR CLIMATE ADAPTATION IN THE EU

BPIE

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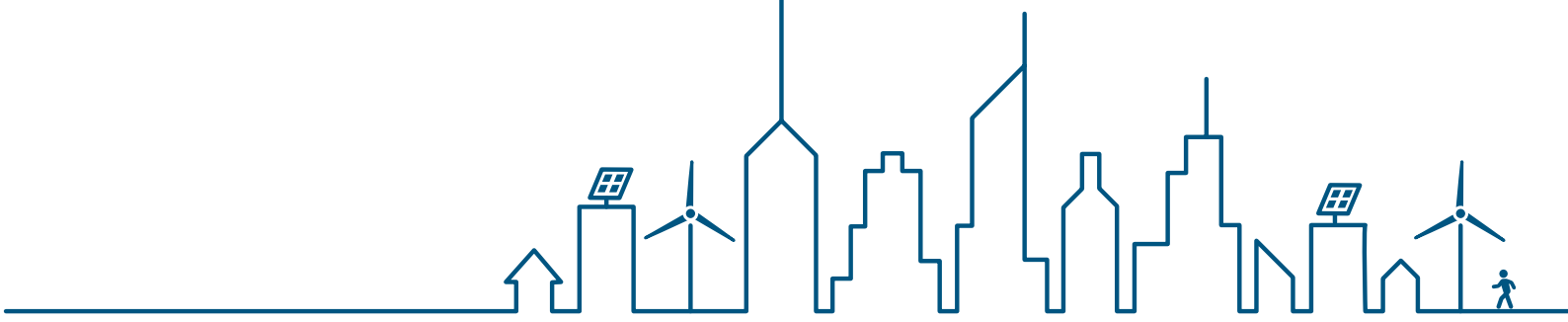


Key messages

- Accelerating climate change exposes the EU built environment to increasing risks, jeopardising its foundational role in human life and prosperity.
- A holistic approach to climate resilience is needed to reduce the risk of maladaptation, ensure Just Resilience and exploit synergies of adaptation and mitigation efforts at all levels of governance. Just Resilience involves addressing the unequal distribution of climate impacts and ensuring that adaptation efforts are inclusive, leaving no vulnerable populations behind.
- The EU does not have a clear definition and vision for a climate-resilient built environment based on such a holistic approach.
- As the topic of a climate-resilient built environment is not specifically encompassed by any single EU policy file, consistency between adaptation and buildings policy documents could be increased through a European Commission-led EU Strategy for a Climate-Resilient Built Environment.
- A patchwork of non binding EU initiatives demonstrates awareness of the relevance of climate adaptation for a climate-resilient built environment. However, they only cover parts of the EU, in particular pioneer regions and cities, which means other areas could potentially be left behind. A comprehensive EU Strategy for a Climate-Resilient Built Environment would enable all cities and regions in the EU to benefit from capacity-building and accelerated action to reduce climate risk. Incorporating local voices from across the EU is crucial in drafting this strategy.
- As yet, there is no comprehensive monitoring framework at EU level to ensure that actions taken will adequately address climate risks and achieve a climate-resilient built environment.
- Based on the European Environment Agency's indicators for Just Resilience, the European Commission should take the lead, and set out a Just Resilience monitoring framework for Member States.

THE BUILT ENVIRONMENT IS AFFECTED BY ACCELERATING CLIMATE IMPACTS

The EU built environment is increasingly exposed to worsening climate impacts. To protect livelihoods and avoid damages and costs, the EU needs to intensify adaptation action towards achieving a climate-resilient built environment. This requires a holistic approach, enhancing the adaptive capacity of buildings, of their surrounding ecological environment, and the well-being and health of their users – while putting justice considerations at its centre. This will avoid the risk of unintended impacts from inadequate adaptation actions, and will facilitate greater synergies with mitigation actions.

Climate impacts affect human livelihoods directly, for instance when floods and storms damage buildings and cause the long-term displacement of communities. But climate impacts also magnify existing risks, such as health issues, poor water management practices, and social inequality [1]. For example, in many cities, areas at risk of indoor overheating and urban heat islands (UHI) often include hospitals, where many ill people are housed, as well as social housing, which is consistently associated with poor health [2]. Higher UHI effects increase the risk, especially for vulnerable populations.[1] Heat-related deaths have already increased by 94% in the EU between 2000 and 2020 [4]. What's more, severe floods can disrupt communities, especially in places with inadequate sewage and stormwater systems, leading to significant health issues and economic instability. In nearly 13% of EU cities, over a quarter of the population resides in areas that are at risk of river flooding [3, p. 1852].

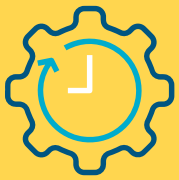
As well as directly threatening livelihoods, the absence of decisive action could result in economic losses of EUR 1 trillion *per year* due to coastal flooding alone by the end of the century [1]. The EU has already incurred an estimated EUR 650 billion in damages from climate-related extreme events between 1980 and 2022 [5]. For 2023, it has been estimated that EU economic losses related to weather and climate events exceeded €13.4 billion [4], which is more than the total EU budget for security and defence between 2021-2027 [6].

[1] 'Vulnerable populations' refers to infants, children, the elderly, people with disabilities, those with low incomes or in poor health, individuals with limited social networks, immigrants, ethnic minorities, and Indigenous Peoples [3]. These demographic segments often have less involvement in decision-making processes.

The EU built environment – the buildings and infrastructure that integrate the physical, natural, economic, social and cultural capital they hold and are surrounded by [7] – is one of the key societal systems exposed to this increasing and increasingly expensive physical climate risk. This has repercussions for its cultural and historical value, increases the risk of stranded assets, and jeopardises its role as the foundation of human life and prosperity. Climate impacts also risk derailing ongoing mitigation actions for buildings; for example when floods damage freshly renovated buildings, or when increased air-conditioning consumption offsets energy efficiency investments.

Therefore, it is crucial for the EU to set a clear path towards a **climate-resilient built environment,** as one piece of the puzzle in wider efforts to ensure a resilient society. Its strategy must take a holistic approach, considering both mitigation and adaptation. Adaptation should not only address the vulnerabilities of buildings as technological entities or systems, but should integrate them with nature-based solutions and improve the health and well-being of their occupants and users. What is more, the unequal burden of climate impacts borne by more vulnerable communities should be acknowledged and systematically integrated into action planning. At the same time, the voices of those affected should be included in the decision-making process, in order to fairly distribute the costs and benefits of adaptation action. With a systemic approach, an EU strategy for a climate-resilient built environment can create and exploit synergies with existing mitigation actions, and safeguard against any unintended consequences of adaptation action.

ADAPTATION



In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects.[3]

RESILIENCE

The capacity of interconnected social, economic and ecological systems to cope with a hazardous event, trend or disturbance, responding or reorganising in ways that maintain their essential function, identity and structure. Resilience is a positive attribute when it maintains capacity for adaptation, learning and/or transformation.

A HOLISTIC APPROACH
FOR A CLIMATE-RESILIENT BUILT ENVIRONMENT IN THE EU

Amidst escalating climate impacts and societal challenges, climate adaptation policies in the built environment need to gain prominence if the EU is to advance towards a more resilient society. Current policy responses to the climate crisis focus on mitigation. While this is an essential aim, it nevertheless fails to address the vulnerabilities of buildings and infrastructure and the ecological systems they are embedded in, as well as the communities they serve. A climate-resilient built environment should withstand diverse climate impacts, be highly energy-efficient and based on decentralised renewables, and foster adaptability, justice and inclusivity to enhance community well-being.

EU policies have so far primarily aimed to reduce greenhouse gas (GHG) emissions from the building sector, acknowledging its contribution to the worsening climate crisis. Buildings are responsible for around 35% of the EU's energy-related GHG emissions (in 2021) [8]. This is reflected in **climate mitigation policy-related documents dealing with buildings**, like the Energy Performance of Buildings Directive (EPBD) [9] and the Renovation Wave Strategy [10].

Europe is the fastest-warming continent on Earth [4], **yet its adaptation policies and actions do not match escalating climate risks** [1]. Furthermore, in Europe, the implementation of existing adaptation options in vulnerable sectors, regions and societal groups is impeded by barriers such as limited resources, lack of private-sector and citizen engagement, insufficient mobilisation of finance, lack of political leadership, and low sense of urgency [3, p. 1821]. However, the EU Climate Law states that "relevant Union institutions and the Member States shall ensure continuous progress in enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change" [11]. So what would a fully climate-resilient built environment for the EU look like, and which adaptation actions would be needed to achieve this?

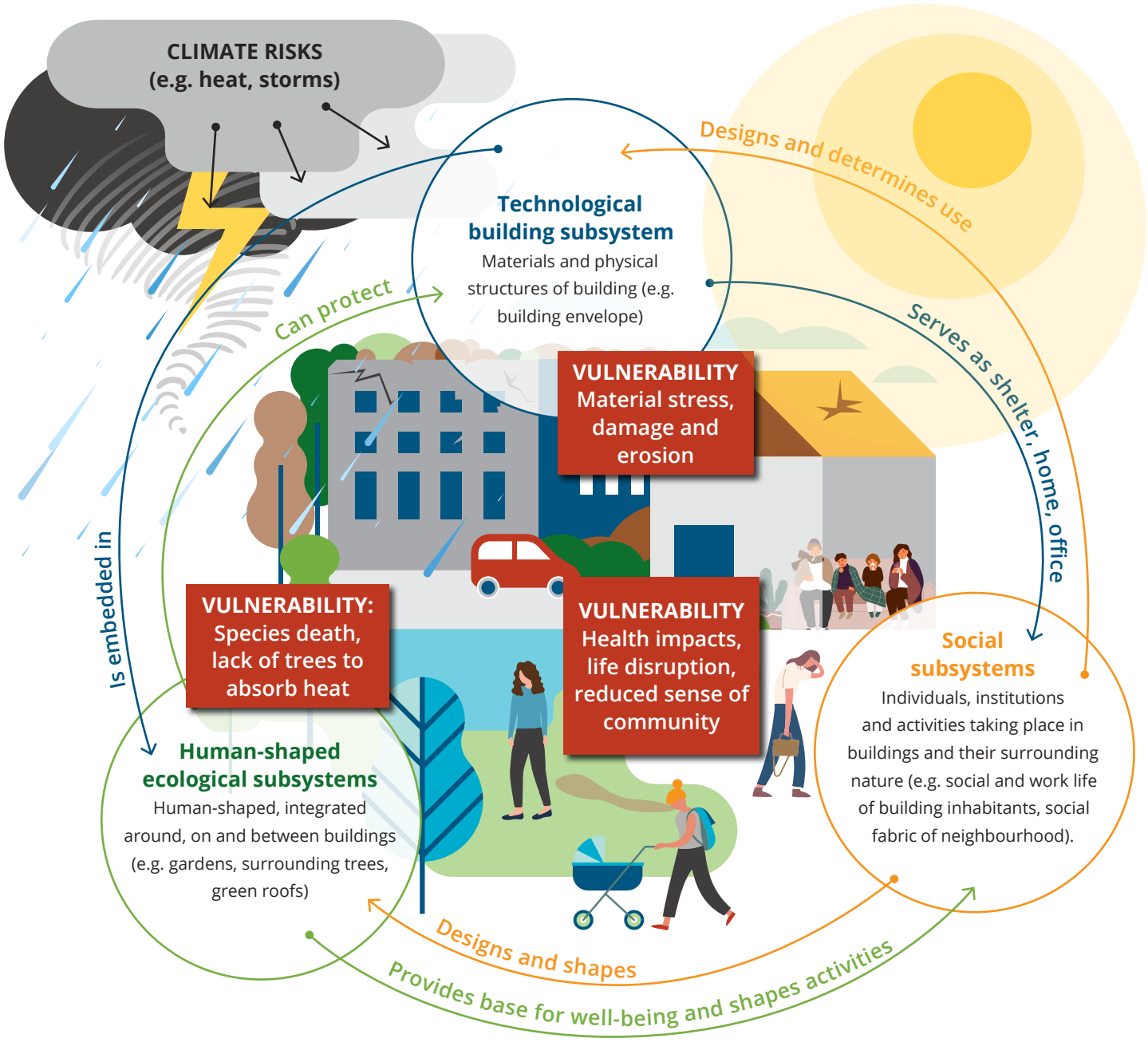
ADAPTING THE BUILT ENVIRONMENT TO BE CLIMATE-RESILIENT REQUIRES GREATER CAPACITY OF SUBSYSTEMS TO RESPOND TO THE IMPACTS OF CLIMATE CHANGE.

The built environment can be conceptualised into three interconnected subsystems: technological building subsystems, social subsystems, and human-shaped ecological subsystems (Figure 1).

Figure 1: The built environment is made of three interconnected subsystems

Each subsystem has its own way of functioning, and therefore its own vulnerabilities to climate risks. Adaptation solutions might address the vulnerabilities of each subsystem in isolation. For example, climate-responsive – and thus climate-resilient – technological building subsystems (e.g. building envelope) can be encouraged through architectural and urban design (Figure 2).

Figure 2: Three subsystems of the built environment, their vulnerabilities and interactions



Each subsystem has specific adaptation strategies in isolation. For example:

- Technological subsystem: Using fire-resistant building compartments
- Social subsystem: Emergency response and evacuation plan and space in the built environment where people can gather
- Ecological subsystem: Plant local tree species that can withstand local climate threats (e.g. heat) in cities

ACHIEVING CLIMATE-RESILIENCE REQUIRES A HOLISTIC APPROACH TO ADAPTATION ACROSS SUBSYSTEMS

The vulnerabilities of the technological, social and ecological subsystems are linked. When nature-based solutions malfunction, they not only weaken the broader urban natural ecosystem, but also fail to provide protection such as a cooling effect for buildings and people. Buildings impacted by storms or floods can no longer provide the protection and shelter required for occupant well-being. Actions to achieve more climate resilience thus require a holistic approach which incorporates all three subsystems and their interactions. In this way, synergies between interventions can be exploited, increasing cost-effectiveness and improving the protection offered by each subsystem (see Figure 3 for examples). A more holistic view also allows the integration of existing and planned mitigation interventions into the adaptation planning process, so time schedules can be aligned and actions can be designed to reinforce each other. For example, support for tenants in understanding how to operate the building effectively can increase its adaptive capacity while reducing energy use for air conditioning, mitigating its climate impact. And using more sustainable building materials for adaptation intervention can extend the service life of technological building subsystems, thus reducing their overall carbon footprint. Additionally, renovation actions that do not consider adaptation features can exacerbate vulnerabilities, emphasising the importance of integrating adaptation measures in planning and execution. Highly insulated buildings, for example, are at risk of overheating without adequate adaptation measures such as sufficient ventilation and solar protection [4].

The vulnerabilities of the different subsystems are linked. When nature-based solutions malfunction, they not only weaken the broader urban natural ecosystem, but also fail to provide protections such as a cooling effect for buildings and people.

Figure 3: Interventions for climate resilience in the built environment should take a holistic approach

A HOLISTIC APPROACH FOR CLIMATE-RESILIENCE REDUCES THE RISK OF MALADAPTATION

Failing to consider the interactions of the different subsystems of the built environment and their interdependences can result in maladaptation. Maladaptation refers to adaptation measures with unintended consequences that shift vulnerability to other sectors, other locations or other communities, resulting in their increased exposure or vulnerability to climate risk and lock-ins [3], [13].

EXAMPLES OF CLIMATE MALADAPTATION INCLUDE:

Overlooking integrated solutions: Rising energy demand for cooling/air conditioning, especially in southern Europe, threatens to undermine mitigation actions such as energy efficiency efforts [14]. Instead, cooling should be achieved through adaptive design choices in buildings (e.g. passive ventilation through thermal chimneys or solar shading installations) and using nature-based solutions (e.g. trees) [15].

Increased urban heat island effect: Using nature such as increased tree coverage is a cost-effective way to mitigate UHI effects and reduce related deaths [16]. However, planting non-native, dark-leaved trees around buildings can inadvertently raise local temperatures and increase the UHI effect rather than mitigating it [17]. The type and characteristics of the trees chosen for use should therefore be carefully assessed to fit the local context.

Ignoring future climate projections in infrastructure planning: The construction of critical buildings (such as hospitals) in areas prone to flooding, sea-level rise, or extreme weather events should be avoided through comprehensive climate risk assessments and effective planning.

Economic and social displacement: Without careful planning, upgrading buildings to be more climate-resilient could lead to gentrification and a lack of affordability [18]. This may force lower-income residents out of their homes and communities, displacing their vulnerabilities rather than alleviating them.

Considering each subsystem on its own, with climate solutions structured against individual climate risks, e.g. floods, droughts and storms, does not adequately address the complexity of the challenge facing the built environment. While this approach may help clarify costs and risk magnitude – which is particularly relevant for insurance stakeholders – the built environment does not face these risks in isolation. A more intervention-centred strategy deriving from a holistic approach can provide useful insights, if it is structured alongside intervention types such as behaviour change, technological measures, governance measures, or economic instruments [19]. This means that the impact of an intervention on all three subsystems can be considered more systemically.

A HOLISTIC APPROACH INCREASES 'JUST RESILIENCE'

Adaptation measures are more effective when they consider the dynamics of the built environment subsystems. They can be even more effective when justice is considered [3]. Adaptation measures carried out in a just and fair manner lead to 'Just Resilience':

- The first aspect of 'Just Resilience' [18] is to acknowledge that climate change impacts different parts of society unevenly. While location and quality of buildings determine exposure to climate risk, there are systemic injustices that cause disproportionate vulnerabilities among specific people and communities. For example, poor citizens are more likely to live in areas with less green space, in poorly insulated buildings, or they may lack the means to change location or building design. Reaching resilience thus entails understanding vulnerabilities and their intersectionality[2] [20]: people might be vulnerable through different parts of their identity, such as age, disability, socioeconomic background, gender, skin colour, or other factors.
- The second aspect of 'Just Resilience' is about how to design adaptation measures which 'leave no one behind', both in terms of sharing the benefits and burdens of adaptation action, and ensuring fair participation in decision-making. For example, a programme to plant trees to cool buildings should pay special attention to neighbourhoods with higher concentrations of UHI effects and vulnerable people. Overall, this would ensure that maladaptation – and the further burdens it places on certain segments of the population – could be avoided.

DEFINING THE VISION FOR A CLIMATE-RESILIENT BUILT ENVIRONMENT

All the elements mentioned above provide a solid base on which to outline a vision for and definition of a climate-resilient built environment. Current policy efforts can then be benchmarked against this vision, which should also inform the next steps to be taken.

A CLIMATE-RESILIENT BUILT ENVIRONMENT:

- **is the product of a holistic approach which exploits synergies in adaptation and mitigation efforts, is centered on Just Resilience, and avoids maladaptation;**
- **is adaptable in each of its three subsystems and as a whole;**
- **can anticipate, withstand, and recover from diverse climate impacts;**
- **is highly energy-efficient, renewable-based and healthy; and**
- **actively enhances the well-being of its inhabitants and contributes to the resilience of society more broadly.**

[2] Intersectionality refers to the notion that while some people might experience discrimination or increased vulnerability due to a single specific aspect of their identity (e.g. their gender), others will experience it as a result of a combination of factors (e.g. their gender, their skin colour and their age).

EU POLICY ACTION FOR A CLIMATE-RESILIENT BUILT ENVIRONMENT: WHERE DO WE STAND?

Existing EU adaptation and buildings policies do not currently provide a concrete roadmap to achieve a climate-resilient built environment. Instead, adaptation action for the built environment stems from a patchwork of legislative files and initiatives such as the Mission on Adaptation to Climate Change or the New European Bauhaus. The EU is directly creating networks, empowering people at local level and seeking to mainstream Just Resilience. However, while these actions are essential, this patchwork approach and the absence of a clearly defined and legally binding policy document on the topic could lead to maladaptation and delayed action in times of escalating climate risk.

To respond to climate risks, the EU should set out a clear strategy and take strong action to achieve a climate-resilient built environment. To assess the extent to which EU policy documents are already fit for this purpose, this chapter presents a gap analysis.[3] The analysis has three dimensions:

(1) Approach and narrative: Is the holistic approach of adaptation for climate resilience in the built environment reflected – i.e. using 'built environment' instead of 'buildings', recognising that adaptation actions need to go beyond the technological building subsystem, acknowledging Just Resilience and maladaptation? Does the EU have a clear definition or vision for a climate-resilient built environment, and is this definition used consistently across documents?

(2) Policy consistency: In which policy file(s) are adaptation actions for the built environment set? What actions are specified in buildings and adaptation policy documents, and do they match each other when they appear in different documents (cross-referencing)? Will actions be taken at the scale required? In this analysis, policy documents related to EU financial policy (e.g. the EU Taxonomy[4]) are not considered – this will need further assessment.

[3] The analysis builds on the analysis of policy documents of various formats such as directives, communications, initiatives, guidance. It is supported by input from conversations with experts on adaptation and cities.

[4] For an initial assessment consider Chapter 1.3.1 in the EU-level technical guide for adapting buildings to climate change [21].

(3) Implementation: What actions have already been implemented? What monitoring systems are in place?

HOW IS ADAPTATION FRAMED IN CURRENT EU POLICY FILES?

A (slowly) more systematic approach to adaptation by the Commission

Historically, the Commission has approached adaptation as a manageable "challenge for planning authorities in Europe" [22, p.12] rather than something that requires systemic changes (Annex 1 provides an overview of the historic development of narrative in EU adaptation policy documents). The 2021 EU Adaptation Strategy marks the beginning of a change towards a more systemic understanding of and language on adaptation, acknowledging its more integrated nature, recognising ecosystem services and nature-based solution approaches, introducing the concept of Just Resilience, and highlighting the risk of extreme weather to buildings' mitigation potential [23]. The 2024 Communication on managing climate risks takes this systemic approach one step further and mentions the need for cross-cutting solutions to address climate risks alongside other societal challenges [24].

There is a gradual shift of language from 'buildings' to 'built environment', yet its definition and relevance remains unclear.

The Renovation Wave contains the following definition: "Climate-resilient buildings means that the buildings are renovated to be resilient against acute and chronic climate-related hazards relating to temperature, wind, water and solid mass, as appropriate". Since this definition was formulated, buildings have begun to be seen as more than just components of infrastructure at risk. The EU adaptation strategy recognises the link between technological and ecological subsystems by highlighting the value of green roofs and walls for adaptation. The Communication on managing climate risk is the first to have a chapter on infrastructure and *built environment*: "The design of the built environment determines the resilience of the buildings themselves, and its inhabitants. Co-benefits of climate proofing residential housing in terms of affordability, a healthier living environment, and improved energy efficiency should be maximised." [24, p.20]. This shows a significant shift toward a more holistic understanding of the built environment, considering the interconnection of buildings and their users. However, throughout EU policy documents, 'built environment' is used interchangeably with 'buildings' without a more nuanced understanding of its meaning and the interactions of its three key subsystems. The recognition that adaptation action goes beyond the design of buildings is not reflected in a clear EU definition of or vision for a climate-resilient built environment.

Awareness of the importance of placing justice at the centre of adaptation policy is growing, yet understanding remains limited.

The EU Adaptation Strategy introduced the term Just Resilience. This is a welcome addition. However, the Commission's priority in its implementation seems to relate more to the reskilling and requalification of workers – which is an important aspect, but not the only one. While just resilience is mentioned, what is missing is the recognition of unequal *systemic* vulnerabilities through pre-existing inequalities, and the inclusion of those affected by adaptation measures through participatory policymaking. The EU Mission on Adaptation to Climate Change[5] stands out as the EU initiative which makes the most references to the principles of Just Resilience. The mission is a good example of how to adopt a more systemic policy narrative spanning disciplines and governance. However, the EU Mission on Adaptation to Climate Change is a non-legislative initiative that only operates in selected parts of the EU, and thus only pioneer regions profit from its resources.

[5] It belongs to one of five EU missions launched under Horizon Europe in 2021.

The risk of maladaptation is not acknowledged in adaptation-related EU policy documents.

Maladaptation is only mentioned once, and marginally, in all the EU policy documents analysed. The EU-level technical guidance on adapting buildings to climate change gives excellent examples of adaptation [21]. However, it is structured alongside climate risks (e.g. storms, heat). This makes sense as a blueprint for adapting technological building subsystems. However, it also means that the risks of adapting these subsystems in isolation are not mentioned. For example, adaptation measures may be implemented without considering the perspective of those affected by the intervention. The risk of maladaptation itself is not even mentioned, which could potentially lead to unintended and undesirable outcomes.

Despite its fragmentation across a number of policy documents, the narrative on adaptation at EU level has increasingly widened its focus beyond the technological building subsystem. It is moving towards acknowledging that there are co-benefits for sociocultural and economic subsystems (e.g. liveability), and synergies with the human-shaped ecological subsystem (e.g. green roofs) as well as with mitigation action (energy efficiency). However, a definition and vision for a climate-resilient *built environment* is absent from the EU policy landscape. This is a missed opportunity to address the risk of maladaptation and the critical importance of Just Resilience – two essential aspects that should underpin the approach to adaptation in the built environment.

The following section will explore how the existing narrative and approaches have been reflected in concrete policy actions or intentions.

HOW COHERENT ARE CURRENT EU BUILDING AND ADAPTATION POLICIES?

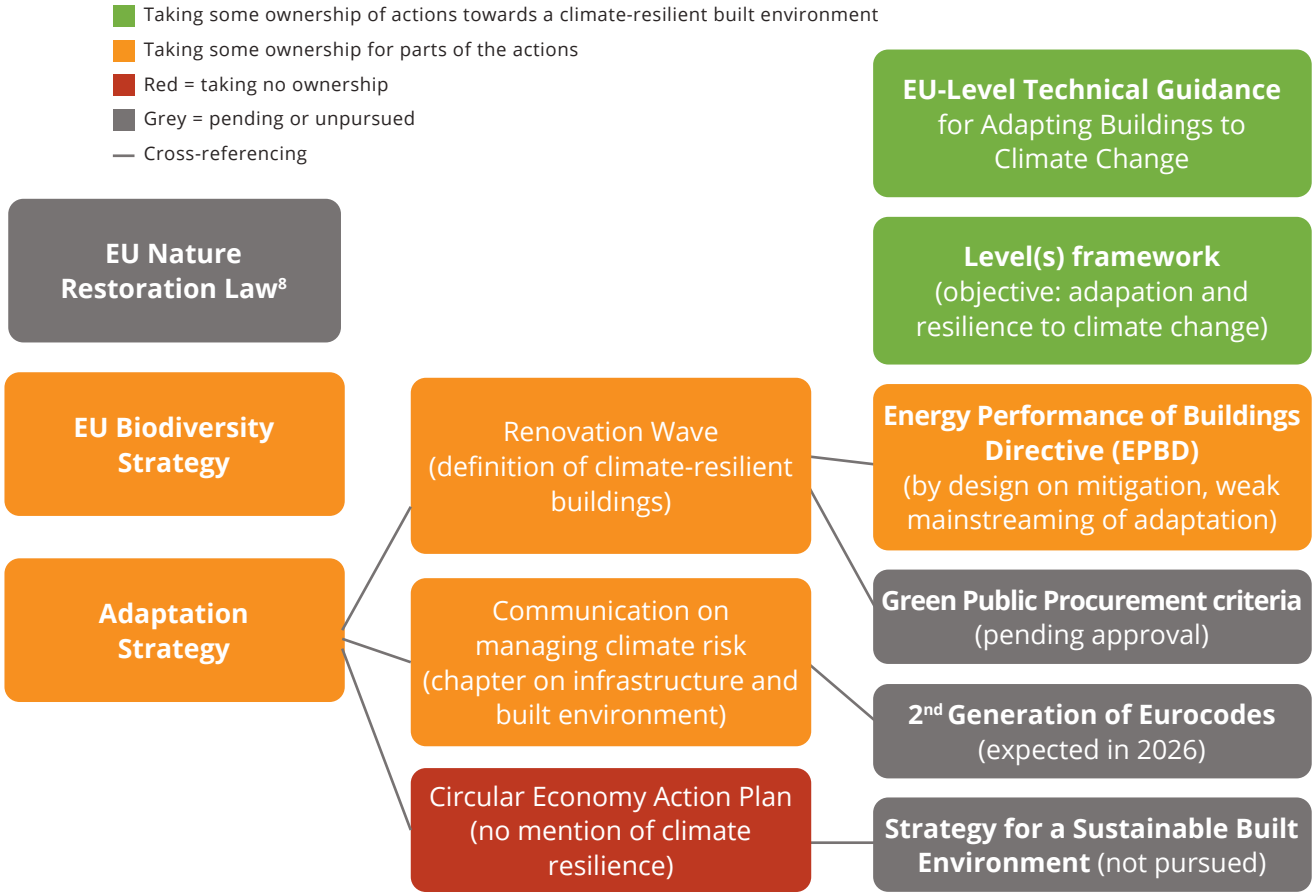
The topic of a climate-resilient built environment is not covered by one clearly identifiable EU policy file. Rather, the topic is cross-referenced in a number of different policy documents. This reflects an attempt to mainstream and delegate climate-resilience. However, the lack of a clear and centralised strategy undermines the opportunity to deliver concrete and coordinated impact.

Under the European Climate Law, EU institutions and Member States are required to ensure consistency across policy areas,[6] and Member States are obliged to regularly submit a national adaptation strategy or plan.[7] Mainstreaming adaptation across EU policies is a key pillar of the EU Adaptation Strategy, which includes providing support at national, regional and local levels. The strategy sets intentions for smarter, more systemic and faster adaptation actions, but on adaptation, but it refers back to buildings-focused documents to elaborate on climate-resilience for the built environment.

Figure 4 highlights this fragmented approach to adaptation policy: it shows how the EU Adaptation Strategy refers to other documents to elaborate on the issue of buildings and adaptation, and these in turn refer to other policy documents to do so. At the same time, directly relevant policy documents – such as the Level(s) framework or the EU-level technical guidance on adapting buildings to climate change – are not cross-referenced in other policy documents in the context of climate resilience or adaptation.

[6] Article 5 (3) Adaptation to climate change; 6 (2b): Assessment of Union progress and measures
[7] Article 5 (4) Adaptation to climate change

Figure 4: Assessment of cross-referencing of climate-resilience or climate adaptation in EU policy documents



More specifically, the Adaptation Strategy states that the Circular Economy Action Plan (CEAP) and the Renovation Wave Strategy identify climate resilience as a key principle.

- The Renovation Wave provides a definition of 'climate-resilient buildings' within the context of building renovations and limited to the technological building subsystem. It sets the intention to develop green public procurement (GPP) criteria (currently voluntary) related to climate-resilience for certain public buildings based on the Level(s) framework.[9]
  - Originally due at the end of 2022, the GPP criteria update prepared by the Joint Research Centre (JRC) is currently pending approval by the Commission. However, the Renovation Wave does not mention adaptation at all, nor can it provide a holistic and strategic direction for a climate-resilient built environment.
  - The Energy Performance of Buildings Directive (EPBD), a key policy file to implement the Renovation Wave, includes some mainstreaming of adaptation: for major renovations or new builds, Member States must address adaptation to climate change among a list of other indicators such as fire risk. It mentions that guidance for under-represented groups may include guidance on adaptation to climate change.[10] Furthermore, it mentions that Energy Performance Certificates (EPCs) could provide owners or tenants with information on how to increase the climate resilience of buildings. Under

[8] The EU Nature Restoration Law passed on 17/06/2024 but final (adopted) text was not analysed because it was not available at the time of writing.
[9] Level(s) is an assessment and reporting framework used by the European Commission to assess the sustainability performance of buildings.
[10] Article 29 Information

voluntary indicators in the National Building Renovation Plan (NBRP) template in Annex II, Member States can specify how policies and measures will increase the climate resilience of buildings. This is crucial to ensure that renovations and new building designs support adaptation. However, the EPBD, despite being designed to improve building energy performance, lacks a systemic approach to a climate-resilient built environment with Just Resilience at its core. Climate-resilience in the NBRP indicators remains voluntary.

- No policy document, not even the newly recast EPBD, refers to the elaborated EU-level technical guidance for adapting buildings to climate change [21]. This guide provides concrete suggestions for increasing the adaptive capacity of technological building subsystems in support of human-shaped ecological systems, and is thus a key intervention for making the built environment more resilient. However, while it is a crucial instruction manual, it cannot replace a strategic policy document that coordinates these actions, directs funding for their implementation, and ensures that the needs and interest of tenants are met in a just and inclusive manner.

- The Circular Economy Action Plan does not mention climate resilience, which reflects a clear coherence gap with the EU Adaptation Strategy. It announced a Strategy for a Sustainable Built Environment under which adaptation might have found a place, but this has not yet been pursued.

- The EU Adaptation Strategy set an action point to develop an EU-wide climate risk assessment. This manifested in the Communication on managing climate risks (2024), which is the first to have a specific chapter on infrastructure and the built environment. It mentions the New European Bauhaus (NEB) festival as an avenue to promote mainstreaming climate adaptation in the construction sector. It also mentions the planned update of the Eurocodes standards by 2026, in which it will be mandatory to consider future climate risks to the structure of buildings.[11]

- The Level(s) framework, officially launched in October 2020, sets six macro-objectives, one of which is adaptation and resilience to climate change. It specifies three areas to future-proof building performance: adapting to changes in thermal comfort, making buildings more resilient, and improving building design to increase sustainable drainage. The framework translates this into three indicators: “protection of occupier health and thermal comfort”, “increased risk of extreme weather”, and “sustainable drainage”. The purpose of these indicators is to assess how building performance can be aligned with strategic EU objectives – in this case, in the area of resilience to climate change. Once the EU sets clearer targets and objectives for a climate-resilient built environment, future indicators could be integrated here.

Policies relevant for adaptation have a particular focus on the integration of green infrastructure into buildings:

- The EU Biodiversity Strategy requires the integration of nature-based solutions, green infrastructure and healthy ecosystems into urban planning and the design of buildings and their surroundings.

[11] The Eurocodes are standards of buildings setting minimum requirements for their structural design. The 2nd generation was announced in 2023 with date of publication in 2027 [25].

- The Nature Restoration Law (version analysed from 15 March 2024) sets requirements for more integration of green urban spaces in new and existing buildings and infrastructure. However, how exactly this will be implemented or monitored remains unclear.

Overall, responsibility and concrete action for reaching a climate-resilient built environment are delegated in a cascading way, as illustrated in Figure 4 (see Annex II for details of the analysis). This leads to fragmented action at best, or unclearly delegated most of the time, which creates 'dead ends'.

One explanation for these inconsistencies or overly delegated responsibilities is that different policies have different legal bases for intervention at EU level. For example, the EPBD draws upon Art 194 of TFEU (energy policy), while environment-related policies relate to Art 191 TFEU. Policies focused on energy and buildings often include little on adaptation because they lack a clear legal basis to do so.

In conclusion, the EU lacks a comprehensive policy file which takes full responsibility for the topic of climate resilience for the built environment. Such a policy file should steer mitigation and adaptation action, ensure their synergies are maximised and that trade offs are avoided, identify the risks of maladaptation, and give clear guidelines to Member States on Just Resilience. However, there are still various on-the-ground initiatives through which the EU has an influence on adaptation.

WHAT CURRENT EU INITIATIVES ARE DELIVERING ACTIONS TOWARDS A CLIMATE-RESILIENT BUILT ENVIRONMENT?

An array of EU initiatives shows awareness of the importance of climate adaptation for the built environment. However, these are non-binding, and only parts of the EU's cities and regions are able to benefit from them.

The EU has launched a variety of initiatives such as the NEB, the EU Mission on Adaptation to Climate Change, and first and foremost the long-established Covenant of Mayors and the European Climate Adaptation Platform Climate-ADAPT which provides thorough documentation and knowledge-sharing on adaptation progress. Delegating adaptation action to the local level is reasonable, given the importance of being sensitive to local needs. Nevertheless, these targeted actions (see Annex III for an analysis) show that there is still a need for knowledge and information sharing among practitioners such as municipalities. The EU initiatives provide valuable insights and experiences at both local level and at EU level to refine decision-making and policy formulation.

However, not all of the EU is benefiting from these initiatives. In fact, where capacity is lacking, regions and cities risk being left behind. Best practices are often shared among larger cities, while small towns remain less recognised and benefit less from these best practice sharing exercises. Member States can receive support for administrative capacity-building for their adaptation plans via the Commission's Technical Support Instrument. However, it is more difficult for small cities to profit from this service. This patchwork of initiatives and efforts needs to be united under a clearer vision, underpinned by a strong strategy and a consistent plan, driven by clear objectives and robust (financial) support from the EU, and it must have a stronger monitoring system. This would help the move from isolated endeavours to coordinated action and shared goals, thereby increasing positive impact at all levels.

While there are many ongoing initiatives, there are still notable gaps in the monitoring of their collective impact.

Since there is no clear and common strategy to reach a climate-resilient built environment, nor clear targets or a vision of what level of resilience needs to be achieved, there is as a consequence no monitoring and verification system to evaluate the (collective) impacts of EU policies and actions. This is a missed chance to determine to what extent current actions already address looming climate risks, and what there is left to do. This is concerning, as it is the most vulnerable groups who will be affected by a lack of preparedness and action. Just Resilience is mentioned in the risk and vulnerability assessment in the Guidelines on Member States' adaptation strategies and plans [26]. As the Climate Law specifies, Member States should focus on the most vulnerable, in consultation with civil society. Indeed, EU Member States already acknowledge this dimension of adaption in national policies, but implementation is limited with no common EU monitoring framework or indicators in place to measure [18]. The EU mission on climate adaptation highlights the need to include "an operational framework for monitoring Just Resilience with a set of indicators to measure its outcomes, outputs and impacts" [27, p. 38]. However, this is still work in progress, and nothing has yet been officially published.

In conclusion, the EU is currently missing the opportunity to steer capacity-building and provide resources and guidance for adaptation to all of its regions and cities. This would ensure that not only pioneers (and especially larger cities) are part of the movement towards a climate-resilient built environment, and that no region or city is left behind. A coherent monitoring system to map the collective impact of all the existing initiatives and assess it against set targets for climate resilience would ensure that accelerating climate risks are adequately addressed.

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NEXT STEPS AND RECOMMENDATIONS

TO MOVE TOWARDS A CLIMATE- RESILIENT BUILT ENVIRONMENT

At a global level, COP28 in 2023 showed a new urgency with agreement on targets for the Global Goal on Adaptation and its framework. At EU level, the Belgian Council Presidency (first half of 2024) highlighted climate adaptation as one of its priorities. With the new European Commission mandate, there are many opportunities to put climate adaptation of the built environment higher on the policy agenda. This and upcoming debates should lead the EU to adopt a Strategy for a Climate-Resilient Built Environment, ensure a common understanding, increase the consistency of policies, and prioritise actions to deliver a climate resilient-built environment across Member States.

MOVING – ADOPTING A COMMON UNDERSTANDING AND THE RIGHT APPROACH FOR A CLIMATE-RESILIENT BUILT ENVIRONMENT

Providing a coherent definition and vision of a climate-resilient built environment that encompasses maladaptation and Just Resilience.

In order to develop a strategy that can efficiently and systemically drive policy action and allocate resources towards achieving a climate-resilient built environment, a common understanding of the issue – as well as a new narrative and approach – are needed. Based on the previously outlined definition for a climate-resilient built environment, there is a chance for the EU to adopt the right narrative, conceptualise Just Resilience, and identify risks of maladaptation in the context of the built environment. Furthermore, it could set the tone for an intervention-centric approach, including behavioural, technical and governance solutions, linked to the subsystems they affect while recognising their interconnectedness [19]. The shift away from a risk-centric towards an intervention-centric approach encourages proactiveness, simplifies the identification of responsible parties, and clarifies implementation strategies. By focusing on solutions, it changes the narrative from who should act to who can act, enabling broader participation beyond those merely responding to risks.

MOVING FORWARD - INCREASING POLICY CONSISTENCY THROUGH A EUROPEAN COMMISSION LED EU STRATEGY FOR A CLIMATE RESILIENT BUILT ENVIRONMENT

Enhancing policy consistency with a European Commission-led approach

There is currently no specific strategy or policy file that coordinates actions towards a climate-resilient built environment. Despite there being an understanding of the systemic aspect of adaptation as a whole, this systemic approach is not adequately reflected in policies for the built environment. Indications of cross-referencing between buildings and adaptation documents are visible, but while intentions for actions are set, their implementation is passed on between these policy documents, and intentions are repeated. There have been different suggestions for how to tackle the fragmentation of EU policy instruments for buildings and ensure that combined efforts are aligned with the Paris Agreement, but they have not been fully followed through in practical terms. The Commission should therefore develop an EU Strategy for a Climate-Resilient Built Environment encompassing the definition and vision referred to above, and incorporating learning from the various EU initiatives previously mentioned. It should also set clear targets and actions. Ideally, topics outside the scope of this discussion paper would be included, such as mitigation (in particular circularity and the whole-life carbon (WLC) perspective on building materials), sufficiency considerations, risk assessment frameworks for regions and cities, and financing.

MOVING FORWARD TOGETHER – A CONNECTED AND SUPPORTED STAKEHOLDER AND POLICYMAKER COMMUNITY FOR EASIER AND STRONGER IMPLEMENTATION

Voices of all cities and regions should be heard at EU level

Current initiatives such as the EU missions or the NEB only support the frontrunners among European cities and regions. Many other cities and regions do not have access to the same funds and knowledge, nor the chance to provide input at national or EU level during the policy design phase. If cities and regions are not equally well equipped to identify and act on climate risks in line with Just Resilience principles, there is a risk of alienating a large part of the EU. In 2024, the Belgian EU Council Presidency gave a voice to cities and regions at EU level on the topic of adaptation, via a large number of high-level events and conferences, resulting for example in the Liège Declaration which showcases a deep understanding of the holistic nature of adaptation [28]. This effort to involve local actors should be continued. Given the importance of the local context, local perspectives need to be considered from the beginning of the policymaking cycle. Consulting voices at regional and local levels could be especially important in the process of the design, governance, and implementation of the EU Strategy for a Climate-Resilient Built Environment to ensure that maladaptation is avoided, that Just Resilience can be implemented and monitored, and that synergies with existing mitigation efforts are leveraged.

Ensure EU-wide Just Resilience monitoring across policies relevant for the built environment and adaptation

The concept of Just Resilience was first mentioned in the Adaptation Strategy. The Belgian EU Council Presidency focused its work on linking social issues and climate issues, aiming to promote a transition which is both green and just. While these are welcome developments, to truly reduce the unequal burden of climate risk and ensure the equitable distribution of the benefits and burdens of adaptation, there is a need for clear indicators and a governance process to monitor Just Resilience in adaptation interventions in the built environment. Only then will the inequalities in climate risks and adaptation action be truly overcome [18]. The Commission should take the lead based on the European Environment Agency's (EEA) groundwork on indicators for Just Resilience and set out a monitoring framework for Member States, as was intended in the implementation plan of the EU Mission on Adaptation to Climate Change.

Local perspectives need to be considered from the beginning of the policymaking cycle. Consulting voices at regional and local levels could be especially important in the effective design, governance, and implementation of the EU Strategy for a Climate-Resilient Built Environment with Just Resilience at its core.

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ANNEXES

ANNEX I: ANALYSIS OF APPROACH AND NARRATIVE ON ADAPTATION AND FOR BUILDINGS IN EU ADAPTATION-RELATED DOCUMENTS.

EU adaptation-related documents	Approach and narrative on adaptation and for buildings
2007 European Commission Green Paper on adapting to climate change in Europe – options for EU action	• Frames adaptation as an environmental problem which can be solved by market and technological innovation • Mentions the need for civil society participation and ecosystem services • Calls for an integrated, cross-sectoral and holistic approach to research
2009 WHITE PAPER: Adapting to climate change: Towards a European framework for action	• Makes mostly an economic case for strategic approach to adaptation • Recognises need for methods, models, data sets and prediction tools to better forecast climate impacts • Already mentions need to mainstream adaptation into EU policy • Maladaptation is mentioned for the first time
2013 The EU Strategy on adaptation to climate change	• Establishes Climate-ADAPT online platform as one-stop-shop for adaptation information in Europe • Introduces adaptation to Covenant of Mayors framework • Insists that climate mitigation remains the priority • Mentions resilient infrastructure (e.g. buildings) under action 7 and sets intention to identify standards in the areas of energy, transport and buildings to be revised for better inclusion of adaptation considerations
2021 Communication: Forging a climate-resilient Europe – the new EU Strategy on Adaptation to Climate Change	• Puts stronger emphasis on co-benefits from nature-based solutions, revises its language on solidarity across and within Member States • Highlights need for 'just resilience', and is more specific in the way the local level can be supported • Mentions green roofs and walls to reduce UHI and water retention, and thus buildings' potential to contribute to large-scale adaptation • Mentions risk of extreme weather to buildings' mitigation potential • Mentions both buildings and built environment with no clear distinction • Mentions maladaptation once (and only in brackets)
2023 EU technical guidance on adapting buildings for climate change and best-practice guide	• Description of buildings structured alongside hazards • Built environment language chosen in context that mentions vulnerability of building users and communities • Only best-practice guide mentions maladaptation in context of historic buildings • No mention of justice or Just Resilience
2024 Communication: Managing climate risks – protecting people and prosperity	• Acknowledges that poorly designed adaptation solutions can further deepen inequalities, and states the need for cross-cutting solutions • Includes a section on infrastructure and built environment • Investment in climate resilience framed as business opportunity • Makes a single mention of Just Resilience as something that Member States should do more • Does not mention maladaptation

ANNEX II: ADAPTATION CONSISTENCY CHECK ACROSS EU POLICY DOCUMENTS

This list includes a variety of policy documents with different legal natures such as directives, communications, and guidance documents.

Buildings-relevant policy documents

Key provision	Relevance for adaptation	Assessment of policy consistency
Green Public Procurement Criteria for buildings 2016 (under revision)		
Aims to guide public sector construction projects towards sustainability. Key focuses include enhancing energy efficiency, promoting the use of sustainable materials for resource efficiency, and ensuring healthy indoor environments.	Through these criteria, buildings can be designed and renovated to withstand extreme weather events, temperature changes, and other climate-related challenges.	The JRC has finished the revision of EU GPP criteria for buildings, waiting for Commission internal approval.
Renovation Wave Communication 2020		
Aiming to double the renovation rate of buildings by 2030 to increase energy efficiency and reduce emissions. Key objective is renovating 35 million buildings to be more energy-efficient, focusing on public and poorly performing buildings for early action.	In light of the EU communication on buildings, and given that renovations are an intervention point for adaptive design changes, the Renovation Wave would be a key place to mainstream adaptation.	Calls for acceleration of work with standardisation organisations on climate resilience standards for buildings by 2020, but this did not happen.
A Circular Economy Action Plan 2020: Construction & buildings		
Focuses on reducing waste and promoting sustainable resource use across the entire life cycle of products within the EU.	Provides avenues to reduce dependency on vulnerable supply chains, encourages innovation in materials and design which should mainstream adaptation.	Aims to promote measures to improve the durability and adaptability of built assets in line with circular economy principles for building design.
2024 EPBD recast		
Aims to improve the energy performance of buildings within the EU.	Regulates tools such as Energy Performance Certificates (EPCs) or digital building logbooks (DBLs) which could contain climate-risk information and intervention suggestions.	Adaptation is mentioned consistently throughout the directive besides fire safety, indoor air quality for new buildings (article 7 (6)) and major renovations (article 8(3).) Mentions information on increasing climate resilience in EPCs. Increased climate resilience is also a voluntary indicator in the NBRP template in Annex II. No mention of the EU-level technical guidance on adapting buildings to climate change as a way to implement this. No mention of Level(s) as a way to assess building performance in regards to adaptation and resilience.

Adaptation-relevant policy documents

Key provision	Provisions on buildings	Assessment of policy consistency
European Climate Law (2021)		
Establishes legally binding framework for achieving climate neutrality in the EU by 2050, and a net GHG emissions reduction target of at least 55% by 2030 compared to 1990 levels. Also mandates the development of measures to monitor progress and adjust policies.	Nothing specifically on buildings, but acts as a foundational document on adaptation: sets that by 2023 every five years the Commission is to review the consistency of EU measures on collective Member State progress, aiming to improve climate resilience and adaptive capacities. EU Member States are obliged to regularly update their national adaptation strategies, focusing on the most vulnerable in consultation with civil society.	Sets the base for policy consistency across Union institutions and Member States under article 5. Aims to work towards the integration of adaptation in a consistent manner in all policy areas. It mentions that co-benefits with other policies and legislation should be maximised in recital 31. It does not explicitly mention the benefits of addressing mitigation and adaptation together, or balancing trade-offs between actions.
EU Adaptation Strategy 2021		
Systemic adaptation, support policy development on all levels and sectors, increase local resilience. Faster adaptation to reduce risk.	Mentions buildings as large contributor to adaptation. Acknowledges the risk posed by climate impacts to mitigation potential.	Considers justice, mentions material loss. Aims to better predict climate-induced stress on buildings through GPP, DBL and EPBD.
EU Biodiversity Strategy for 2030, 2020		
Aims to halt the loss of biodiversity and ecosystem services in the EU by protecting and restoring natural habitats and species.	Aims to influence the integration of green and blue infrastructure in urban planning and construction, promoting biodiversity-friendly design and the use of native plant species in landscaping.	Mentions that green infrastructure and nature-based solutions should be systematically integrated into urban planning, including in public spaces, infrastructure, and the design of buildings and their surroundings.
Nature Restoration Law, 2024 - Text analysed from 15 March 2024		
Focus on ensuring biodiversity and resilience across the EU, such as by restoring degraded ecosystems, particularly those with significant carbon capture potential, and integrating climate adaptation and biodiversity targets to enhance ecosystem services and connectivity.	Mentions the integration of urban green space into buildings and infrastructure in article 8(2). Acknowledges building exterior and interior lighting as a contributor to light pollution driving insect decline.	Does not mention the built environment, and the integration of green infrastructure and NBS into building design is only mentioned in the recitals.
Managing Climate Risk Communication, 2024		
Emphasises the need to accelerate responses to climate emergencies and strengthen the EU's overall resilience. Advocates for integrated, cross-sectoral approaches to climate adaptation and risk management, underscoring the necessity of aligning policies across different levels of governance to enhance climate preparedness and response capabilities across the EU.	Notes that increasing renovation rates and decarbonising the economy are opportunities to improve climate resilience. Notes that the design of the built environment determines the resilience of buildings themselves, and of their inhabitants. Acknowledges co-benefits of climate-proofing residential housing in terms of affordability, a healthier living environment, and improved energy efficiency.	Infrastructure and the built environment has its own chapter, with a link made between mitigation (e.g. renovation) and adaptation (building design). Mentions the 2026 update of the standards (Eurocodes) of buildings which will set the minimum requirements on structural design in the EU and make it mandatory to consider future climate hazards on structures of buildings.

ANNEX III: ANALYSIS OF EU INITIATIVES

Responsible actor	What?	Details
Covenant of Mayors on Climate and Energy (2008)		
European Commission, DG CLIMA	Voluntary initiative to bring together local and regional authorities for a bottom-up approach to energy and climate action	Local authorities are supported in developing adaptation strategies within sustainable energy and climate action plans (SECAP). This is supported by an informal group of organisations and Commission Directorate Generals who take an interest in subnational adaptation. The initiative addresses the fragmentation of adaptation information for cities. It seeks to improve the accessibility and quality of data pertaining to cities, focusing on standardised methodologies and indicators.
Climate-ADAPT platform (2012)		
European Commission in partnership with the European Environmental Agency (EEA)	Knowledge-sharing platform for a climate-resilient Europe (one-stop-shop)	The platform aims to support and drive EU adaptation policy and practice. It has included the European Climate and Health Observatory since 2021 to anticipate and minimise health impacts from climate change. The platform has been transitioning from raising awareness to rolling out solutions. It also hosts the Urban Adaptation Support Tool and supports the EU Mission on Adaptation to Climate Change as a 'mission knowledge hub' [29].
New European Bauhaus (2020)		
Coordinated by the JRC and the cabinet of the Commission President 2019-2024	Initiative to connect the European Green Deal to daily life and living spaces	The NEB operates on the principles 'sustainable, inclusive and beautiful'. While the NEB was initially criticised for being 'dubious' and 'elitist' [30], it was mentioned as an avenue to showcase best practices and pilot more transformative climate adaptation. From 2025-2027 the NEB facility will financially support the NEB via Horizon Europe. The NEB Festival 2024 showed an increased presence of adaptation topics.
EU Mission on Adaptation to Climate Change (2021)		
European Commission DG RTD via Horizon Europe	Supporting 150 regions and communities to become climate-resilient by 2030	It promotes the development and implementation of innovative solutions for climate adaptation, including the integration of climate risk assessments into planning processes and the enhancement of knowledge-sharing platforms on adaptation strategies. It encourages the adoption of climate-resilient building standards and the integration of green infrastructure into urban planning. It stands out as an EU initiative which makes frequent references to the principles of Just Resilience.
Built4People Partnership (2021)		
European Commission DG RTD with World Green Building Council (WGBC) and European Construction and Sustainable Built Environment Technology Platform (ECTP)	Co-programmed partnership under cluster 5 of Horizon Europe	Does not mention adaptation in its memorandum of understanding, but has included calls for design for adaptability in the 2023-2024 work programme.
Climate Resilience Dialogue (2022)		
European Commission, co-chaired by DG CLIMA and DG FISMA	Comprising 17 stakeholder organisations from insurance, business, consumer and public authorities, this was announced in the 2021 Adaptation Strategy	States the objective of reducing the climate protection gap (the difference between how much is lost and how much is insured) [31]. The goal is to identify how the insurance industry can contribute more to climate adaptation. Common practices and voluntary commitments will be developed in 2024.

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