

THE CLIMATE IS CHANGING, SO WE MUST ADAPT

Climate Adaptation in
Public, Cooperative and
Social Housing in Europe



European Federation of Public,
Cooperative and Social Housing



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EXECUTIVE SUMMARY

Climate change is already having significant and measurable impacts on public, cooperative and social housing across Europe, and these impacts are expected to intensify in the coming decades. Floods, heatwaves and extreme weather events are increasingly damaging housing stock, disrupting services, displacing residents and placing growing financial pressure on housing providers and public authorities. As long-lasting social infrastructure that predominantly houses vulnerable populations, public, cooperative and social housing is at the frontline of climate impacts and plays a crucial role in ensuring a just and resilient transition.



This report assesses the climate risks faced by the sector, evaluates its level of preparedness for climate adaptation, and identifies priority actions to strengthen resilience. Recent climate events in countries such as Italy, Belgium and Sweden illustrate the scale of the challenge, with substantial economic losses, damage to buildings and infrastructure, and long-term operational consequences for housing providers. These impacts are not evenly distributed: low-income households, older people and residents with health or mobility constraints are disproportionately affected, reinforcing existing social inequalities.

The analysis shows that the sector faces high climate risks due to a combination of exposure, vulnerability and structural constraints. Much of the housing stock is old and was not designed to cope with rising temperatures, heavy rainfall or flooding. While energy renovation efforts are accelerating, climate adaptation has not yet been systematically integrated into housing strategies, asset management or investment planning. In some cases, mitigation measures may even increase climate risks, for example by worsening summer overheating when adaptation is not properly addressed.

The report also assesses the sector's readiness for climate adaptation across six key dimensions: experience, strategy, capacities, data, policy and investment. Overall readiness remains uneven and insufficient. While some frontrunners are testing solutions such as green infrastructure, passive cooling, stormwater management and data-driven risk assessments, most housing

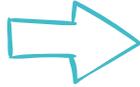
providers lack comprehensive adaptation strategies, internal expertise and dedicated financial resources. Data gaps, limited access to climate risk information tailored to housing stock, and fragmented governance further hinder effective action.

Clear regional differences emerge across Europe. Southern European countries show strong experience in passive cooling and disaster response but face financial and technical capacity constraints. Northern European systems tend to have more structured adaptation approaches, supported by close cooperation between housing providers and local authorities. In Western Europe, enabling regulatory and funding frameworks exist, yet adaptation remains largely driven by a limited number of frontrunners rather than coordinated national strategies.

The report concludes that climate adaptation must become a strategic priority for public, cooperative and social housing at all governance levels. It calls for stronger integration of adaptation into urban planning and housing policies, closer links between energy efficiency and resilience measures, improved climate risk assessment and data systems, recognition of social and cooperative housing as critical infrastructure, strengthened multi-level governance, and increased, dedicated investment. Without a more proactive and coordinated approach, climate risks will continue to undermine the social mission, financial stability and long-term sustainability of the sector.

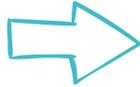
GLOSSARY

CLIMATE ADAPTATION



The process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, adaptation is the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects¹.

CLIMATE MITIGATION



Making the impacts of climate change less severe by preventing or reducing the emission of greenhouse gases (GHG) into the atmosphere. Mitigation is achieved either by reducing the sources of these gases — e.g. by increasing the share of renewable energies, or establishing a cleaner mobility system — or by enhancing the storage of these gases — e.g. by increasing the size of forests².

MALADAPTIVE ACTIONS (MALADAPTATION)



Actions that may lead to increased risk of adverse climate-related outcomes, including via increased greenhouse gas (GHG) emissions, increased or shifted vulnerability to climate change, more inequitable outcomes, or diminished welfare, now or in the future. Most often, maladaptation is an unintended consequence³.

HAZARD



The potential occurrence of a natural or human induced physical event or trend or physical impact that may cause loss of life, injury or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources. In this report, the term 'hazard' usually refers to climate-related physical events or trends or their physical impacts⁴.

EXPOSURE



The presence of people, livelihoods, species or ecosystems, environmental functions, services, resources, infrastructure, or economic, social or cultural assets in places and settings that could be adversely affected⁵.

VULNERABILITY



The propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt⁶.

CLIMATE RISK



The interaction of climate-related hazards (including hazardous events and trends) with the vulnerability and exposure of human and natural systems⁷.

NATURE-BASED SOLUTIONS



Nature-based solutions (NBS) are actions to protect, sustainably manage and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits. NBS across scales to reduce temperature shocks and provide natural flood defences among other adaptation and resilience benefit⁸.

INSURANCE PROTECTION GAP



The difference between optimal insurance coverage and actual coverage.

1 IPCC (2022).
2 EEA (2024).
3 IPCC (2022).
4, 5 IPCC (2014).
6 IPCC (2022).
7 IPCC (2014).
8 IPCC (2022).



1.

PURPOSE AND SCOPE



Climate change is already happening, and even with significant reductions in global emissions, its effects will persist. Floods, droughts, heatwaves, and other climate-related hazards are becoming more severe, prolonged, and frequent, posing serious health and economic challenges. While some regions and communities are more at risk, Europe as a whole remains unprepared for the rapidly increasing climate threats.

Global warming disproportionately hits Europe and some regions are hotspots for multiple climate risks. Southern Europe is particularly at risk from wildfires, heat waves and water scarcity. Heavy rainfalls and flooding threaten Europe's low-lying coastal regions, including many densely populated cities close to water bodies. Vulnerable people also are particularly affected by the heat.

Access to decent housing usually means the ability to afford cooling and access to green areas. Those who are unable to live in decent homes, especially low-income groups, (esp. the elderly and young children) suffer from the heat. Furthermore, heat waves aggravated pre-existing ailments, not just physical, but mental as well. In a broader sense, low-income groups suffer from energy poverty and have found it hard to cool their homes adequately, which can affect rest and result in fatigue.

The first appointed Global Chief Heat Officer at UN-HABITAT, Eleni Myrvilli sees three solutions for our problems, which we need to work on simultaneously. To her, first we need to improve the understanding of the problem, to enable us to develop better insight and, consequently, better policies.

Secondly, decision-makers should provide short-time solutions, for instance, offer public (indoor) spaces where people can move to if they experience heat problems at home.

And finally, we must rethink how we build our cities. For instance, by no longer using impermeable building materials like asphalt, glass, and metal and changing to permeable ones, such as clay, wood which might mean using older techniques and local materials. 'We can do it,' Myrvilli said.

Social, cooperative and public housing providers have long been proponents of combining environmental, social and economic resilience enhancing measures at the local level.

When developing new construction and renovation projects, the sector has an exemplary role to play and thus, has been assuming the responsibility to balance affordable housing provision with sustainability. This means providing quality homes that fit economic needs within the limits of the natural resources that we have at our disposal (land, energy, materials, water, among others).

All demographic projections show that the number of households will continue to rise (and age) in many European countries (even if the European population will gradually decline by 6% by 2100) and housing needs will increase proportionally. This will inevitably require new ways of building homes that are adapted to current and future climate risks.



2.

WHAT IS CLIMATE ADAPTATION?

While climate mitigation aims to prevent or lessen climate change itself by reducing greenhouse gas emissions (e.g., renewable energy production or energy efficiency measures) or enhancing carbon sinks (e.g., green space), climate adaptation focuses on adjusting to the effects of climate change, aiming to minimise the impacts of both slow-onset and extreme events caused by climate change (i.e. floods, droughts, storm, heat waves or sea level rise) . In short, adaptation deals with managing climate impacts, while mitigation tackles the root causes of climate change.

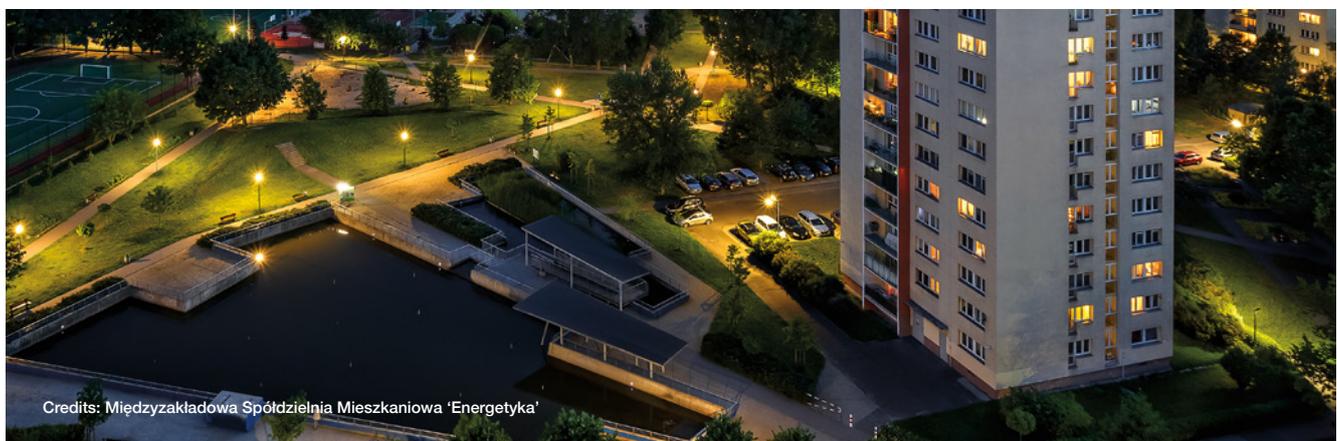
Actions that target both goals should be promoted.



For example, strategies that reduce the Urban Heat Island (UHI) effect, improve air quality, increase resource efficiency in the built environment and energy systems, or enhance carbon storage related to land use and urban forestry are likely to contribute to greenhouse gas (GHG) emissions reduction while improving a city's resilience¹⁰.

Having said that, there are actions that despite fostering adaptation in the short-term might negatively affect long-

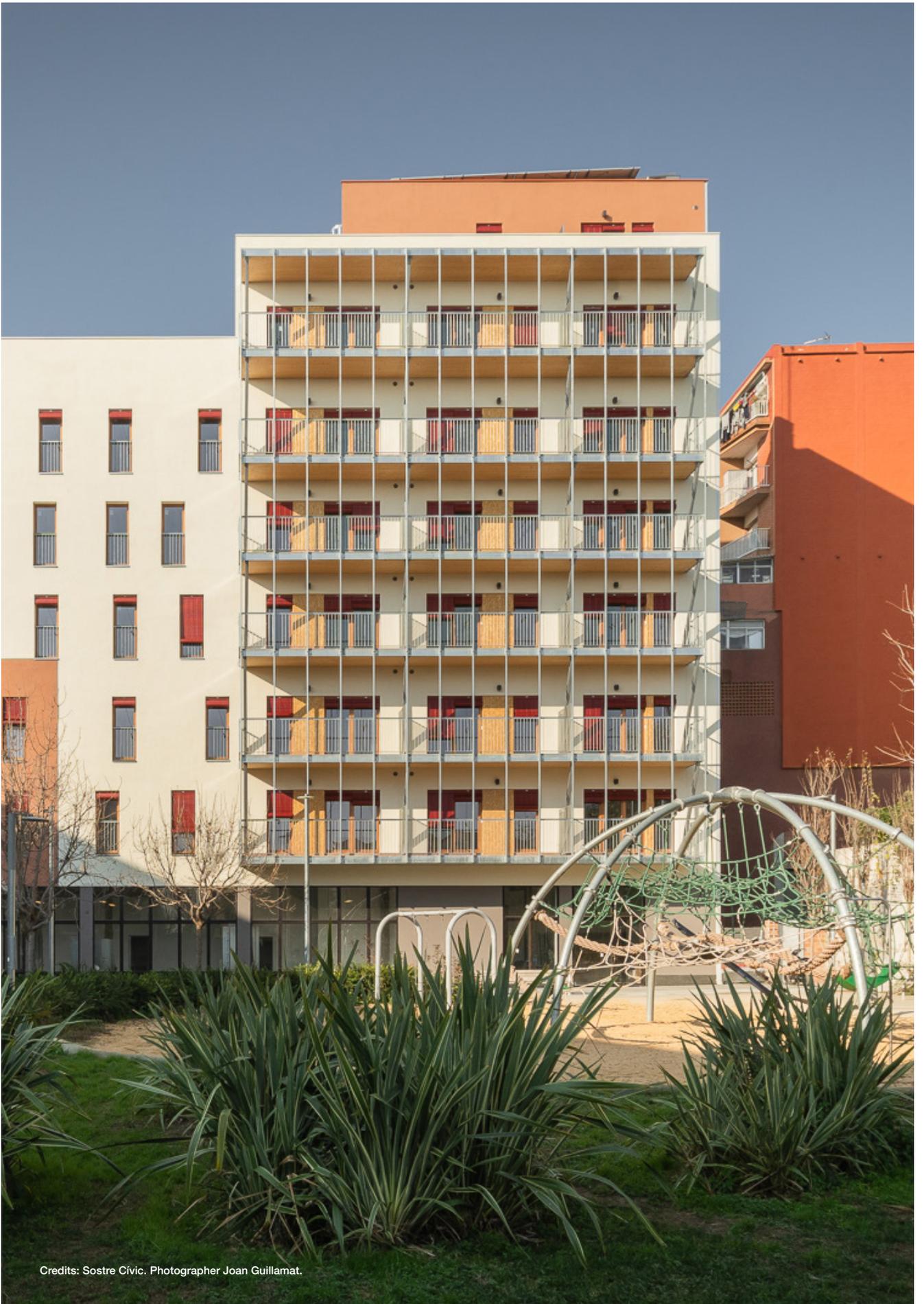
term vulnerability and/or adaptive capacity to climate change. This generally defines **'maladaptation'**. For example, using solutions such as increased tree coverage is a cost-effective way to mitigate UHI effects. However, planting non-native, dark-leaved trees around buildings can inadvertently raise local temperatures and increase UHI effects rather than mitigating it. The type and characteristics of the trees chosen should therefore be carefully assessed to fit the local context¹¹.



⁹ European Environment Agency (EEA) (2024a).

¹⁰ Grafakos, S., et al. (2018). Integrating mitigation and adaptation: Opportunities and challenges.

¹¹ BPIE (2024). Towards a Climate-Resilient Built Environment.



Credits: Sostre Cívic. Photographer Joan Guillamat.

How to plan for climate adaptation?



Based on the **Regional Adaptation Support Tool (RAST)** developed by Climate ADAPT to help local and regional authorities with climate change adaptation strategies and plans, a six-step process is proposed:

1



Preparing the ground for adaptation:

Gathering the data supporting the needs for adaptation; securing long-term political commitment; establishing a governance framework with relevant stakeholders ; assessing the resource needs and developing a clear communication strategy.

2



Assessing climate change risks and vulnerabilities:

Evaluate local climate risks and vulnerabilities by defining the core elements of a risk assessment, identifying specific risks, understanding vulnerabilities and cross-regional impacts, and ultimately assessing climate risks. This assessment highlights key risks and sets adaptation objectives.

3



Identifying adaptation options:

After assessing risks, identifying potential adaptation options to address the key risks identified. This involves exploring various strategies and finding inspiration from successful examples to inform the selection of appropriate adaptation measures.

4



Assessing and selecting adaptation options:

The identified adaptation options are evaluated and prioritised based on criteria such as effectiveness, feasibility, cost, and benefits. This prioritization helps in selecting the most suitable measures for implementation.

5



Implementation of adaptation actions:

Once suitable adaptation options are selected, regions implement them through standalone adaptation action plans or by integrating them into broader organizational plans. This step includes securing funding, maintaining supporting governance, and ensuring continuous stakeholder engagement.

6



Monitoring and evaluating adaptation:

The final step involves establishing mechanisms to monitor and evaluate the implemented adaptation measures. This ensures that the actions are effective and allows for adjustments as needed to improve resilience and address emerging challenges.

3.

WHY DO WE NEED TO ADAPT PUBLIC, COOPERATIVE AND SOCIAL HOUSING TO CLIMATE CHANGE

1

→ The public, cooperative and social housing sector is suffering from the impacts of climate change today and this will only worsen in the future.

Facing a changing climate and growing related risks, public, cooperative and social housing will have to be climate-proof. This means buildings with an average lifetime of 50 years will be more often exposed to severe weather events for longer periods.

The future may bring about increased risk of building degradation even at the level of their structural integrity, or significant loss of value due to increased prevalence of extreme weather events (rain, snow, heat), subsidence damage, water encroachment, deteriorating indoor climate and overall reduced building lifetime. New and existing buildings need to be assessed for resilience to current risks and future climate changes and planned or upgraded accordingly¹².

Extreme weather events like storms, heatwaves and flooding accounted for 85,000 to 145,000 human fatalities across Europe, over the past 40 years. Over 85% of those fatalities were due to heatwaves. Economic losses from weather and climate-related extremes in Europe reached around half a trillion euros over the same period¹³.

The summer of 2024 was the hottest on record for Europe and globally. Over 370.000 hectares of forest have been destroyed by wildfires in the first nine months of 2024. Around two million people across Central Europe were affected by the severe flooding in September 2024 alone¹⁴. Floods in Valencia, in October, killed 230 people and destroyed homes and businesses. On 14 and 15 July 2021, a flood event affected parts of Belgium,

Germany and surrounding countries, causing more than 200 fatalities and resulting in substantial socioeconomic impacts¹⁵.

In the Italian province of Ravenna, public housing provider ACER Ravenna registered damages amounting to €9.1 million from the May 2023 floods, €615,600 from a windstorm in July 2023, and €5.7 million from flooding in September 2024, with many buildings affected, including 32 fully flooded dwellings, 86 partially flooded, and significant damage to thermal plants, elevators, and garages.



Credits: ACER Ravenna (Italy)

In Wallonia, the July 2021 floods caused 38 fatalities, 230 social dwellings relocated, around 50.000 dwellings damaged and a €50 million aid package to assist social housing providers in providing temporary housing and repairing damages.

¹² European Climate Adaptation Platform (Climate-ADAPT).

¹³ European Environment Agency (EEA) (2024f).

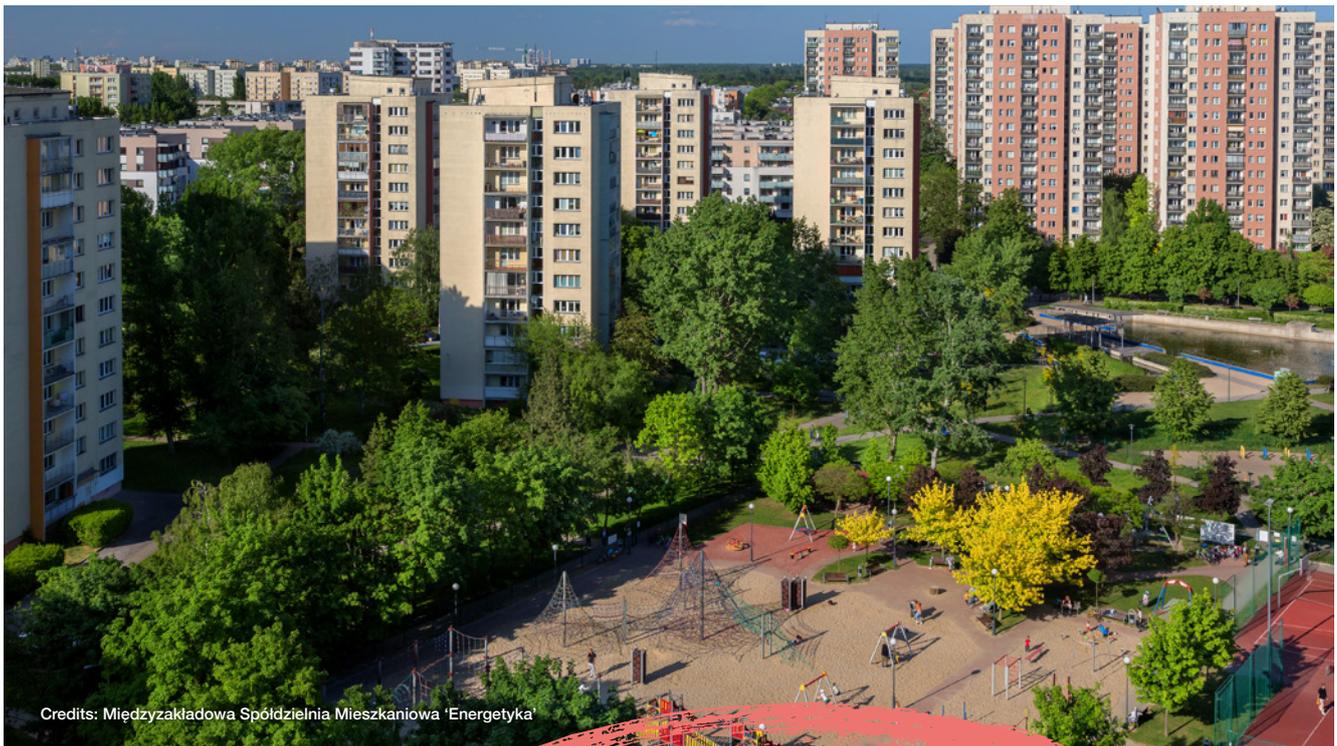
¹⁴ European Environment Agency (EEA) (n.d.g).

¹⁵ Copernicus Climate Change Service (C3S). (2021).



Gävle in Sweden experienced severe flooding in August 2021, caused by unprecedented rainfall which severely impacted 50% of public housing stock, damaging homes, public areas, and infrastructure like roads, sewage, and piping. The event led to damages in 174 housing units and extensive flooding of basements and equipment, displacing around 70 tenants. The total damage cost reached 110 million SEK (9,981,400 EUR).

What is built today will still be standing in 2080 and beyond, so it is fundamental to protect buildings, tenants and outdoor spaces from damages.



2

→ **Buildings and people experience different risk levels, affecting the most vulnerable and reinforcing inequalities.**

The lack of adaptation can have far-reaching consequences, especially for vulnerable regions and low-income people, as often those already privileged benefit from access to better infrastructure. **Without consideration of equity in adaptation, the existing inequalities may be reinforced**, or new inequalities may arise. This is why **it is crucial to ensure the adaptability of social infrastructure such as public and social housing to climate-related risks.**

Certain groups of people are disproportionately impacted by climate change. The most affected tend to be those already at a disadvantage, because of their age, health or socio-economic status. These groups include the young and the elderly, people with disabilities, poor or low-income households, people in poor health, people with limited social networks, migrants, and ethnic minorities. People's ability to avoid or cope with these climate hazards depends on their financial resources, the

extent of their social networks, the quality of their home, or access to green spaces may make it more difficult for lower income groups to prepare for and recover from extreme weather events¹⁶.

For instance, urban heat may put lower-income households, especially migrants, at much higher risk due to **inadequate housing, less access to air-conditioning, and occupations, such as manual labour and waste picking, that exacerbate heat exposure**¹⁷.

Urban poor and ethnic minorities often settle in more vulnerable settlement zones, and are therefore more exposed and impacted by flooding¹⁸. Areas suffering from disinvestment in infrastructure might have a high risk of flooding¹⁹.

Understanding who has access to what infrastructure is therefore important as it can help in identifying who is least able to adapt to climate risks sufficiently. As infrastructure is often not adequately implemented in low-income urban areas and not equally accessible to all, a good diagnosis can redress the drivers of social vulnerability that are central to just resilience.

For example, low-income neighbourhoods often have less green space and therefore less associated cooling benefits²⁰. Or some people may have few opportunities to relocate away from flooded areas in the long term or to evacuate in the short term. It is also harder for many from low-income areas to rebuild after an extreme event²¹.

3 → **Public, cooperative and social housing is key infrastructure to guarantee just resilience.**

Not only has the climate changed at an accelerated pace, but megatrends such as urbanisation, biodiversity loss, pollution, mass tourism and the housing crisis are happening simultaneously. Central to addressing these issues is the built environment, encompassing housing, transport infrastructure, service networks, and public spaces²².

Public, social, and cooperative housing occupies a unique and critical position as long-lasting social infrastructures that often serve as a stepping stone to better opportunities in life. When designed, constructed, renovated, and maintained with resilience in mind, they can offer essential protection against climate hazards such as heatwaves, flooding, and extreme weather events.

As pioneers in the energy transition already, public, social, and cooperative housing providers can now set the standard for climate adaptation. Their leadership has

the potential to inspire and influence private developers, positioning the public and social sector as a driving force in climate adaptation.

Budget constraints, while challenging, further underline the importance of innovation and efficiency in the sector. Housing providers are often tasked with finding optimal solutions that balance cost with effectiveness, ensuring these practices can be readily adopted by private developers.

Often the strategic position of housing providers as landowners and urban planners gives them the power to shape cities and neighborhoods in ways that prioritise long-term climate adaptation goals.

The role of the sector is therefore crucial in safeguarding vulnerable populations while driving the shift towards a climate-resilient built environment.

¹⁶ European Topic Centre on Climate Change Impacts, Vulnerability and Adaptation (ETC/CCA). (2018).

^{17, 18, 19, 20, 21} IPCC (2022).

²² European Environment Agency (EEA). (2024c).

4

→ A lack of adaptation measures can counteract mitigation efforts.

Energy renovation efforts primarily target reducing greenhouse gas emissions and improving energy efficiency. As a result, public funding and policies fail to address growing risks such as heatwaves, soil shrinkage and swelling (affecting foundations), and flooding. These climate-related risks remain largely overlooked in current energy renovation frameworks.

Although energy renovation measures, such as insulation and ventilation, can indirectly support climate adaptation, they are not designed to directly address the increasing frequency and severity of climate-related challenges. For instance, while insulation is a critical element in reducing energy use and can aid in mitigating overheating, its effectiveness depends on integrating additional measures like ventilation and shading solutions. Neglecting these

leads to a risk of overheating, especially in the face of increasing heat waves, which could lead to an increase in the use of air conditioning, higher energy bills, raising carbon emissions and urban island effects due to the release of warm air outdoors. This would counteract the intended mitigation effects of energy retrofits.

In France, integrated renovations that combine both energy efficiency and adaptation measures are rare, representing only 3% of renovated surfaces²³.

Mitigating the impacts of climate change by reducing greenhouse gas emissions and resource use will not be enough. **Mitigation and adaptation should be taken as complementary strategies to reduce the risk and impact of climate change** (IPCC 2022).

5

→ Lack of insurance protection against climate disasters translate into high costs for housing providers.

The average annual (constant 2023 EUR prices) economic losses were around 44.5 billion for the period 2020-2023, of which, less than 20% of total losses were (privately) insured. This is the so-called 'insurance protection gap', the difference between optimal insurance coverage and actual coverage.

In the event of a climate disaster, the financial burden tends to fall on housing providers. While insurance may cover part of the damage, it does not account for the entire cost. As the frequency of climate hazards increases, insurance premiums rise, and coverage becomes more limited, making it increasingly unaffordable for housing providers.

In the public, cooperative and social housing sector the insurance protection gap varies across countries. While in Sweden, the public housing company in Gavle could recover up to 85% of the damage costs from the

2021 floods, in Italy the insurance compensation for the damage caused by the 2023 floods only amounted to 27%.

Local authorities are also reducing the coverage for damages, further shifting the financial burden onto property owners, particularly public entities such as municipalities or regional governments, which own the majority of social housing in Italy. While insurance may cover some costs, government²⁴ responses and investments in recovery remain uncertain.

If homes are not adapted to climate change now, the cost of damage in the future will be overwhelming, and housing providers will not be able to bear the financial burden. To ensure the long-term viability of their assets, housing providers must adapt their properties to climate change. Otherwise, homes could become uninhabitable, and housing provision could be severely impacted.

²³ Cour des comptes. (2024)

²⁴ European Commission (2021).



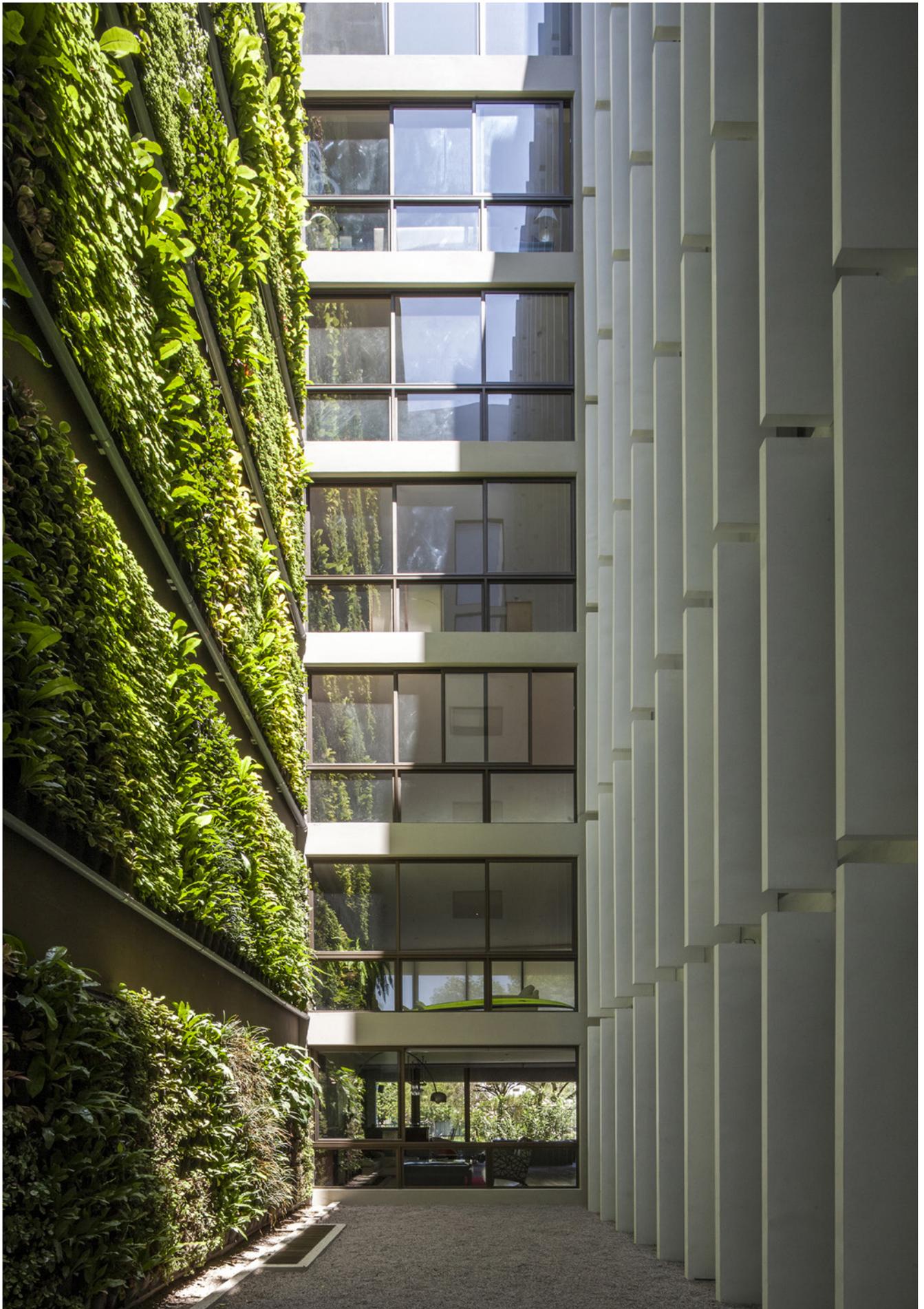
6

→ The current EU policy framework increasingly focuses on climate adaptation.

Since 2021, the EU has a [strategy on climate adaptation](#) which focuses on increasing the knowledge of climate risks (in particular through the [Climate-ADAPT portal](#)) and the funding dedicated to climate adaptation in the existing EU programmes such as LIFE + and Horizon Europe. The Commission is developing a new integrated framework for European climate resilience and risk management to help Member States prevent and prepare for the growing impacts of climate change. It will consist of a balanced policy package which, following a thorough impact assessment process, is expected to be adopted during the second half of 2026. The framework could have relevant implications on the preparedness and adaptation of the building sector, and have important consequences for public, cooperative and social housing providers'. The following set of EU legislative initiatives will have an impact on climate adaptation efforts by local public or private stakeholders including providers of social, cooperative and public housing. We can for instance mention:

 <p>The European Climate Law requires EU Member States to adopt, implement and regularly update national adaptation strategies and plans and biannually report on adaptation actions.</p>	 <p>Water Framework Directive requires Member States to use their River Basin Management Plans (RBMPs) and Programmes of Measures (PoMs) to protect and, where necessary, restore water bodies in order to reach good status, and to prevent deterioration.</p>
 <p>Corporate Sustainability Reporting Directive (CSRD) and the EU taxonomy provide a standardised framework to incentive investment in climate adaptation measures.</p> <p>Do Not Significant Harm (DNSH) principle requires risk and vulnerability assessments to be performed and relevant adaptation measures to be implemented in the following 5 years.</p>	 <p>Green Public Procurement (GPP) criteria for the design, construction, renovation, demolition and management of buildings. Draft technical report.</p>
 <p>Nature Restoration Law requires Member States to restore biodiversity including in urban ecosystems.</p>	 <p>Eurocodes as state-of-the-art reference design codes for buildings, infrastructures and civil engineering structures. They are the recommended reference for technical specifications in public contracts and designed to result in more uniform levels of safety in construction throughout Europe.</p>
 <p>Floods Directive, requires Member States to assess and manage flood risks and take adequate and coordinated measures to reduce these.</p>	 <p>On 29 September 2021, the Commission launched five EU missions to tackle big challenges in health, climate and the environment. The mission “Adaptation to climate change” focuses on solutions and preparedness for the impact of climate change to protect lives and assets.</p>

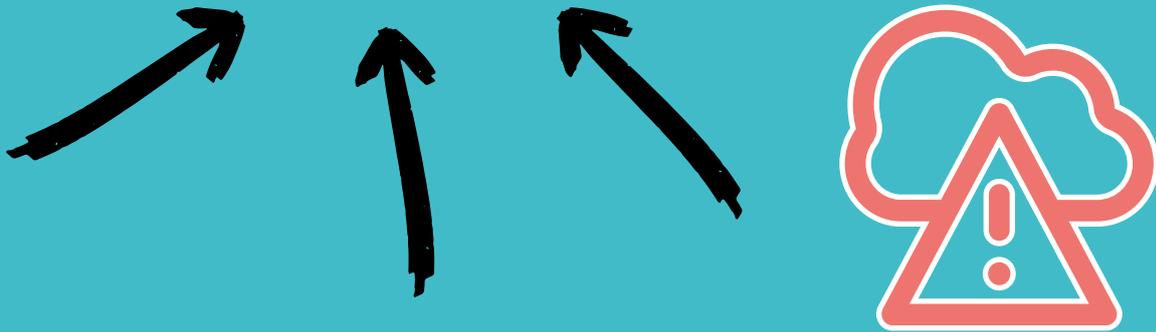
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4.

CLIMATE RISKS FOR SOCIAL, PUBLIC AND COOPERATIVE HOUSING PROVIDERS

Main climate hazards impacting the sector



Climate change has been associated with risks to the built environment, as well as the people and natural systems who live in it. Damage from extreme weather events to the built environment is projected to increase up to 10-fold by the end of the 21st century as a result of the effects of climate change only²⁵.

Climate change is increasingly shaping the landscape of public, cooperative, and social housing across Europe. While some countries have already faced severe disruptions, others are beginning to see only incremental changes, highlighting the need for tailored adaptation strategies.

While housing providers in southern countries (Spain and Italy) face high temperatures and extreme weather events like droughts and river floods, leading to sharp increases in energy demand and infrastructure damage, in the north (Finland and Sweden) providers experience more isolated events, with summer comfort and cooling needs becoming a new challenge. In western Europe (Wallonia, Germany, and France) flood risks and overheating have become a primary concern.

→ Heavy rainfall and floods



Precipitation patterns in Europe are changing, with downpours and other extreme precipitation events increasing in frequency and magnitude. Recent years have seen catastrophic floods in various regions, while southern Europe can expect considerable declines in overall rainfall, pluvial flooding risk is expected to increase significantly in northern Europe and some western-central European cities by 2030 (near term)²⁶.

Urban landslide risks are expected to increase in regions experiencing higher extreme rainfall, necessitating comprehensive risk mitigation strategies. Heavy hail storms and wind storms are also becoming more frequent, causing severe damage to building elements like roofs, facades and insulation materials.

Floods can have several **origins**²⁷:

- ➡ **Pluvial flooding** occurs due to extreme rainfall, either overwhelming drainage systems in urban areas or causing sudden flash floods with high-velocity water, often worsened by urbanization.
- ➡ **River flooding** happens when excessive rain or snowmelt causes rivers, lakes, or streams to overflow, with severity influenced by terrain, soil saturation, and climate change effects on rainfall duration and intensity.
- ➡ **Coastal flooding** results from seawater inundation due to storm surges, strong winds, high tides, or tsunamis, posing significant risks to coastal communities.

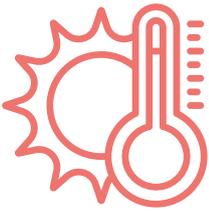
Flooding has severe **consequences** for the environment (buildings, people and the surrounding natural environment):

- ➡ **Structural damage to buildings**, including foundations, load-bearing walls, and beams, is common due to prolonged water exposure, soil saturation, and salinity, while non-structural elements such as facades and roofs suffer functional flaws, leading to economic losses and delayed recovery (IVE, *Flooding Guide*).
- ➡ **Essential services** like electricity, water supply, and air conditioning can be disrupted, making homes uninhabitable and businesses unsafe. Additionally, critical infrastructure such as wastewater systems, sewerage, and telecommunications can be severely affected, amplifying the impact of floods beyond the immediate area. Flooding of key facilities like pumping stations and electricity substations can also result in widespread service outages (IVE, *Flooding Guide*).
- ➡ **Transport networks**, including roads, railways, and tramlines, may be damaged or rendered inaccessible, causing long-term disruptions and costly repairs.
- ➡ **Environmental impacts** include soil and bank erosion, landslides, and siltation, which degrade ecosystems and threaten biodiversity. Pollutants carried by floodwaters reduce water quality, further endangering habitats, though periodic flooding can benefit wetlands by maintaining their sustainability and helping to store excess water (EEA, 2024).
- ➡ **On a societal level**, floods cause emotional distress, displacement, and, in extreme cases, loss of life (IVE, *Flooding Guide*). Pluvial flood risks are expected to rise significantly in northern and western-central European cities by 2030 (Komolafe et al., 2018; EEA, 2024).

²⁶ European Environment Agency (EEA). (2024d).

²⁷ Zurich Insurance Group.

→ Raising temperatures: heat waves and droughts



The summer of 2024 was the hottest on record for Europe and globally²⁸. Heatwaves are getting worse in Europe: more frequent, longer and hotter. Many European countries have experienced their warmest-ever temperatures in recent years.

Heat risks will escalate in many cities by the end of the century (long term), especially in southern Europe, leading to a potential decrease of 74% in thermal comfort hours at 3°C of global warming by the end of the century (long term)²⁹.

Raising temperatures have several **consequences** for the built environment:

- ➔ **Overheating of buildings and infrastructure, and reduced indoor environmental quality**, with thermal comfort increasingly compromised by factors such as insulation, solar shading, ventilation, and geographical location.
- ➔ **Increased energy demand** for air conditioning leading to higher utility consumption and energy losses.
- ➔ **Structural deterioration**, including corrosion in reinforced concrete and steel structures, while the shrinking and swelling of clay soils threaten the stability of homes, particularly in sub-urban areas.
- ➔ **Worsening health conditions and increasing mortality** due to heat waves, particularly among elderly populations. Heat stress, dehydration, and aggravated chronic and respiratory diseases contribute to higher fatality and illness rates, affecting both physical and cognitive well-being (IPCC, 2022).
- ➔ **Vulnerable groups**, especially individuals of lower socioeconomic status and migrants, face heightened risks due to inadequate housing, limited access to cooling, and occupations that expose them to extreme heat, such as manual labor and waste picking (IPCC, 2022).

Drought is a growing problem, driven by the combination of higher temperatures with reduced and more irregular precipitation. Longer and more intense droughts will result in deeper desiccation, extending up to the first two metres of the soil surface exposed to evapotranspiration³⁰. Prolonged droughts cause severe economic damage across many sectors. They can severely degrade the water resources that people, agriculture, industry and ecosystems depend on, as well as hamper transport via inland waterways. Southern Europe is particularly vulnerable, but countries in central and northern Europe are also at risk and unprepared for prolonged droughts.



²⁸ European Environment Agency (EEA). (n.d.g).

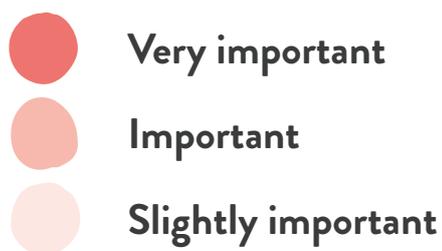
^{29, 30} European Environment Agency (EEA). (2024d).

Main climate hazards impacting the public, cooperative and social housing sector³¹.



	FRANCE	WALLONIA	GERMANY	SPAIN	ITALY	SWEDEN	FINLAND
Pluvial floods	Important	Very important	Slightly important	Slightly important	Very important	Important	Very important
Raising temperatures and heat waves	Very important	Important	Slightly important	Very important	Slightly important	Important	Important
Droughts	Slightly important	Important	Important	Important		Slightly important	
River floods	Important	Very important		Slightly important	Very important	Slightly important	Important
Coastal floods				Slightly important			Slightly important
Sea-level rise				Slightly important		Slightly important	

Source: Housing Europe



³¹ Italy, and a small group of other EU countries, face [other types of nature related risks \(earthquakes, volcanoes, tornados, tsunamis\)](#). While those risks also require adapting building practices and involve urban planning decisions, they will not be the subject of this briefing.



→ SOUTHERN EUROPE: High temperatures and extreme weather events

Southern European countries, particularly Spain and Italy, are facing intense climate pressures, including heatwaves, droughts, and extreme weather events such as floods and windstorms. Rising temperatures are increasing energy demand, especially for cooling, while floods and storms are causing significant damage. Insurance plays a crucial role in managing these risks, but long-term adaptation strategies are necessary to improve resilience.



SPAIN

Rising temperatures and water scarcity

Climate hazards are increasingly impacting Spain's public housing stock, with regional differences in the extent and nature of these effects. In Spain, rising temperatures are increasing energy demand, and public housing often serves as shelter for displaced private-sector residents during disasters like fires, which, alongside water damage, are the most common property damages. A 10% stock buffer is typically maintained for emergencies. In **Catalunya**, where overheating in summer reduces climate comfort, air conditioning has become essential. Water restrictions during droughts, such as the 2023-2024 emergency, further strain resources, and double-skin façades exposed to high temperatures face potential deterioration. In **Baleares**, public housing has not experienced significant climate-related impacts. Public providers across regions rely on insurance to manage property damage, underscoring the growing need for resilient housing strategies.



ITALY

Extreme weather events and costly damage

Italy has been significantly impacted by climate hazards, including floods, windstorms in the provinces of Ravenna, Tuscany and Piemonte as well as rising temperatures and heat waves in the southern regions. In 2023, floods and windstorms caused substantial damage, with windstorms primarily affecting roofs and floods damaging engines, walls, and other infrastructure. These events led to tenant displacement and property damage. Notably, the May 2023 floods caused 14 fatalities, over 200,000 evacuations, and widespread destruction, including 376 landslides and 714 closed roads. **ACER Ravenna** provided temporary accommodation for both social and private tenants displaced by the floods, using vacant stock for this purpose. The damage costs for ACER Ravenna included €9.1 million from the May 2023 floods, €615,600 from a windstorm in July 2023, and €5.7 million from flooding in September 2024, with many buildings affected, including 32 fully flooded accommodations, 86 partially flooded, and significant damage to thermal plants, elevators, and garages. Additionally, the region has a history of earthquake impacts, such as the 2012 Emilia-Romagna earthquake.

→ NORTHERN EUROPE: Emerging cooling needs and isolated flooding

Northern European countries like Finland and Sweden have experienced relatively limited climate-related damage, though an increasing need for cooling, particularly for vulnerable populations, is emerging. The 2021 floods in Gävle (Sweden) highlighted the potential for extreme weather events, reinforcing the need for enhanced resilience.



FINLAND

Minimal impact but rising cooling needs

The public housing stock in Finland, particularly in Helsinki, has not been significantly impacted by climate hazards, with minimal effects from climate change so far. However, there has been a slight increase in energy demand due to the need for cooling, especially in buildings housing elderly people or groups with special needs, where cooling requirements have risen.



SWEDEN

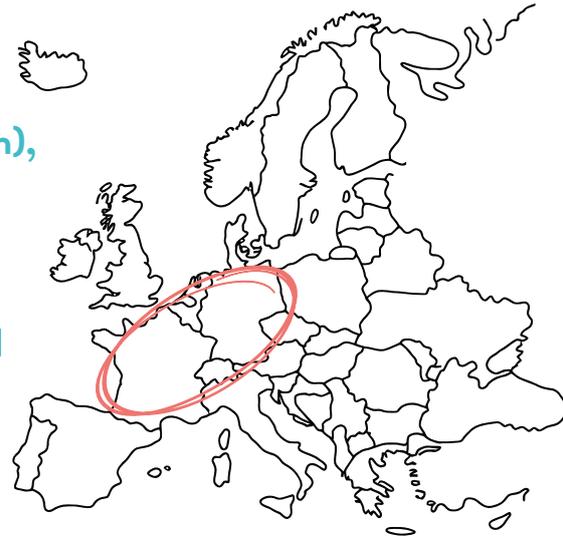
Isolated flooding and heatwave incidents

The impact of climate hazards on Sweden's public housing sector has been relatively limited, with a few notable exceptions. A heatwave in 2018 affected much of the country. Gävle, however, experienced severe flooding in August 2021, caused by unprecedented rainfall (166 mm in 24 hours, with 102 mm in just two hours)³², which severely impacted 50% of their housing stock, damaging homes, public areas, and infrastructure like roads, sewage, and piping. This event led to 174 housing unit damages, 200+ secondary area damages, and extensive flooding of basements and equipment, displacing around 70 tenants. The total damage cost reached 110 million SEK (9.6 million €), with insurance covering most costs (up to 85%), but the public housing provider in Gävle still bore 40 million SEK (3.5 million €). Recovery efforts included temporary housing and significant rebuilding, with a team of consultants assisting with insurance claims.

³² Mårtensson, L., & Månsson, G. (2021).

→ WESTERN EUROPE: Flooding and rising insurance costs

Western European countries, including Wallonia (Belgium), Germany, and France, have experienced flooding as the primary climate-related challenge. For France, summer comfort is a growing concern and is preparing for rising insurance costs, which may become a significant financial burden. While Germany has seen relatively stable conditions, the region as a whole must focus on flood mitigation and long-term resilience planning.



WALLONIA (BELGIUM)

Heavy flooding and recovery challenges

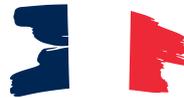
The social housing stock in Wallonia has been significantly impacted by climate hazards, as evidenced by the 2021 flooding event that severely affected many properties, particularly in the Ardennes region. This event affected up to 100,000 people and caused 38 fatalities and 1 missing person. Around 50,000 buildings were destroyed or damaged to varying degrees, necessitating substantial investments to provide emergency accommodation, rehouse affected residents, and renovate the damaged buildings.



GERMANY

Limited long-term impacts

The public housing stock in Germany has not experienced significant damage in the last 20 years. The western regions were impacted by the 2021 floods, but this event was not considered representative of broader trends or a recurring issue.



FRANCE

Gradual challenges and raising insurances costs

The social housing stock in France has been impacted by climate hazards, including floods in Nord-Pas-de-Calais in 2024 and the 2003 heatwave, which disproportionately affected seniors across the country, leading to nearly 15 000 fatalities across the country³³. Summer comfort is a growing concern in social housing in France affecting 38% of tenants, particularly in warmer regions where the rate rises to 51%. Heat discomfort significantly reduces tenant satisfaction, dropping from 80% to 43% among those experiencing extreme heat. Passive cooling measures like shutters and sunshades help mitigate heat, with only 33% of tenants using them reporting discomfort, compared to 50% without. Cross-ventilation is also crucial, as 55% of those unable to create airflow suffer from heat. Small apartments are more vulnerable to overheating due to limited ventilation³⁴.

The sector has also experienced some effects of clay shrinking/swelling due to droughts, though L'Agence Qualité Construction provides best practices to address this. While the social housing stock has not yet been significantly affected by climate change events, a noticeable and progressive rise in insurance costs due to climate change is expected in France starting in January 2025. To manage these cost increases, short-term strategies will focus on identifying risks and defining mitigation measures, while medium- to long-term efforts will involve developing an adaptation strategy to reduce the sector's vulnerability.

³³ Santé publique France. (2019).

³⁴ ANCOLS (2024).

Exposure and vulnerability to climate hazards



Housing is exposed to various climate-related hazards, depending on location and topography, while the building conditions and socio-economic characteristics of occupants influence their vulnerability. Both exposure and vulnerability to climate change are key determinants of climate risk.

An **estimation of risk** essentially consists in assessing the possible impacts of certain hazards, over exposed assets weighting their vulnerability and exposure. The main opportunity for reducing risk lies in reducing vulnerability and exposure since it is not always possible to reduce the severity and frequency of natural hazards³⁵.

A key landscape and environmental feature that influences exposure is for example proximity to a watercourse for fluvial flooding. In many cases the position of an asset in the landscape and whether it is exposed to (or sheltered from) the prevailing weather will determine its exposure (Scotland, 2019).

Urban flooding risks are also increased by urban expansion and land use and land cover change which enlarges impermeable surface areas through soil sealing, impacting drainage of floodwaters with consequent sewer overflow³⁶.

The presence of buildings in densely-populated urban areas with high amounts of soil sealing and limited green and blue spaces may also increase the exposure to the Urban Heat Island (UHI) effect and flooding.

Vulnerability, on the other hand, refers to the propensity of exposed buildings or occupants to suffer adverse effects when impacted by hazard events or understood as the features of an asset that make it more or less susceptible to the hazard³⁷.

For example, the vulnerability of a building to floods can depend on a series of factors like: design (elevation of the building; building openings to the outside (doors, windows or others); organisation or distribution of habitable space; construction and facilities (walls, facades, floors, electric facilities); materials (synthetic wood; cork, cellulose)³⁸.

Exposure is necessary but not sufficient determinant of risk. It is possible to be exposed but not vulnerable (for example by living in a floodplain but having sufficient means to modify building structure and behaviour to mitigate potential loss). However, to be vulnerable to an extreme event, it is necessary to also be exposed³⁹.

³⁵ Joint Research Centre (JRC). (2022).

^{36, 37} IPCC (2022).

³⁸ Instituto Valenciano de la Edificación (2020).

³⁹ IPCC (2022).

Exposure and vulnerability also varies across regions, sectors and societal groups that will be impacted differently by climate-related hazards depending on a series of factors: social (demography, health, social interactions, education); political (institutional robustness; state capacity); economic (GDP per capita, income inequality; access to infrastructure, innovation capacity); and environmental (health of the ecosystem/ environmental degradation and the presence of public policies to preserve it)⁴⁰.

Western European cities are more exposed to flooding events, while those in **southern** Europe are more exposed to droughts. Cities in southern, western Europe and central-eastern Europe face significant exposure to heatwaves, partly due to limited solar shading and air conditioning installations. In **northern Europe**, buildings have been designed for cold winters without any regard

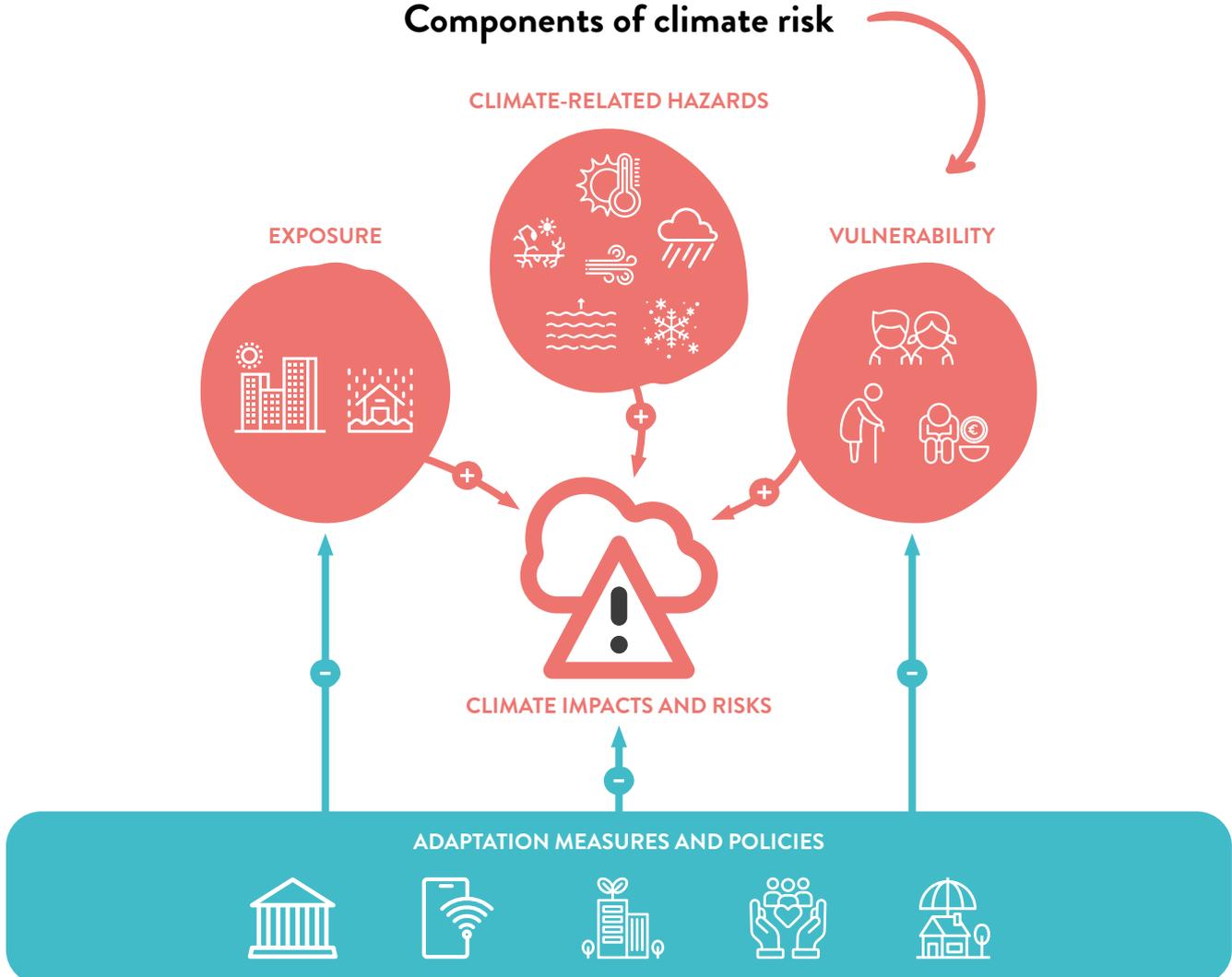
for exceptionally hot summers. Hence, the overheating of residential buildings is a severe issue threatening the health of vulnerable population groups⁴¹.

Low-lying coastal regions, including many densely-populated cities, are at risk from flooding, erosion and saltwater intrusion aggravated by sea level rise.

EU outermost regions face particular risks as a result of their remote location, weaker infrastructure, limited economic diversification and, for some of them, strong reliance on a few economic activities. Specific climate risks may have hotspots in regions beyond the ones highlighted here.

Regions characterised by high levels of unemployment, poverty, migration and ageing populations have a lower capacity to adapt to the impacts of climate change.

Components of climate risk



Source: European Environment Agency (EEA) (2024c)

⁴⁰ Joint Research Centre (JRC). (2022).

⁴¹ European Environment Agency (EEA). (2024d).

The risk level for public, cooperative and social housing providers depends on both **exposure** (climate hazards affecting the housing stock) and **vulnerability** (the ability of buildings and tenants to withstand those hazards). Below is a country-by-country assessment:

	EXPOSURE	VULREABILITY	RISK
SPAIN			
ITALY			
WALLONIA			
FINLAND			
SWEDEN			
GERMANY			
FRANCE			

-  High
-  Moderate
-  Low



→ HIGH RISK: High levels of exposure or vulnerability



SPAIN

EXPOSURE: High regional variability, with risks including flooding, droughts, extreme heat, and rising sea levels (e.g., Balears, Catalunya, and Valencia).

Spain's public housing sector faces varying levels of exposure to climate hazards, with significant regional differences. **Nationally**, buildings, including public housing, are often located in compact and dense peripheral areas often crossed by watercourses, which makes buildings largely exposed to UHI and river flooding, but comprehensive data on exposure at national level remains lacking. Public housing is not more exposed to these risks than private buildings, as both face similar vulnerabilities. **Catalunya** is highly affected by droughts and overheating, worsened by urban heat island (UHI) effects, although strong regulatory measures minimise

risks like flooding and droughts. **Valencia** has identified areas prone to floods, UHI, and fires, but there is limited knowledge about the exposure of public housing. Balears, as a Mediterranean archipelago, is particularly vulnerable to extreme heat, droughts, rising sea levels, and torrential rains, which cause significant damage.

These challenges highlight the need for region-specific strategies and improved cross-sectional data to better identify the presence of public, social housing stock in identified exposed areas.

VULNERABILITY: Aging stock, high energy poverty, and large populations of elderly and low-income tenants increase climate risks.

Public housing in Spain is highly vulnerable to climate hazards due to the socio-economic profile of tenants, who are often low income and face energy poverty, health issues, and reduced mobility. **Across Spain**, an ageing building stock exacerbates risks for people with reduced mobility, the elderly and groups with special needs, particularly during floods due to accessibility issues, and during heat waves due to inappropriate insulation. However, adherence to building codes has proved essential in Spain to mitigate risks like fires and earthquakes. Vulnerabilities vary across regions: in **Catalunya**, energy poverty and the elderly population

are critical concerns, despite well-maintained buildings; in **Valencia**, building design is more critical than age for flood resilience, with strategies like avoiding living areas on ground floors in flood-prone zones; and in **Balears**, ongoing renovations have improved energy efficiency and accessibility, addressing some vulnerabilities.

A targeted tenant-centred approach focusing on the most vulnerable is needed to enhance resilience through energy efficient retrofits, accessibility improvements, and climate-sensitive building codes and design.





ITALY

EXPOSURE: Ravenna province has high flood risks due to rivers and proximity to the sea, as well as landslide hazards.

In the province of Ravenna, many buildings, including public housing, are situated near rivers, making them vulnerable to flooding, particularly as rainfall intensity has increased, surpassing the rivers' capacity to absorb water. The region's proximity to the sea contributes to additional flood risks, while surrounding hills can lead to

landslides in some municipalities. Between May 2023 and September 2024, the province faced three floods and one windstorm, highlighting the ongoing climate hazards. Public housing is not more exposed to these risks than private buildings, as both face similar vulnerabilities.

VULNERABILITY: Public housing has poor building conditions, and tenants are largely low-income, elderly, or migrants, increasing risks.

The public housing stock in the province of Ravenna is particularly vulnerable due to the high proportion of low-income households, senior occupants, migrants, and tenants with special needs, who are the most vulnerable

to climate hazards. Additionally, the stock itself is at risk because of its poor building characteristics, including age and inadequate renovation conditions.



WALLONIA

EXPOSURE: High flood risk due to numerous rivers; concerns about overheating.

The social housing sector in Wallonia is fairly exposed to climate hazards, particularly flooding, due to the region's numerous rivers and water bodies sensitive to heavy rainfall. The risk of flooding is concentrated in specific regions of Wallonia where social housing buildings are highly exposed, for example in the provinces surrounding

the Ardennes. Heritage buildings are also at risk of flooding.

However, the prevalence of single-family homes in the social housing stock reduces exposure to the Urban Heat Island effect.

VULNERABILITY: Old social housing stock with poor energy performance (F/G ratings), and over half of tenants are elderly or have health issues.

The social housing sector in Wallonia is very vulnerable to climate hazards, particularly overheating during extreme heat, due to an aging housing stock from the 1960s with poor energy performance (F and G ratings) that is in need of renovation. Social housing tenants are especially at

risk, as over half are over 60 years old, have health issues or reduced mobility, and face low-income challenges, further exacerbating their vulnerability to both overheating and floods.



→ MODERATE RISK: Moderate levels of exposure or vulnerability



GERMANY

EXPOSURE: Regional variations—West/South prone to river floods, East to droughts, and the entire country to heatwaves.

The social housing stock in Germany is somewhat exposed to climate hazards, with regional variations due to different climate zones and geography. West and South Germany is more prone to river floods and heavy rainfall, although housing providers typically do not have buildings

near rivers. The eastern regions, including Berlin, face higher risks of droughts, while rising temperatures and heat waves are also significant concerns for housing providers across the country.

VULNERABILITY: Mixed-income neighborhoods reduce overall vulnerability, but elderly tenants in cooperatives remain at risk.

Germany's social housing stock is also vulnerable to climate hazards, with socially mixed neighbourhoods that include some vulnerable groups, particularly elderly tenants who are more susceptible to rising temperatures.

While not all tenants are equally vulnerable, cooperatives have a higher proportion of elderly residents. Currently, there is no special support or targeted climate adaptation measures in place for these vulnerable populations.



EXPOSURE: High flood risks (major cities built along rivers) and significant concerns over heatwaves and UHI.

The social housing sector in France is actively working on assessing the exposure of its building stock to various climate hazards, both present and future (2050-2100), through a study conducted in collaboration with Banque des Territoires in the first half of 2025. This study led to development of an online platform PrioRéno Logement Social that social housing providers can use to analyse their buildings' exposure to major climate hazards. In the future, the platform should provide a first-level evaluation of building vulnerabilities to these risks.

The majority of the social housing stock is located in Île-de-France (25%), Hauts-de-France (20%), and Auvergne-Rhône-Alpes. Flooding risk is especially prevalent in the Hauts-de-France region and in major cities situated along rivers and waterways. Heatwave hazard, present across the entire territory, particularly impacts the Mediterranean region and urban areas prone to heat island phenomena.

Coastal flooding and sea-level rise are also considered **key climate hazards** for France. With coastal zones covering a substantial share of the national territory, early research shows a **high level of exposure of housing** to these risks, compounded by ongoing coastal erosion⁴².

France's EU outermost regions' situation also necessitates a thorough assessment of their exposure to various and critical hazards. The specificities of their geo-

climatic contexts imply the need to conduct contextual surveys of their exposure and vulnerability.



Credits: USH

VULNERABILITY: 60% of housing stock is old (built before 1990), with a significant elderly tenant population (30% over 65).

The social housing sector in France is highly vulnerable to climate hazards, with 60% of its stock being relatively old (built before 1990), making it more susceptible to rising temperatures and reduced summer comfort. Having said that, the sector has a higher renovation rate than the private sector, with 100,000 renovations annually, which is helping reduce its vulnerability. The sector consists mainly

of multi-family buildings (85%), which are less impacted by clay shrinking issues compared to the private housing sector mostly made of single-family homes. A significant share (over 30%) of social tenants is over 65 and particularly vulnerable to rising temperatures. The sector in France is also working with Banque des Territoires to assess the long-term vulnerability of the stock.

⁴² <https://www.banquedesterritoires.fr/erosion-cotiere-les-principaux-scenarios-du-cerema-sur-la-table>



→ **LOW RISK:**
Low levels of exposure and vulnerability



FINLAND

EXPOSURE: Some risk from pluvial flooding, coastal hazards (Helsinki), and rising temperatures.

The public housing stock in Finland, particularly in Helsinki, is somewhat exposed to climate hazards due to the city's coastal location. Helsinki faces challenges from heavy rains, pluvial floods, and rising temperatures. Some public housing buildings are vulnerable to coastal flooding, but the local authority has implemented planning and development restrictions concerning building heights and proximity to the sea to mitigate these risks.

VULNERABILITY: Older public housing lacks cooling measures, affecting lower-income tenants, but strong planning policies help mitigate risks.

Finland's public housing stock, especially in Helsinki, is also relatively vulnerable to climate hazards due to its diverse range of buildings, including older structures from the early 20th century and newer buildings constructed annually. Extreme temperatures, especially during heatwaves, affect the older buildings and their occupants, who are often from lower-income groups due to income limits in Finnish public housing. Overheating, caused by rising temperatures and the lack of cooling measures, is a growing concern in Finland.



SWEDEN

EXPOSURE: Rising temperatures are the main threat, with some regional risks of floods and droughts.

Public housing in Sweden is variably exposed to climate hazards, with rising temperatures being a widespread issue affecting most providers, while droughts and floods are more prominent in certain regions, such as the southeast. A significant portion of the housing stock experiences summer overheating due to insulation designed for winter warmth, with multi-family buildings in urban areas being more susceptible than single-family homes in suburban settings. Flooding is a concern in several areas, but housing companies don't generally have the knowledge and capacities to identify buildings at risk.

VULNERABILITY: Overheating is a growing concern, especially in buildings from the 1960s-70s. However, public housing providers are well-prepared and proactive.

While not a widespread issue, some areas of the public housing stock in Sweden are particularly vulnerable, especially in buildings from the 1960s and 1970s, where many low-income residents live, which is raising concerns about the unequal distribution of risk. Rising temperatures are contributing to overheating in buildings, exacerbated by retrofitting insulation. In Gävle, collaboration between the local authorities and the public housing provider, has prioritised key community buildings such as health facilities, hospitals, homes for the elderly, and schools in disaster response planning, with risks identified jointly.



BEST PRACTICES



→ Risk and vulnerability analysis for Östersundshem

SWEDEN

As part of a joint project between **Public Housing Sweden** and **IVL (Swedish Environmental Research Institute)**, the **public housing company Östersundshem** assessed the risks of heavy rainfall and flooding in Östersund, particularly in Hjorten, Härads skrivaren, and Valhall. The findings highlighted severe flooding risks, erosion threats to land stability and buildings, and mobility issues for residents and property managers. Protective measures are needed to prevent water intrusion in basements and entrances, while existing green infrastructure may be inadequate for managing excess water. Recommended actions include enhancing drainage systems, reinforcing soil stability, improving building protections, and ensuring better accessibility during extreme weather events.

→ Heat mapping analysis for MKB

SWEDEN

As part of the same project, the public housing company MKB participated in a separate analysis focusing on heatwaves.

The heat mapping analysis for MKB's properties, based on MSB (Swedish Civil Contingencies Agency) data and satellite records from 2017–2022, revealed that maximum summer temperatures reached 30–35°C in several areas, posing health risks, especially for vulnerable populations like the elderly. Cooler areas (25–30°C) were often inaccessible, exacerbating heat stress, particularly in Katrinelund (which houses an elderly care home) and Rosengård. Heatwave risk assessments highlight increasing health concerns when temperatures exceed 26°C for three consecutive days. To mitigate these risks, recommendations include expanding green infrastructure, adding shaded public spaces, incorporating water features, and improving building insulation and ventilation.

→ Reducing the vulnerability of existing buildings in Wallonia

WALLONIA

The guide **Réduire la vulnérabilité des constructions existantes** published in 2023 by the Service Public de Wallonie (SPW), aims to assist housing providers, occupants, architects, and permitting authorities in mitigating flood risks for existing structures in Wallonia. It offers a range of preventive measures to enhance the resilience of buildings against flooding.

5.

ADAPTATION OPTIONS

Climate adaptation aims to reduce risks by lowering exposure to hazards and reducing vulnerability of buildings and residents. This can be achieved through spatial planning and design, nature-based and technical solutions, and awareness-raising measures that increase the capacity of people and buildings to cope with climate shocks.

Adaptation measures are often hybrid, combining physical (“grey”) infrastructure with nature-based solutions (NBS), and should be designed to respond to multiple climate hazards. Measures addressing one risk (e.g. insulation for cold) may increase vulnerability to others (e.g. overheating), making integrated, multi-hazard approaches essential.

Nature-Based Solutions (NBS)

The European Commission defines nature-based solutions as “solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions⁴³”. In public, cooperative, and social housing, nature-based solutions play a key role in climate adaptation by reducing exposure to climate hazards, lowering vulnerability and delivering multiple, complementary functions:

→ Temperature regulation⁴⁴ and solar shading

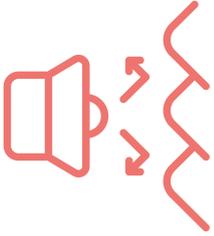


Urban vegetation such as street trees, green roofs and facades cool indoor and outdoor environments through shading and evapotranspiration. Larger green spaces can reduce the urban heat island effect by 2–3°C, while green roofs and facades can lower surface temperatures by up to 10–20°C. Cooling performance depends on vegetation density, species selection and canopy characteristics.

⁴³ https://research-and-innovation.ec.europa.eu/research-area/environment/nature-based-solutions_en

⁴⁴ IPCC, 2022.

→ Noise buffering⁴⁵



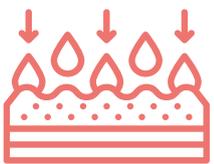
Dense vegetation, particularly evergreen species located close to noise sources, can reduce perceived noise levels by up to 5–10 dBA. While not a standalone noise barrier, it can significantly improve acoustic comfort in residential areas.

→ Air cleaner⁴⁶



NBS help regulate air quality by absorbing pollutants. To maximise benefits and avoid trapping emissions, careful tree and species selection is required, prioritising low-VOC (low volatile organic compounds), low-allergen species adapted to local conditions.

→ Water absorption⁴⁷



Green spaces, green roofs and sustainable drainage elements reduce stormwater runoff, limit surface flooding and improve water quality. Combining different NBS types enhances stormwater retention and flood regulation, addressing both pluvial and fluvial flooding risks.

→ Wind breaks⁴⁸



Evergreen vegetation can function as windbreaks, reducing winter wind speeds and unwanted air infiltration. Shelterbelts of uniform height located close to buildings provide the most effective protection.

⁴⁵ The Environmental Design Pocket Book 2015.

^{46, 47} IPCC, 2022.

⁴⁸ The Environmental Design Pocket Book 2015.

<p>STREET TREES AND SHRUBS⁴⁹</p>	<p>Trees can be integrated into the built environment as single rows along streets and paths, as boulevards with canopies providing shade and cooling, or in grouped plantings for courtyards, squares and dense urban areas. Shrubs, while smaller, play an important role in enhancing biodiversity, supporting pollinators and birds, and improving air quality by trapping pollutants and absorbing greenhouse gases. To maximise their climate adaptation benefits, careful selection of species, canopy cover and leaf area is essential.</p>
<p>GREEN ROOFS AND FACADES⁵⁰</p>	<p>Green roofs and façades are vegetated systems integrated into roofs or building envelopes, combining insulation, drainage and waterproofing layers to improve thermal comfort and stormwater management.</p> <p>➡ Green roofs with diverse plant species enhance water retention during flooding and provide cooling during heatwaves. Two main types exist: extensive systems, which are lightweight and low-maintenance, and intensive systems, which support a wider range of vegetation.</p> <p>➡ Green façades typically use climbing plants rooted in the ground, growing directly on walls or supporting frames, offering a cost-effective solution for shading and cooling building envelopes.</p>
<p>GREEN SPACE⁵¹</p>	<p>Residential parks provide cooling, recreational and biodiversity benefits that extend into surrounding neighbourhoods, while larger district parks often combine multiple functions such as leisure and water retention. Green corridors—often created by regenerating disused infrastructure or waterways—connect green spaces, enhance biodiversity, and promote walking and cycling. Urban gardens, including community and allotment gardens, strengthen residents’ interaction with nature, support local food production, foster social cohesion and contribute to mental well-being.</p>
<p>SUSTAINABLE URBAN DRAINAGE SYSTEMS (SUDS)⁵²</p>	<p>Sustainable Urban Drainage Systems combine landscape-based elements such as rain gardens, bioswales, retention ponds, channels and green roofs to slow surface-water runoff, reduce flood risks and relieve pressure on sewer networks. These systems promote water infiltration, improve water quality and support biodiversity. Rain gardens manage runoff from sealed surfaces at a small scale, retention ponds temporarily store excess water during heavy rainfall, and bioswales convey and filter stormwater through vegetated, shallow channels, contributing to resilient and multifunctional urban environments.</p>
<p>BIRD NESTING, BEEKEEPING IN ROOFS, FACADES AND INTEGRATED ELEMENTS</p>	<p>Urbanisation has reduced natural habitats for birds and insects, increasing the importance of integrating nesting and shelter elements into buildings. Nest boxes discreetly built into facades provide safe breeding spaces for birds and shelter for bats and insects, while bee bricks integrated into masonry support solitary pollinators. When properly designed and positioned, these elements enhance urban biodiversity with minimal impact on building design or maintenance.</p>

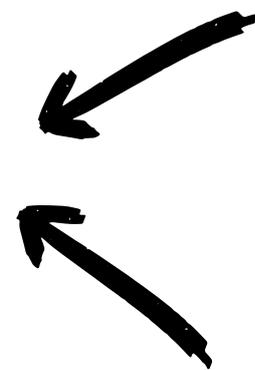
⁴⁹ UNALAB (2022).

⁵⁰ World Green Infrastructure Network (WGIN). (n.d.) ; UNALAB (2022).

⁵¹ <https://unalab.eu/system/files/2022-11/unalab-nbs-technical-handbook-factsheets2022-11-17.pdf>

⁵² Heywood, 2015.

Building design and construction



Building design and construction play a critical role in the climate adaptation of public, cooperative, and social housing by determining how buildings respond to heat, flooding, wind and other climate hazards over their lifetime. Design choices related to layout, orientation, materials and construction techniques directly influence thermal comfort, resilience and maintenance needs, enabling housing providers to reduce vulnerability, protect residents and limit long-term costs when adaptation is integrated from the outset or during renovation.

SOLAR SHADING ⁵³	Solar shading controls solar heat gains to prevent overheating in summer while allowing beneficial sunlight in winter. External devices—such as louvers, overhangs and movable screens—are the most effective, as they block radiation before it enters the building, and can reduce indoor temperatures by around 3°C.
NATURAL VENTILATION ⁵⁴	Passive cooling systems such as wind towers, solar chimneys and air vents promote air circulation and reduce reliance on air conditioning, which can exacerbate the urban heat island effect. When carefully designed to local climatic conditions, natural ventilation strategies can reduce indoor temperatures by up to 14°C, though excessive wind speeds and local exposure must be avoided.
PERMEABLE PAVEMENTS	Permeable paving systems are surfaces that can absorb stormwater, minimising and delaying surface water run-off, while reducing the amount of some pollutants. Water is then temporarily stored in the underlying stone layer and infiltrates into the soil or to an additional drainage layer that conveys water into the sewage system (subsurface drain). They are commonly installed in parking lots, residential streets, and sidewalks. There are many different systems of permeable pavements. For example, porous asphalt and permeable concrete improve infiltration of homogeneous surfaces. Other solutions such as vegetated grid pavers increase the share of substrate or vegetation cover for better infiltration and allow for water uptake by plants.
PHOTO-CATALYTIC SURFACES/ MATERIALS	Increasing surface albedo through high-reflectance (“cool” or “white”) roofs and facades reduces solar heat absorption and helps mitigate overheating. However, their effectiveness compared to green roofs varies, as reflective surfaces can lose performance over time due to dust and air pollution.
ALTERING THE THERMAL MASS ⁵⁵	Thermal mass refers to a material’s ability to store heat, with denser materials generally offering better performance. Thermally massive buildings can reduce indoor temperatures by 3–5°C, lower cooling demand by 7–17% and cut heating demand by up to 32%. Materials such as brick, concrete and stone are durable and help maintain airtightness, though exposed concrete solutions have high embodied carbon.

⁵³ IPCC (2022).

⁵⁴ Heywood, H. (2020) ; IPCC (2022).

⁵⁵ Platten, S. (2015).



BUILDING AND ROOM ORIENTATION

Building orientation influences solar exposure and wind patterns, affecting daylighting, thermal comfort and energy demand. Designs should maximise winter solar gain while limiting summer overheating and avoid single-aspect dwellings. Living areas can be oriented to tolerate higher temperatures, while sleeping areas benefit from cooler orientations, with southern exposure preferred in cold climates and northern exposure in warmer ones.

SMART HEATING AND COOLING SYSTEMS

Sensors and digital thermal regulation devices can be integrated with demand side management measures, helping to reduce the impact of heating or cooling demand on peak loads during periods of electrical system stress.



BEST PRACTICES

→ AI-based smart heating system

The social housing company **SAB (Sønderborg Housing Association – Salus Boligadministration)** in Denmark has integrated an AI-based smart heating system in 432 dwellings. The system is based on a dynamic model that uses weather predictions and indoor temperature measurements to determine the optimal heating supply temperature without compromising comfort. It addresses the challenge of reducing uncontrolled heat losses and emissions, achieving 5-7% energy savings.

The integration of this innovative smart heating system was possible thanks to the **EU-funded project ARV**, under the Horizon 2020 programme.

The concept supports the general trend of digitalisation of the district heating system and is available on the market.



ARV



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 101036723.

<p>RAINWATER HARVESTING SYSTEMS</p>	<p>A rainwater harvesting system reduces excess stormwater by collecting rainfall for other uses—typically harvesting the runoff from a roof. Gutters or drains collect the runoff into a storage tank. This collected rainwater can be put to other uses such as washing clothes or gardening, reducing the need for water from the tap. Homes and buildings with rainwater harvesting systems help prevent urban flooding and conserve treated water for appropriate uses.</p>
<p>GREY WATER RECYCLING</p>	<p>Greywater, or household wastewater, refers to lightly polluted domestic water from showers, sinks, washing machines, and dishwashers. It differs from blackwater, which is more heavily polluted and comes from toilets. Grey water can be intercepted and recycled on site to be re-used for non-potable and non-bathing uses such as toilet flushing and irrigation. However, treatment is usually required prior to use, and several wastewater systems are available in the market for this.</p>
<p>FLOOD PREVENTIVE AND PROTECTIVE MEASURES⁵⁶</p>	<p>Flood risks can be reduced through permanent or temporary barriers such as earthworks, embankments, dikes and watertight walls that prevent water from reaching buildings. Additional measures include waterproofing façades, floors and basements, using water-resistant materials in flood-prone areas, and installing removable flood barriers. Spatial organisation also plays a key role, by locating vulnerable functions on higher floors, adapting building entrances above expected flood levels, and avoiding critical uses in areas where flooding may occur.</p>



⁵⁶ Instituto Valenciano de la Edificación (IVE) (2020).

Spatial planning strategies



Spatial planning plays a central role in the climate adaptation of public, cooperative, and social housing by shaping where housing is located and how it is integrated into its wider urban environment. Through land-use regulations, planning policies and development standards, spatial planning can reduce the exposure of housing stock to climate hazards by discouraging construction in high-risk areas and promoting resilient, climate-aware land use and management practices. When aligned with housing strategies, it enables the long-term protection of residents, assets and public investment.

<p>PROTECTION OR RETREAT FROM HIGH-RISK AREAS⁵⁷</p>	<p>Retreat involves the permanent relocation of housing from high-risk to safer areas, often applied in coastal or flood-prone zones exposed to sea-level rise, storm surges or river flooding. While effective in reducing long-term risk, relocation is costly for housing providers and highly disruptive for residents, and is therefore considered a measure of last resort. Future-proof flood risk zoning is essential to prevent new public, cooperative, and social housing development in high-risk areas.</p>
<p>INTEGRATED LAND USE PLANNING</p>	<p>Land use planning shapes the location of housing and infrastructure and their exposure to climate risks. Adaptation-oriented zoning supports green infrastructure, permeable surfaces and compact development, while counteracting single-use zoning by promoting mixed-use neighbourhoods that reduce travel needs and improve walkability and cycling. Prioritising transit-oriented development further limits car dependency and strengthens the resilience and liveability of housing areas.</p>
<p>BROWNFIELD DEVELOPMENT AND RESTORATION (INFILL)</p>	<p>Brownfields are previously developed sites, often located in existing urban areas and served by infrastructure. Prioritising their redevelopment limits urban sprawl and supports climate adaptation, particularly when combined with nature-based solutions to improve soil permeability and water retention. While remediation may increase upfront costs, brownfield reuse reduces pressure on greenfield land and enhances long-term urban resilience.</p>
<p>DENSIFICATION</p>	<p>Concentrating urban growth within existing urban areas helps preserve surrounding natural land and water systems, strengthening climate resilience by protecting floodplains, reducing storm surge impacts and safeguarding water catchments. Minimum densities of around 80 dwellings per hectare support efficient public transport, walkability and proximity to essential services, contributing to compact and resilient neighbourhoods.</p>
<p>CAR PARKING RESTRICTIONS</p>	<p>Reducing minimum car parking requirements and introducing mobility management measures—such as car sharing, public transport incentives and secure bicycle parking—helps limit car dependency. In social, cooperative, and public housing, excessive parking requirements increase construction costs, waste land and raise carbon emissions, undermining affordability and environmental performance.</p>

⁵⁷ European Environment Agency (EEA). (2024h).



CAR PARKING RESTRICTIONS

The EU-funded SHARE-North Squared (SN²) project supports social housing providers in improving living environments by integrating shared mobility solutions, promoting multimodal travel and reducing reliance on private cars.

➔ In **Mechelen (Belgium)**, the social housing provider **Rivierenland (Woonland)**, in cooperation with the City of Mechelen, is piloting shared mobility measures across several housing sites. While the city leads communication and awareness-raising, Woonland is responsible for the necessary infrastructural adaptations.

➔ In **Bremen (Germany)**, the public housing association **GEWOBA** is implementing mobility management measures in new and existing developments, including mobility hubs, car- and bike-sharing services and user-oriented communication. These actions are closely coordinated with municipal transport and planning departments, supporting the city's wider mobility policy objectives.



PLANNING OF CONTINUOUS GREEN CORRIDORS AND OPEN SPACES⁵⁸

Urban green and blue infrastructure planning is a strategic approach to interlink open spaces to form continuous green corridors that reverse the effects of fragmentation on biodiversity while providing a wide range of environmental, social and economic benefits. Housing providers shall ensure that greenery is interlinked at macro, micro and building scale to enhance climate resilience.

ESTABLISHING CLIMATE SHELTERS⁵⁹

Cooling centres provide protection during extreme heat, particularly for vulnerable residents, and can be integrated into housing stock or public spaces. Refuge areas are essential in flood-prone areas where evacuation is not possible, offering accessible protection in public or residential buildings. Designing shelters with dual everyday and emergency functions enhances space efficiency and resilience.

URBAN DESIGN FEATURES

Urban microclimates can be improved through design that considers solar access, street orientation and prevailing winds, reducing exposure to heat and strong winds. Preserving the sky view factor⁶⁰ limits heat accumulation in dense streets, while street layouts that support air circulation enhance cooling and pollutant dispersion. Urban breaks further improve ventilation, daylight access and thermal comfort in streets and buildings.

⁵⁸ European Environment Agency (EEA). (2024i).

⁵⁹ Facilities Management Advisor (2023) ; Service public de Wallonie (EDIWALL) (2022).

⁶⁰ C40 Knowledge Hub (2020).

Awareness raising and behaviour change strategies

Residents and tenants need to be aware of what they can do to increase their own resilience and contribute to overall societal resilience.

To increase knowledge and encourage behaviour change among residents, public, cooperative and social housing providers can implement two general types of measures: information and awareness-raising, and capacity building (empowerment)⁶¹.



Information and awareness measures

include a wide range of tools such as information campaigns in social media or websites, to more operational information designed to assist decision-making, including adaptation portals and early warning apps.

Capacity-building measures

are typically hands-on, such as workshops or practice-sharing helping residents turn knowledge into actual precautionary behaviours like: cooling practices during heat waves; protection protocols during floods; conserving water during droughts; or signing up for early warning apps.



These measures can address local risks and vulnerabilities resulting from climate change, and offer information about the actions residents can take to minimise their risk.

Knowledge and behavioural tools must be differentiated according to the needs of different target groups. The most vulnerable groups may need direct hands-on training and workshops, while emerging interactive technologies may be effective in reaching younger people.

⁶¹ European Environment Agency (EEA). (2024c).



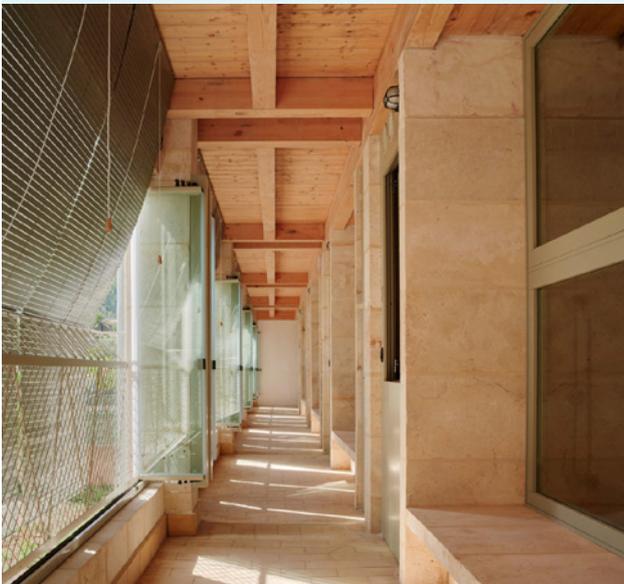
BEST PRACTICES



→ Intergenerational Social Housing in Esporles, Mallorca

SPAIN

The project developed by **Institut Balear de la Vivenda (IBAVI)** incorporates a bioclimatic access gallery to provide comfort to the units without any active heating source. Awareness raising strategies for tenants include guidance on how to use passive house measures to reduce energy demand: keeping the house cool in summer and warm in winter. Following the instructions printed on glazing tiles at the building entry hall a climate concierge will set up the different components every morning and night.



Credits: Emiliano López Mónica Rivera Arquitectos

<https://arquitecturaviva.com/obras/18-viviendas-sociales-intergeneracionales-en-esporles>

<https://lopez-rivera.com/project/intergenerational-social-housing/>

Main climate adaptation measures implemented in the public, cooperative, and social housing sector.

	FRANCE	WALLONIA	GERMANY	SPAIN	ITALY	SWEDEN	FINLAND
Nature-based solutions							
Building design & construction							
Spatial planning & design strategies							
Awareness raising and behaviour change strategies							
Disaster management							

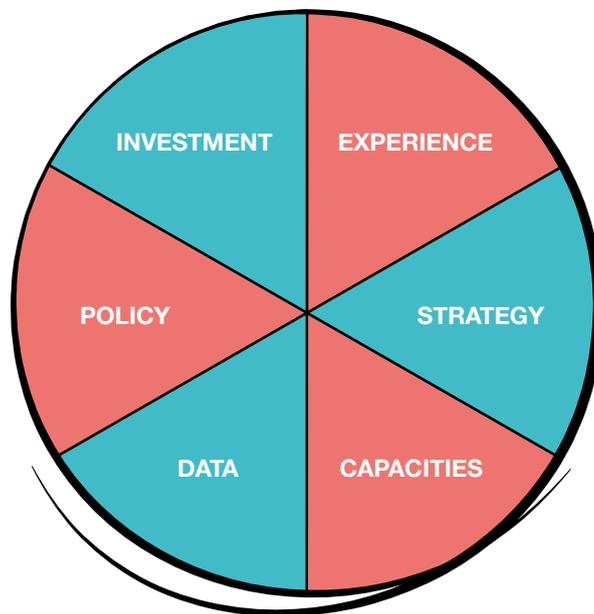
Source: Housing Europe



6.

READINESS OF THE PUBLIC, COOPERATIVE AND SOCIAL HOUSING SECTOR

READINESS is understood as the level of readiness of the public, cooperative and social housing sector to adapt their stock to climate change.



- ➔ **EXPERIENCE:** Experience of the sector in integrating climate-adaptation measures in the housing stock through projects or concepts.
- ➔ **STRATEGY:** Existence of an internal climate adaptation and/or disaster management strategy for the sector or as a strategic priority for the organisation.
- ➔ **CAPACITIES:** Whether social housing organisations build internal capacity and leverage the skills to plan and implement climate adaptation measures.
- ➔ **DATA:** How the sector is harnessing data internally to inform its strategy, and support the development of appropriate climate adaptation measures.
- ➔ **POLICY:** Supporting regulation at local, regional or national level stimulating the adoption of climate adaptation measures.
- ➔ **INVESTMENT:** Level of financial resources (internal or external) the sector has committed to supporting climate adaptation measures.

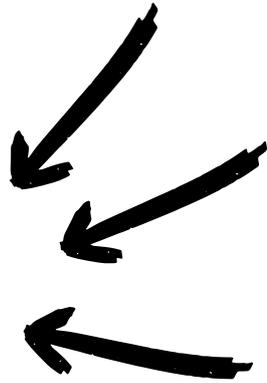
Readiness level of public, cooperative and social housing sector on climate adaptation.

	EXPERIENCE	STRATEGY	CAPACITIES	DATA	POLICY	INVESTMENT
ITALY						
SWEDEN						
FINLAND						
WALLONIA						
GERMANY						
FRANCE						
SPAIN						

Source: Housing Europe



Experience



Experience of the sector in integrating climate-adaptation measures in the housing stock through projects or concepts.

The integration of climate adaptation measures in the public, cooperative, and social housing sector across Europe shows varying levels of progress, with countries balancing the need for resilience against climate change with decarbonisation policy targets. Climate mitigation measures focused on energy efficiency continue to be at the core of the development operations in the sector and climate adaptation projects are steadily emerging. Nature-based solutions and green building practices are being implemented, but issues of cost, maintenance, and scalability remain key barriers.

The public housing sector in **Spain** is still in its early stages, the focus has primarily been on energy efficiency and passive design for summer comfort, with a growing interest in water management solutions. However, the sector faces challenges in supporting tenants with the use of these measures, and lighthouse projects remain limited. In regions like Catalunya and Baleares, passive building measures like natural ventilation and solar shading are well-established in their building requirements, though broader solutions for water management and drought remain a work in progress.

In **Italy**, the public housing sector has limited experience with climate adaptation but has developed strong expertise in disaster management strategies, especially in regions prone to flooding like the province of Ravenna. Short-term resilience measures such as reinforcing walls and creating rain gardens have been implemented, and effective disaster response protocols have been tested during recent floods. These involved efficient internal communication (e.g., a WhatsApp group for staff coordination), dissemination of emergency guidelines to



Credits: ACER Ravenna (Italy)

tenants, collaboration with authorities, and a thorough damage assessment process. Tenant representatives played a critical role in reporting property conditions, while technicians conducted inspections and immediate repairs.

Meanwhile, in **Finland**, although the primary focus has been on energy-efficient buildings, adaptation measures such as natural stormwater management, green roofs, and geothermal underfloor cooling systems are being integrated into new housing projects. Awareness campaigns, including mobile apps to help tenants manage heat during heatwaves, support this effort, though challenges persist in the widespread adoption of nature-based solutions.



Credits: <https://ilmastoinfo.hsy.fi/>

Sweden is one of the leaders in integrating climate adaptation into public housing, with a focus on nature-based solutions and innovative building design. Public Housing Sweden promotes lighthouse projects through initiatives like “Allmännyttan’s klimatinitiativ,” and measures such as elevating electrical equipment and using weather modelling for flood resilience are being

implemented. However, the high cost and maintenance concerns surrounding nature-based solutions have hindered their widespread adoption. The public nature of housing companies is beneficial in this context, as local authorities are leading climate adaptation strategies, making the sector’s adoption of these measures seamless.

In **Wallonia, Belgium**, moderate progress has been made, driven by design guidelines that include shading, bio-based insulation, and flood protection systems like retention basins. After the 2021 floods, the social housing sector took key actions to support affected households, including, renovating 544 vacant units, rehousing over 230 social housing households as well as other private households in need, acquiring additional housing for displaced residents, and deploying modular housing through municipal agreements and land provisions. While addressing water access during droughts and rehousing tenants after flooding are key priorities, the sector faces challenges in scaling up these efforts.

Germany’s social housing sector, though primarily focused on climate mitigation, is slowly integrating adaptation measures, particularly in stormwater management and green roofs. Interest in rainwater management is growing, especially in response to increasing drought concerns. However, adaptation strategies remain at an early stage, with more investment needed to scale them effectively.

In **France**, the social housing sector is progressively integrating climate adaptation measures in their stock, with a few pioneers leading resilience efforts. Building design measures to improve summer comfort, such as shutters and sunshades, are becoming common, and tenant awareness campaigns during heat waves have been successful in the past. In recent years, integrated approaches for water management have emerged in the sector and provide a promising blueprint for replication. Despite these efforts, spatial planning remains a significant challenge, as many decisions are made by local authorities, and strategies like densification and the reuse of vacant buildings are still emerging.



BEST PRACTICES



→ Buckower Felder project, a sponge city concept

GERMANY

The Buckower Felder project by **STADT UND LAND Wohnbauten-Gesellschaft mbH**, in Berlin, integrates advanced climate adaptation measures, including a decentralised rainwater management system for infiltration, retention, and evaporation, despite challenging soil conditions. The 23,000 m² traffic areas are drained using swale-trench systems, deep bed trenches, and tree trenches. The tree trenches were first tested in Berlin's public streets as a pilot project. Excess rainwater is directed to a 7,300 m² multifunctional area in the landscape park. Emergency water pathways in streets prevent flooding during heavy rainfall events.

To ensure an efficient and resource-saving energy supply, **STADT UND LAND** has developed a modern heating network in collaboration with Berlin's public utilities. The system operates at lower temperatures and incorporates a high share of renewable energy sources. A key feature is the wastewater heat recovery system, which uses a heat exchanger on the wastewater pressure pipe at Buckower Damm. Additionally, photovoltaic systems installed on 40% of the rooftops generate environmentally friendly electricity.

The mobility concept aims to reduce traffic, noise, and CO₂ emissions. Car parking is concentrated in two district garages, creating car-free areas. A mobility station offers eco-friendly transport options, including electric mobility.

Green roofs and facade vegetation enhance biodiversity, improve the microclimate, and cool the district.



Credits: © Christian Kruppa/ CITY AND COUNTRY
<https://stadtundland.de/unternehmen/presse/2024und2025/schwammstadt-stadt-und-land-quartier-buckower-felder-ist-regenial-siegerin-2024>

→ A mobile app raising awareness about summer comfort

FINLAND

HEKA, the public housing provider of Helsinki guides tenants with advice on how to keep the house cool during heat waves through an **app** developed by Helsinki Region Environmental Services Authority (HSY) and Motiva - the state company for sustainable development. The app offers practical advice for both residents and housing organisations, including how to ventilate homes, reduce heat load, and stay comfortable during hot days. It also suggests cooling solutions for buildings and communities, such as installing fans, creating shaded areas, and using cooling methods like placing wet towels in the freezer.

→ L'Eco village des Noes

FRANCE

The Eco-Village des Noes in Val De Reuil (France) is a development project carried out by social housing company Siloge by the Eure riverbanks promoting nature and biodiversity. Built between 2014 and 2016, it spans 4.6 hectares and includes 98 passive-energy homes consuming less than 15 kWh/m² annually. The project integrates measures such as extensive green spaces, preserving 1.5 hectares as an undeveloped ecological zone with diverse local plant species. Rainwater management is optimised with retention basins, landscaped swales, and a hydroelectric system to prevent flooding while supporting natural water cycles. It fosters biodiversity with organic farming, community gardens, a pedagogical orchard, and a collective chicken coop. Additionally, a wood-fired heating system and pedestrian-friendly pathways, including the unique "Asinobus" (children walking to school with a donkey), enhance its eco-friendly vision. Recognised with several awards, including the World Wide Fund for Nature (WWF) and the French Ecoquartier label.



→ Urban mining building reusing materials from the existing structure in Palma, Mallorca

SPAIN

This public housing project by **IBAVI (Institut Balear de la Vivenda)** in the Balearic Islands combines urban mining with passive climate-adaptive design. Built on the site of a demolished school, nearly all construction materials from the existing building were reused, with concrete and ceramic debris incorporated into foundations and reclaimed marès sandstone transformed into prefabricated load-bearing blocks. This approach reduced waste, construction time and embodied carbon. At the same time, passive measures such as solar shading, natural cross-ventilation and high thermal inertia address overheating risks and limit the need for mechanical cooling, demonstrating how public housing can integrate circular construction and climate resilience in Mediterranean contexts.



Credits: Adrià Goula / <https://www.harquitectes.com/en/proyectos/ibavi-2104/>

Strategy



Existence of an internal climate adaptation and/or disaster management strategy for the sector or as a strategic priority for the organisation.

Climate adaptation strategies in the public, cooperative, and social housing sector across Europe vary widely, with most countries still in the early stages of development. While there is growing awareness of the need for climate resilience, long-term strategic planning remains limited despite some promising local and regional initiatives. Many providers, especially those impacted by climate disasters, focus on short-term, reactive measures rather than comprehensive, forward-looking solutions. Collaboration between local/regional authorities and housing providers on climate adaptation is not widespread.

In **Sweden**, most public housing companies do not count with their own climate adaptation strategies, although initial guidelines and risk and vulnerability assessments are already being prepared and are serving as a starting point for their development. In general, public housing companies follow the adaptation strategies from local and regional authorities, though frontrunners like **Stångåstaden** in Linköping have developed their own initiatives, and **Gothenburg's three major housing companies** are collaborating on a municipal adaptation plan.

In **Finland** and **Germany**, adaptation remains closely tied to local authority frameworks, with climate adaptation expected to gain priority from 2025 under regulatory frameworks like the CSRD.

Elsewhere, adaptation remains reactive rather than preventive. In **Italy**, public housing efforts, such as those by **ACER in Ravenna**, are limited to small-scale interventions to mitigate immediate climate risks due to a lack of strategic policy and funding framework. In **Spain**, disaster management protocols exist with a limited long-term strategic impact. In regions like Catalunya and the Basque country, public housing providers are aligned with the regional strategies which are slowly introducing

climate adaptation into energy retrofitting plans and programmes, often supported by EU funding. There is awareness at a strategic level in the sector and multi-stakeholder collaboration platforms on climate adaptation issues in construction are starting to emerge in some regions like Catalunya.

In **Wallonia**, while no dedicated climate adaptation strategy exists for social housing, the sector is aligned with the broader regional strategy against floods ([PGRI 2022-2027 - Inondations en Wallonie | Inondations en Wallonie](#)). Post-disaster emergency housing plans were implemented following the severe flooding of 2021. Housing providers prioritised the purchase of flood-resistant homes in less vulnerable areas, ensuring better long-term safety for affected families. A call for projects was also issued by the Wallon region for the construction of 800 high-performance social housing units using EU Recovery Plan funds.

In **France** the sector is working on a coordinated national approach to climate adaptation, but largely leaving strategic planning to individual social housing providers such as **CDC Habitat** and **Vendée Habitat**, while disaster management is mostly handled by civil protection agencies.



Credits: SWL (Société Wallonne du Logement)



Credits: SWL (Société Wallonne du Logement)



RENCONTRES PROFESSIONNELLES





Niveau 2 : Calcul du score de criticité

Criticité = exposition x vulnérabilité

- Vulnérabilité calculée selon les fonctions que doit assurer un EI ;
- Score d'impact par lot technique et par aléa ;
- Pondération suite aux entretiens d'experts.

Systèmes	Sous-systèmes	Composants	Vagues de chaleur	Fortes chaleurs
Bât	Fondations	Fondations superficielles	0	0
		Fondations profondes	0	0
Clos	Facade courante	Ouverture	2	1
		Élément en porte-à-faux	1	0
		Élément en débord reposant sur le sol	0	0
		Totiture plate	1	0
Couvert	Tolture à pan(s) inclinés)	Ouverture	2	2
		Élément en saillie	0	0
		Structure porteuse	0	0
Structures intérieures	Cloisonnement	Structure porteuse	2	1
		Cloisonnement	0	0
		Contreventement	0	0
		Cave et parking souterrain	0	0





BEST PRACTICES



→ Climate adaptation strategy of Stångåstaden

SWEDEN

AB Stångåstaden, a public housing provider in Linköping (Sweden), developed a climate adaptation strategy to protect its buildings and tenants from the impacts of climate change, focusing on risks related to heavy rainfall (flooding) and high temperatures. The strategy is linked to global and national frameworks, including the Paris Agreement and Sweden's national climate adaptation strategy, and integrates environmental aspects such as stormwater management, thermal comfort, and biodiversity.

The strategy was informed by participation in Linköping Municipality's climate adaptation program and the SAMBO research project at Linköping University (2020-2024). During this project, Stångåstaden conducted an inventory of over 800 buildings to identify vulnerabilities and inspected about 200 high-risk buildings. Internal workshops were also held to evaluate findings.

Key focus areas of the strategy include:

- ➔ **Risk identification (vulnerability analyses)**
- ➔ **New property construction**
- ➔ **Renovation and reconstruction of existing properties**
- ➔ **Property management**
- ➔ **Competence development**
- ➔ **Cooperation with stakeholders**
- ➔ **Support for vulnerable tenants**
- ➔ **Communication with tenants and other interested parties**

The strategy emphasises multifunctionality, aiming to combine climate adaptation with benefits such as enhanced biodiversity, improved air quality, and attractive environments. It also outlines related processes, responsibilities, and affected departments for each focus area, with an example given for "Reconstruction and renovation."

Key performance indicators have been developed to evaluate and report progress, and the strategy will be reviewed annually by the management team. Additionally, an action plan for climate adaptation has been created to support the implementation of the strategy.



→ Framtiden Group

SWEDEN

In Gothenburg, three major housing companies — **Bostadsbolaget, Familjebostäder, and Poseidon** — collaborate through the Framtiden group, which has been tasked by the municipality to create a climate adaptation plan. In general, public housing companies follow the adaptation strategies from local and regional authorities.

→ ClimaResponse project in Gävle: a strategic cross-sectoral climate adaptation working group

SWEDEN

The municipal board of Gävle in collaboration with different municipal departments, companies and confederations, is developing a coordinated climate adaptation strategy and management plan with proposals for necessary measures in the short and long term linked to climate change, extreme weather and a growing city. The has so far delivered a climate risk assessment for Gävle, and has defined four cross-cutting themes: infrastructure (electricity, water.), transportation, buildings, and on-ground stormwater management. The initial focus is on resilience of key social functions related to buildings, particularly facilities for vulnerable groups such as elderly, ill, disabled and children as well as buildings used for crisis management. SEK 100 million (€8.5 million) will be added to the investment framework during the plan period in a first stage starting in 2025.



Credits: Council of the Baltic Sea States

→ Climate adaptation strategy of CDC Habitat

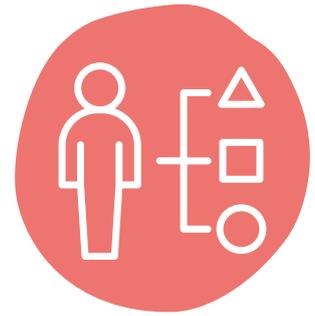
FRANCE

CDC Habitat, a social housing provider managing over 500,000 homes across France, defined their climate adaptation strategy around a comprehensive approach integrating risk assessment, mitigation, and resilience measures. Their plan aligns with the trajectory of France's National Low-Carbon Strategy (SNBC) and considers various climate hazards, including heatwaves, flooding, droughts, and rising sea levels. The strategy follows a three-step process:

- 1. Exposure assessment** – evaluates the impact of climate risks on properties using projections from the IPCC's RCP 8.5 scenario at the municipal level for 2050.
- 2. Risk assessment** – determines the vulnerability of buildings based on their function, technical features, and expert evaluations. The criticality score is derived from exposure x vulnerability.
- 3. Resilience diagnosis and recommendations** – identifies current resilience levels, proposes quantified adaptation measures, and estimates the potential resilience improvement if actions are implemented.

These assessments are fully integrated into CDC Habitat's Strategic Property Plan, ensuring that climate adaptation becomes a core part of asset management and long-term investment strategies.

Capacities



The extent to which housing providers have developed internal capacity and mobilised the necessary skills to plan and implement climate adaptation measures.

The climate adaptation capacities of public, cooperative, and social housing providers across Europe vary significantly, reflecting differences in financial resources, expertise, and institutional support. Across Europe, while some housing providers have developed expertise and tools to address climate adaptation, overall capacity remains limited, with many relying on external consultants, short-term collaborations, and emerging national and regional strategies to build resilience.

In **Spain**, while there are specialised personnel and external support in some regions, the sector's capacity for long-term climate adaptation remains limited. In Catalunya, housing providers have dedicated sustainability and RDI teams with broad skills to address climate adaptation in buildings. In Valencia, technical assistance to public housing providers is delivered through a public foundation offering expertise in building inspections and damage assessments with a focus on preventing accidents following floods, though collaboration remains short-term particularly during disaster situations. In Balears, providers generally rely on external consultancies for environmental impact assessments and passive measures.

In **Italy**, public housing providers, particularly **ACER Ravenna**, struggle with limited financial and technical capacity, relying on external experts and interregional collaboration for post-disaster recovery.

In **Finland**, housing providers count with strong municipal support. In Helsinki, the Housing Production unit of the Urban Environment Division, responsible for new buildings and extensive renovations for **Heka**, incorporates climate adaptation measures through both in-house expertise and external consultants, such as life-cycle planners., though adaptation remains one of several sustainability priorities.

In **Sweden**, the national federation **Public Housing Sweden (PHS)** facilitates training and guidelines on nature-based solutions to housing companies but lacks dedicated personnel for adaptation. Housing companies increasingly engage external consultants to conduct risk and vulnerability assessments.

In **Wallonia**, climate adaptation is emerging as part of carbon neutrality efforts, with training programs and external support from GreenWin helping social housing providers integrate resilience measures. Following the 2021 floods, a dedicated online platform (Extranet) for Public Social Housing Companies (SLSPs) was created to submit questions and access a continuously updated FAQ on housing allocation, rehousing, and insurance matters.

Germany's larger public housing providers typically have one staff member handling adaptation within a broader sustainability team, while national and regional housing associations are developing practical guidelines and funding information.

In **France**, **USH** leads adaptation efforts through multidisciplinary teams, training programs, and technical guidance from CEREMA and CSTB, focusing on biodiversity, water management, and climate resilience.



BEST PRACTICES



→ Guidelines for public housing providers on climate adaptation

SWEDEN

The guidelines developed as a joint collaboration between **IVL (Swedish Environmental Research Institute)**, **Sveriges Allmännyttta (Public Housing Sweden)** and five municipal housing companies from **Östersund, Västerås, Nykvarn, Jönköping, and Malmö**, aimed at assisting housing companies with climate adaptation. The guide provides practical steps for property owners to safeguard their buildings against extreme weather events, particularly heavy rainfall and heatwaves. The document includes checklists and flowcharts to guide users through the process, from initial assessment to the implementation of appropriate measures. It was designed to encourage the integration of climate adaptation into the regular operations of housing companies, especially benefiting smaller organisations with limited resources.

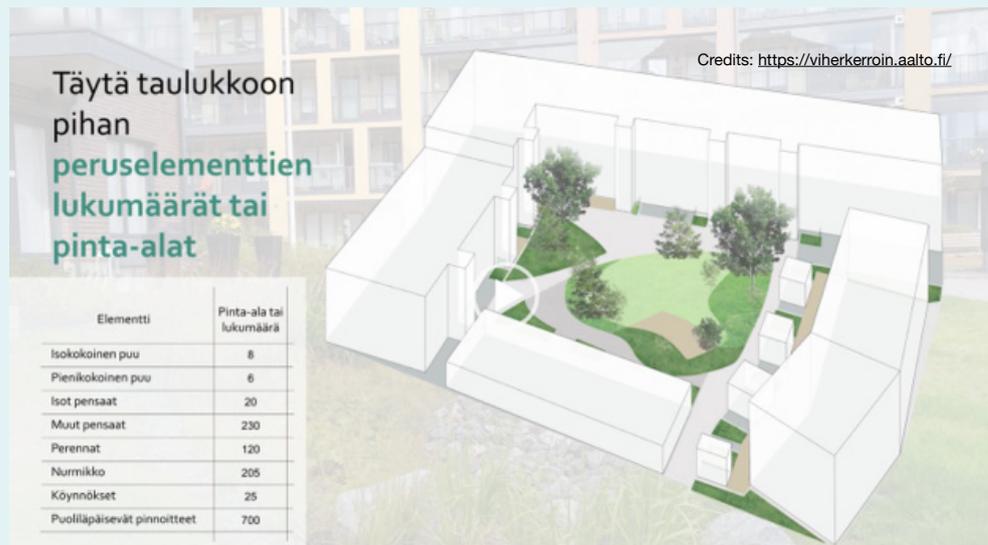


Credits: IVL (Swedish Environmental Institute) and Sveriges Allmännyttta (Public Housing Sweden)

→ Green Factor Tool

SWEDEN

The Green Factor Tool (the Viherkerroin tool) developed by Aalto University is supporting housing providers in the integration of green infrastructure in urban blocks. It assesses the “green factor” of a plot or block by evaluating the proportion of various vegetated surfaces and stormwater retention solutions relative to the total area.



The Housing Production Unit also provides design guidelines for new buildings and extensive renovations.

→ Guidelines for social housing providers on reducing flood risk in existing buildings

WALLONIA (BELGIUM)

A guide published by the Walloon government outlining measures to reduce the vulnerability of existing buildings to flooding. It provides practical advice on evaluating the flood risks to structures and recommends actions to improve safety, limit water penetration, and speed up recovery. The guide is primarily aimed at housing providers, homeowners, architects, and authorities involved in renovation or transformation projects. It highlights specific techniques for floodproofing and emphasises the importance of prevention.

‘Référentiel: Constructions et aménagements en zone inondable’ is a guide published by the Walloon region and developed by the University of Liège providing design assistance and evaluation criteria for planning, development, and construction projects in flood-prone areas.

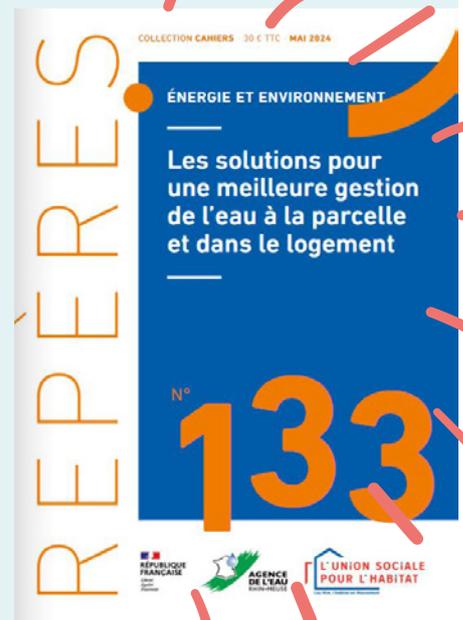


Credits: Le site officiel de l'environnement en Wallonie: <https://environnement.wallonie.be/home/gestion-environnementale/risques-climatiques/inondations/directive-inondation/plans-de-gestion-des-risques-dinondation.html>

→ Collection des cahiers de l'USH – knowledge and expertise on climate adaptation for social housing providers

FRANCE

- ➔ **Résilience urbaine du parc social:** prise en compte des aléas climatiques: a guide showing how social housing can adapt to climate change, covering various climate risks such as storms, heatwaves, and flooding. The guide provides practical tools for housing providers to integrate resilience strategies at all stages of building development, including a legal framework for climate adaptation.
- ➔ **Stratégie du secteur Hlm face au changement climatique – Etat des lieux des ressources pour faciliter la définition des stratégies territorialisées:** a guide established at the national level to document the main issues related to climate change and provide a summary of the associated public policy objectives, available funding, and methodological tools accessible to social housing organisations. The guide addresses the topics of climate change mitigation and adaptation, circular economy, water management, and biodiversity. This guide is accompanied by specific versions for each of the 12 metropolitan French regions, within which social housing organisations can consult maps showing exposure levels to major climate hazards.
- ➔ **La Nature Retrouvée - Biodiversité et Hlm:** a book showcasing the engagement of the French social housing sector in reconnecting residents with nature and preserving biodiversity. It features seven thematic chapters covering topics like nature, social cohesion, health, water management, architecture, and landscape. The book includes practical examples of biodiversity projects in social housing.
- ➔ **Les solutions pour une meilleure gestion de l'eau à la parcelle et dans le logement:** a guide offering solutions for better water management in social housing projects, focusing on rainwater management, greywater reuse, flood risk management, and sustainable landscaping. It showcases 16 case studies of successful projects across different regions of France and overseas, providing insights on integrated water management practices.



Credits: USH

→ Guidelines to improve the resilience of buildings against floods and the UHI effect

SPAIN

Instituto Valenciano de la Edificación (IVE) developed Guide to Strengthen Building Resilience Against Floods offering strategies and best practices to enhance the resilience of buildings against flooding events. It was designed to assist architects, engineers, builders, and property owners in implementing effective measures to mitigate flood risks and improve building safety.

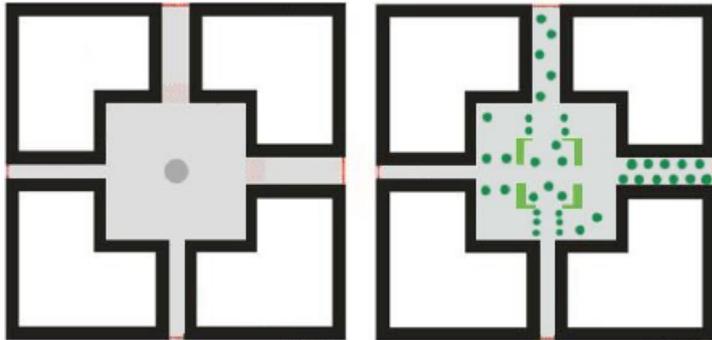


Figura 25. Distribución del espacio a evaluar. (Bruce, 2007).

El parámetro que determina el confort térmico en este estudio es la temperatura media de la piel del usuario. Como se observa en la *Figura 27* la amplitud de las calles es determinante en este parámetro, ya que las calles más anchas tienen mayor superficie expuesta al soleamiento, por lo que la carga térmica de los peatones es mayor, independientemente de la existencia de vegetación (Bruce, 2007).

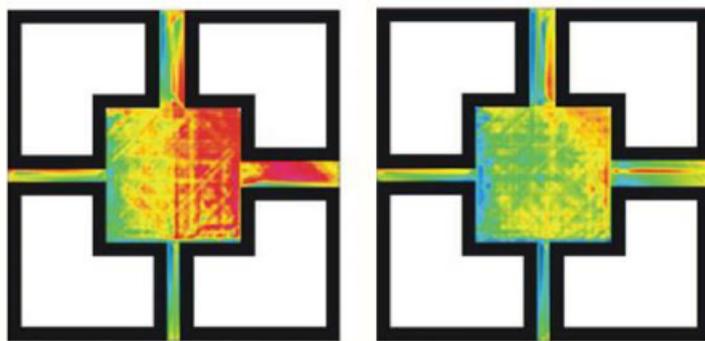


Figura 26. Temperatura media de la piel del usuario. (Bruce, 2007).

La disposición de **vegetación** ayuda a mejorar la percepción del espacio en su conjunto. La influencia de la vegetación en la percepción de un espacio no se limita a los espacios afectados por su sombra.

Credits: Instituto Valenciano de la Edificación: IVE

The guide Urban Design Guide in Mediterranean Areas to Mitigate the Heat Island Effect serves as a tool to assist in the planning and design of urban public spaces in Mediterranean climates.

Data



How the sector is harnessing data internally to inform its strategy, and support the development of appropriate climate adaptation measures.

Data availability on climate adaptation in the public, cooperative, and social housing sector across Europe remains fragmented and scarce. Overall, while some regions are making strides in mapping risk areas, most public, cooperative and social housing providers still face challenges in structuring, integrating, and utilising this information effectively.

In **Spain**, efforts differ by region although, in general, there is limited data collected in the sector, focusing mainly on energy consumption and temperature changes linked to façade upgrades. Catalunya relies on Energy Performance Certificates but seeks to integrate flood risk data, Valencia has developed automated post-disaster damage assessment systems, and Baleares has begun monitoring passive building measures in a limited number of new constructions. In **Italy**, the Ravenna province collects climate hazard data primarily through government records and insurance claims, focusing on flood impacts and financial losses.

Finland lacks regular monitoring systems, while **Sweden** has extensive climate data available from institutional

sources that remains difficult for public housing providers to use due to its complexity and fragmentation.

In **Wallonia**, systematic data collection in social housing is under development with the support of the Wallon region. Geo-spatial data mapping flood and concentrated run-off risk areas is publicly accessible via the WalOnMap portal. Social housing providers make use of this data for the potential acquisition of land.

Germany has no available data, and **France** currently lacks information on social housing exposure to climate risks, though initiatives like the PrioRéno project and Météo France aim to improve future assessments.



Credits: <https://geoportail.wallonie.be/walonmap#VIEWER=WOM#BBOX=-57702.80254262063,339834.4508652196,14924.989745334693,175328.95638660132#SHARE=05382F7C9252510DE063D5AFA49D81EA>



BEST PRACTICES



→ WalOnMap portal

WALLONIA (BELGIUM)

In Wallonia, systematic data collection in social housing is under development with the support of the [Walloon region](#). Geo-spatial data mapping flood and concentrated run-off risk areas is publicly accessible via the [WalOnMap portal](#). Social housing providers make use of this data for the potential acquisition of land.

→ Automated systems to assess property damage and economic costs after disasters

SPAIN

In Valencia, [Instituto Valenciano de la Edificación \(IVE\)](#) provides a comprehensive set of resources to assist public administrations, housing providers, technical professionals, and the general public in addressing buildings affected by floods, such as the recent torrential rains (DANA) in Valencia. These resources include inspection protocols, reconstruction guidelines, and tools to enhance building resilience against future flooding events. The [automated systems to assess property damage and economic costs after disasters](#), enabling data-driven prevention strategies.

The image shows a tablet displaying a digital inspection form titled 'TABLA DE INSPECCIÓN POR CATÁSTROFES - TIC v3.0'. The form is organized into several columns and sections:

- Header:** Includes logos for 'S+EM', 'GENERALITAT VALENCIANA', and 'IVE Instituto Valenciano de la Edificación'. It also contains fields for 'Control de registro', 'Nº exp. IVE', 'Nº exp. Gestor', 'EMPRESA', and 'ABSCOJE'.
- TIC IDENTIFICACIÓN Y ACTUACIONES:**
 - ACCESO AL EDIFICIO:** Contains checkboxes for 'NO PERMITIDO', 'RESTRINGIDO', and 'PERMITIDO', with sub-options for 'Total' and 'Parcial'.
 - MEDIDAS PREVENTIVAS:** Lists various measures like 'ACORDAR', 'DEFINIR EL SUMINISTRO', 'APERTURAS', 'RENDERIA', 'REDES DE SEGURIDAD', and 'DESEMBOLSO DE DEFIKALOS', each with 'Puntuación' and 'Subir el edificio' options.
- PERSONAL INSPECTOR:** A table for recording inspector details such as 'Nombre', 'Categoría', 'DNI', 'Dirección', and 'Municipio'.
- TIPO DE CATÁSTROFE:** Includes checkboxes for 'Bomba', 'Inundación', 'Fuego', and 'Otro', along with a 'Tipo de catástrofe "Otro"' field.
- IDENTIFICACIÓN DEL EDIFICIO INSPECCIONADO:** A table for building identification including 'Dirección', 'Municipio', 'Referencia catastral de parcela', and 'Características del edificio'.
- ALTIMURA ALCANZADA POR EL AGUA:** A table for recording water levels at different points.
- OBSERVACIONES GENERALES:** A text area for general observations.

Credits: Instituto Valenciano de la Edificación: IVE



→ A free and sustainable tool to support the development of asset decarbonisation and climate change adaptation strategies

FRANCE

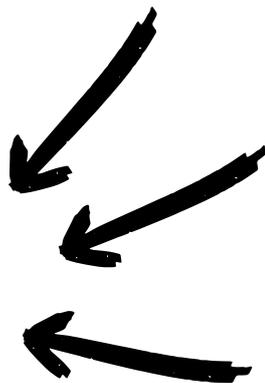
PrioRéno Logement Social is a [free data platform](#) developed by *Banque des Territoires* with the French State, [l'Union Sociale pour l'Habitat](#), [ENEDIS](#) and [GRDF](#). It supports social housing providers in planning renovation and adaptation by combining **building-level and portfolio-wide data** on:

- ➔ **Energy performance:** EPCs and actual energy consumption.
- ➔ **Renovation scenarios:** work packages with estimated energy, carbon and cost savings
- ➔ **Climate risk and adaptation:** hazard exposure mapping (scores 1–5), climate projections for 2030, 2050 and 2100, and indicators on flooding, extreme weather, drought, wildfires, soil risks and summer overheating.



Credits: Heliio

Policy



Supporting policies at local, regional or national level stimulating the adoption of climate adaptation measures.

The climate adaptation policy framework affecting the public, cooperative, and social housing sector in Europe varies significantly across countries, while some are already implementing structured policies, others still lack comprehensive strategies, with local and regional initiatives shaping the sector's resilience. The EU Green Taxonomy and the requirement for climate adaptation assessments in social housing are driving further integration of adaptation measures.

In **Spain**, public housing providers in Catalunya align with national and regional climate policies like Estratègia Catalana d'Adaptació al Canvi Climàtic 2021-2030 and the Climate Change Law (Llei 16/2017 del canvi climàtic). They often integrate ambitious objectives into their project planning, often going beyond urban planning policies, and exploring innovations like shared greywater grids. In Valencia providers follow regional design and quality standards for housing and adhere to national fire protection regulations. The Balearic Islands enforce climate adaptation through their Climate Change Law (Llei 10/2019 de canvi climàtic i transició energètica) which includes specific measures for public buildings. Bilbao has regulatory provisions for rehousing households affected by climate disasters in the public housing stock.

In **Italy**, public housing providers are advocating for policies to relocate buildings from high-risk areas, as local authorities currently lack structured adaptation strategies.

Finland's approach is largely shaped by Helsinki's Carbon Neutral Helsinki 2030 plan, the Lifecycle Management Model, and the Green Roof Policy, which mandates green roofs on public buildings when feasible.

Sweden operates a multi-level governance system, with national strategies and action plans like the Swedish

Expert Council on Climate Adaptation and the National strategy and the government's action plan for climate adaptation. Recommendations, such as maintaining indoor temperatures below 26°C to protect vulnerable populations, underline the health impacts of climate change. However, implementation challenges arise due to the need for collaboration among property owners. Some municipalities offer financial incentives for sustainable water management, while initiatives like Gävle's ClimaResponse initiative have allocated a 100 million SEK (9 million EUR) budget to address flooding risks and protect critical community services. However, this funding is specific to the municipality and does not extend to general housing adaptation.

Wallonia's policy framework on climate adaptation is developing. Legal requirements under the PEB (Performance Énergétique Bâtiment) certificates mandate measures to prevent overheating during renovations, and recent regulations included in the 'Programme de Construction à Haute Performance Énergétique (HPE) prohibit construction in flood-prone areas. Local authorities also require the use of permeable pavements and surfaces to enhance climate resilience. After the 2021 floods, major changes in the Code du développement territorial, or Territorial Development



Code (CoDT) allowed for a more flexible and adaptive urban planning framework, ensuring faster recovery while prioritizing long-term flood resilience. These included for example, urban planning exemptions for rebuilding after a recognised natural disaster or new land-use regulations aimed to avoid high-risk flood zones for future developments. A regional flood control strategy ([PGRI 2022-2027 - Inondations en Wallonie | Inondations en Wallonie](#)) was also adopted for municipalities and social housing providers to follow.

Germany's 2023 Climate Adaptation Law (Bundes-Klimaanpassungsgesetz (KAnG) requires municipalities to develop adaptation plans by 2026-2027. These plans will assist housing providers in assessing the exposure levels of their building stock and guide decision-making for integrating climate adaptation measures. A national climate adaptation strategy will be established once the states report back to the federal government by the end of 2025. Some cities like Mannheim are already implementing their [climate adaptation concept](#).

France is advancing its climate adaptation policies through the upcoming [TRACC \(Trajectoire de Référence d'Adaptation au Changement Climatique\)](#) and the [PNAC \(Plan National d'Adaptation au Changement Climatique\)](#), which are set to be finalised by mid-2025. There is also a [national resource centre for climate adaptation](#), offering tools, methodologies, and case studies for stakeholders, particularly local authorities, to develop and implement climate adaptation strategies. Cities like Paris focus on flood risks and thermal comfort. In response to a historic water shortage in the Var department, the nine municipalities of the Pays de Fayence have decided to halt all new building permit applications for four years. This measure aims to address the region's limited water resources, as rivers have been dry for months and groundwater levels are critically low. The current population is already straining the available water supply, prompting this construction freeze to prevent further depletion⁶⁰.

⁶⁰ <https://france3-regions.francetvinfo.fr/provence-alpes-cote-d-azur/var/draguignan/aucun-nouveau-permis-de-construire-durant-quatre-ans-la-mesure-choc-du-pays-de-fayence-confronte-au-manque-d-eau-2721706.html>



BEST PRACTICES



→ Public housing allocation to residents affected by climate disasters

SPAIN

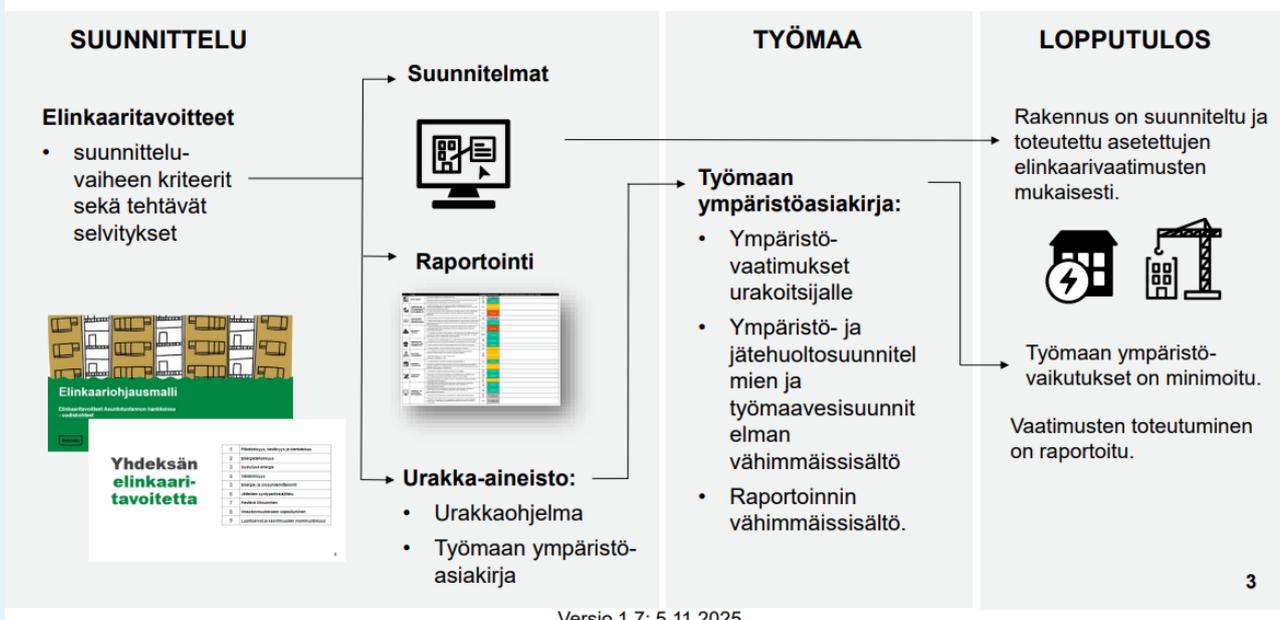
In Bilbao, public housing may be used to provide accommodation for households affected by climate-related disasters, such as fires or floods, under the regulations of the *Sistema de Valoración de Situaciones de Carencia Sobrevenida de Vivienda*. This system governs the allocation of housing in response to unforeseen and exceptional circumstances that necessitate immediate intervention.

→ The Lifecycle Management Model

FINLAND

The *Lifecycle Management Model* (Elinkaariohjausmalli), a framework used by the City of Helsinki to manage the lifecycle of public buildings and infrastructure, focuses on ensuring that buildings are designed, built, maintained, and operated in a sustainable and cost-effective way over their entire lifespan. The model incorporates climate adaptation as a key target, focusing on managing stormwater run-off through natural treatment methods.

Elinkaariohjaus rakennushankkeessa



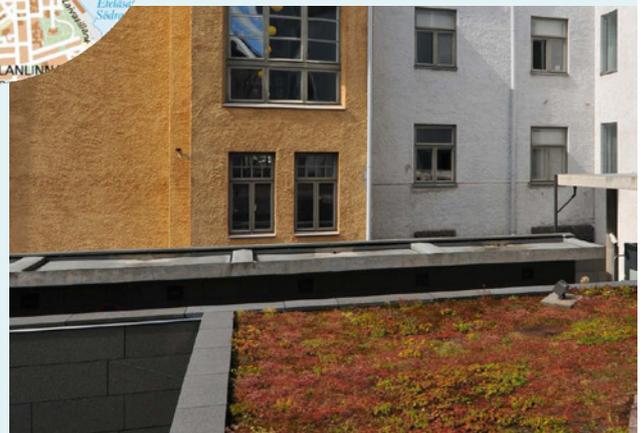


Credits: City of Helsinki: https://www.hel.fi/static/liitteet-2019/Kymp/Att/Elinkaariohjausmalli_uudistuotanto.pdf

→ The Helsinki Green Roof Policy

FINLAND

The Helsinki Green Roof Policy mandates that cold roofs on public buildings should primarily be green roofs when feasible. According to the policy, public buildings and housing developed by the city or its subsidiaries, including public housing companies, are required to incorporate green roofs when constructing new buildings or renovating existing ones. There may be some flexibility in its implementation depending on specific site conditions and the type of building.



Credits: City of Helsinki: https://www.hel.fi/static/hkr/tuote_palvelulinjaukset/viherkattolinjaus/KH_Helsingin_kaupungin_viherkattolinjaus.pdf

→ A Tariff (Water and Sewerage Fee)

SWEDEN

Different municipalities in Sweden **manage water and sewerage fees (VA tariff) for property owners**, particularly regarding **stormwater management**. These tariffs encourage property owners to implement sustainable drainage solutions, such as: **permeable surfaces** (e.g., gravel, green roofs); rain gardens and infiltration zones to absorb water on-site; and disconnection of downspouts to reduce load on the drainage system.

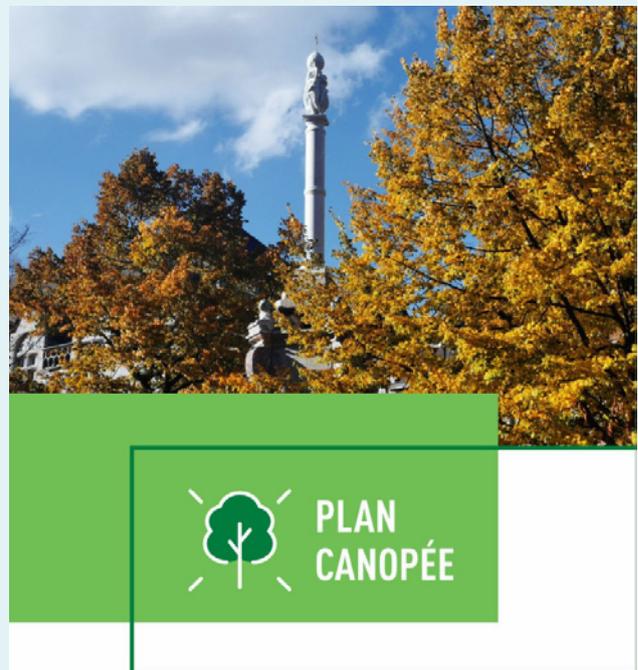
In the **Jönköping Municipality**, the fee is based on the proportion of the property covered by impermeable surfaces (e.g., asphalt, concrete). A larger **impermeable surface area results in a higher fee** because it contributes more runoff to the drainage system. If the property owner can **demonstrate that stormwater is managed on-site** without negatively affecting other properties, the stormwater fee can be **waived entirely**.

In **Västerås Municipality**, property owners can receive a **discount** on the stormwater fee based on: **the number of disconnected downspouts** from the municipal drainage system; **the percentage of impermeable surface** within the property; and **whether drainage is connected** to the municipal system.

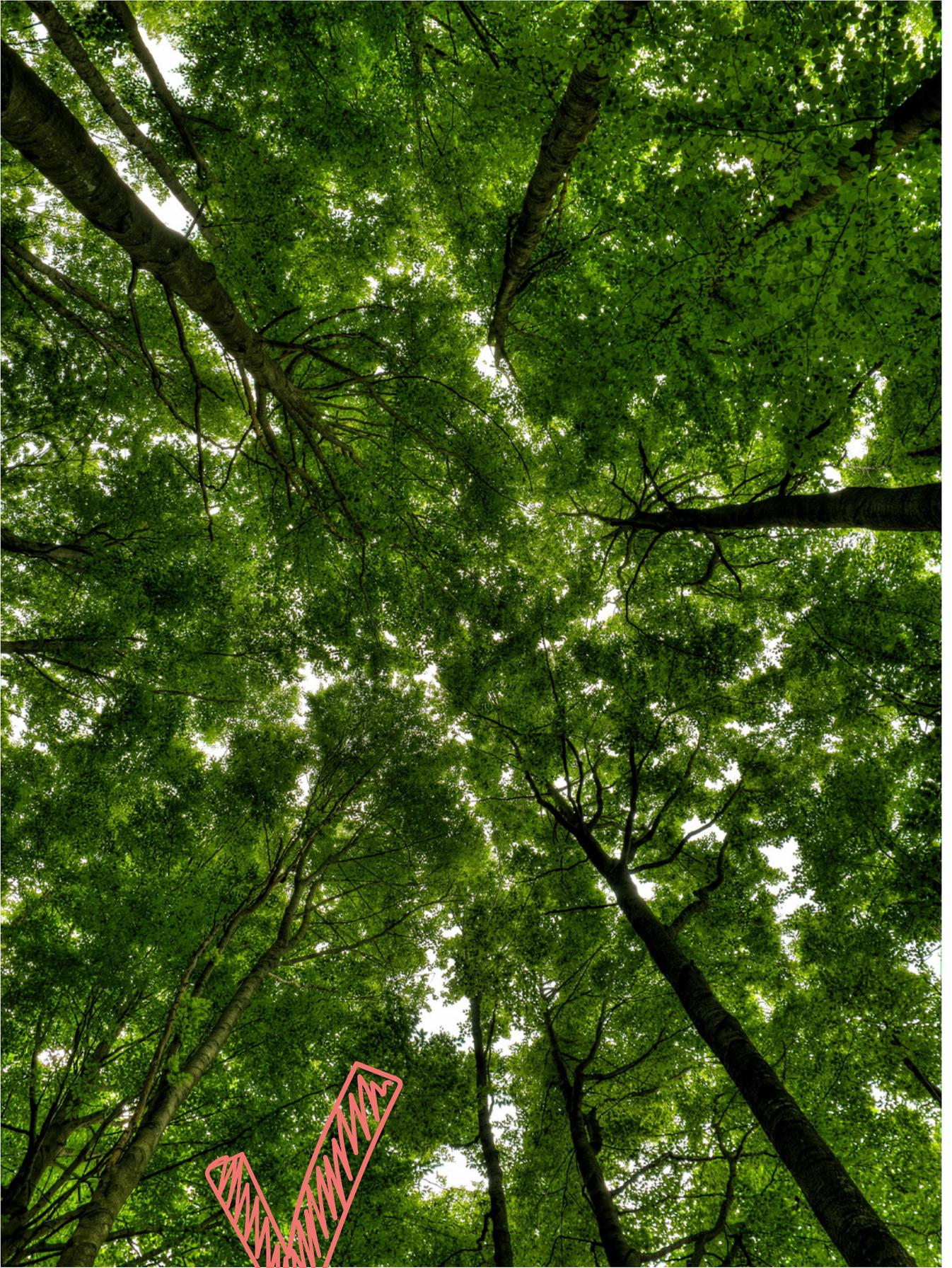
→ Plan Canopée de Liège

WALLONIA (BELGIUM)

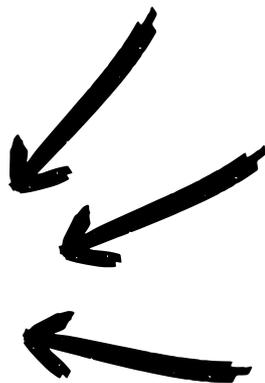
Plan Canopée is an initiative launched by the **City of Liège** in 2020 to enhance urban tree coverage as a strategy to adapt to global climate change. The plan aims to plant over 24,000 trees by 2032, with 8,000 in public spaces and 16,000 on private properties, to make Liège a greener, more resilient, and healthier city by 2050. To support these objectives, the City of Liège has organised participatory workshops, a ‘Tree Week’, a network of volunteers who serve as neighbourhood ambassadors “Passeurs d’Arbres” Program and a dedicated website. As of recent reports, the Plan Canopée has achieved 26% of its goal, with 6,276 trees planted. The city continues to encourage community participation to reach the target of 24,000 trees by 2032.



Credits: <https://canopee.liege.be/>



Investment



Level of financial resources (internal or external) the sector has committed to supporting climate adaptation measures.

Investment in climate adaptation for public, cooperative, and social housing across Europe remains insufficient, with most funding mechanisms prioritising energy efficiency over direct adaptation efforts, limited national strategies and reliance on ad hoc local initiatives and emergency funds.

In **Spain**, public housing providers largely rely on their own resources and EU funding to fit climate adaptation measures as part of energy retrofitting programs. The Balearic Islands benefiting from the Sustainable Tourism Tax, which finances climate-proof renovations in public housing. **Italy** faces severe funding shortages, with public housing providers struggling to finance adaptation measures. While emergency funds were allocated after the May 2023 Emilia-Romagna floods, these were insufficient, covering only 30% of damages in Ravenna.

Finland's public housing sector lacks dedicated climate adaptation funds, though ARA (Housing Finance and Development Centre of Finland) and Kuntarahoitus (Municipality Finance Plc) plan to revise financing criteria to align with EU Taxonomy by 2025. **Sweden** also faces a lack of economic support, as public housing companies are ineligible for subsidies. While some municipalities, such as Gävle, allocate funds for flood resilience projects, these remain local initiatives rather than national policies.

In **Wallonia**, adaptation investments in social housing are limited and often seen as competing with decarbonisation goals. After the 2021 floods, the Walloon Government granted €15 million in direct aid to those social housing providers most affected by the floods. Additionally, a €40 million credit line was made available for housing restoration efforts, allowing housing providers to start repairs without waiting for insurance reimbursements. However, systematic adaptation financing is not in place, with most funds coming from EU loans.

Germany's investments in public housing primarily focus on mitigation, though adaptation funding is growing, particularly for green roofs. A €100 million federal program for 2024-2026 includes adaptation measures, but private cooperatives struggle to access these resources. In **France**, no dedicated public funding exists for adaptation in social housing, and the estimated €300 billion investment gap for climate neutrality poses a major financial barrier.



Credits: <https://illessostenibles.travel/en>



BEST PRACTICES



→ Federal KfW funding programme 2024-2026

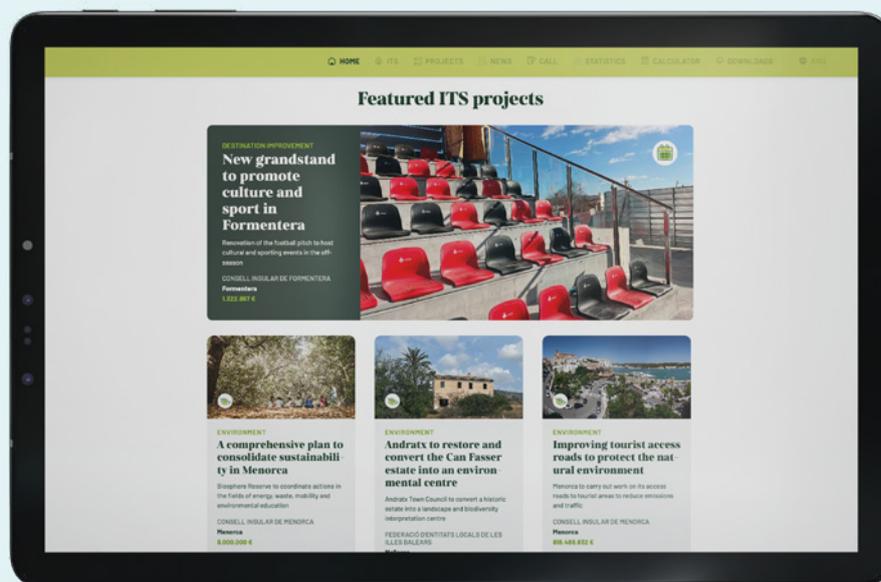
GERMANY

The Federal Funding Programme 444 (2024) by KfW (Kreditanstalt für Wiederaufbau) focuses on supporting municipalities in integrating climate adaptation measures. The programme includes financial support for switching to natural green space management, planting trees, and creating natural oases. It provides €30 million for municipalities in 2024, with a larger allocation of €100 million available in 2025-2026. The funding covers up to 80% of project costs and has been positively received by public housing providers, particularly for integrating trees into their housing stocks.

→ Sustainable Tourism Tax

SPAIN

Since 2016 the Balear government put in place the Sustainable Tourism Tax applying to all tourist accommodation in the Balearic Islands. Thanks to this contribution, important investments have been made to compensate for the impact that tourism has on the environment and the housing sector in the islands. Tax revenues can be used to finance a wide range of climate-proof renovation in the public housing stock such as passive building design.



Credits: <https://illesostenibles.travel/en>

7.

CONCLUSIONS

- ➔ **The climate risks of the public, cooperative, and social housing sector are high.** The sector has been severely impacted already by heavy rainfall and flooding episodes across different European regions and reduced summer comfort caused by recurrent heat waves is a growing concern for housing providers from southern, western as well as nordic countries.
- ➔ **The sector is highly vulnerable to the impacts of climate change** due to the socio-economic profile of occupants (i.e. lower-income, elderly, people with reduced mobility or health conditions), as well as the still predominantly old building stock lacking climate-proof measures, despite the growing renovation efforts devoted. Universal housing allocation systems like those in Northern Europe that allow for a diversity of income groups to access public and social housing show lower levels of climate vulnerability.
- ➔ **The sector's building stock shows moderate to high levels of exposure** to different climate hazards, particularly in southern and western Europe. It is predominant in densely-populated urban areas, often near water bodies, exposing public, cooperative, and social housing buildings and their occupants to floods and the UHI effect.
- ➔ **The integration of climate adaptation measures in the public, cooperative, and social housing sector across Europe is progressing unevenly.** Climate mitigation efforts focused on energy efficiency remain the dominant priority, but adaptation projects are gradually gaining traction. While green roofs, water management systems, and passive cooling techniques are being tested by some front-runners, concerns about long-term maintenance and high upfront costs impede widespread adoption.
- ➔ **Most housing federations and providers lack comprehensive long-term climate adaptation strategies,** with adaptation efforts often driven by municipal policies. Some providers directly affected by climate



disasters have put in place short-term reactive measures rather than comprehensive, forward-looking solutions. Collaboration between local/regional authorities and housing providers on climate adaptation is not widespread.

- ➔ **The internal capacities of the sector on climate adaptation requires more support**, often with heavy reliance on external consultants, short-term collaborations, or regional support programmes for capacity-building. However, housing federations are making good progress in developing guidelines to inspire and support providers in adapting their stock to climate change.
- ➔ **The sector has significant data gaps in monitoring climate adaptation progress.** While open geo-spatial data is available in some countries mapping climate risks, this is often not accessible enough for housing providers and there is a lack of cross-matching with public, social or cooperative housing stock. This may hinder informed decision-making and the development of effective adaptation strategies in the sector.
- ➔ **While some national governments have already started developing climate adaptation policies, others lack comprehensive frameworks, relying on local initiatives.** In countries where a good collaboration exists between housing providers and local authorities, the integration of climate adaptation strategies, policies and standards in the sector is more consistent.
- ➔ **Investment in climate adaptation is inadequate for the public, cooperative, and social housing sector in Europe**, with most funding mechanisms prioritising energy efficiency over resilience measures. Most climate adaptation measures are financed with housing providers' own resources, often resulting in costly projects. Emergency funds and insurance protection, while available, often fail to cover the full scope of climate damages.

Different housing systems in Europe translate into different climate adaptation readiness in the public, cooperative, and social housing sector.



→ SOUTHERN EUROPE

Southern Europe (Spain, Italy) faces mounting climate risks, including heatwaves, water scarcity, and flooding. While both countries have developed strong passive cooling strategies and disaster management protocols in response to recent climate disasters, their public housing sectors generally lag in broader adaptation strategies and investments, partly due to financial and technical capacity constraints and lower insurance coverage. Spain shows promising regional initiatives, such as greywater systems in Catalunya and automated damage assessments in Valencia, but broader implementation remains limited. Similarly, Italy's experience in disaster response, particularly in flood-prone regions like Emilia-Romagna, is notable, yet widespread adaptation efforts are still hampered by resource limitations.

→ NORTHERN EUROPE

In **Northern Europe (Sweden, Finland)**, adaptation strategies tend to be more structured, driven by strong collaboration between local authorities and public housing providers. Nature-based solutions such as green roofs, stormwater management, and geothermal cooling are increasingly integrated into housing projects. In Sweden, public housing providers demonstrate high climate risk awareness and have developed strong capacities with substantial support from the national housing federation, while Finland, although primarily focused on energy efficiency, is seeing local authorities like Helsinki implement policies and design guidelines to extend building lifespans and prevent overheating. Universal housing allocation systems in both countries help ensure a diversity of income groups can access public and social housing, reducing climate vulnerability levels, and greater insurance coverage further supports resilience efforts.

→ WESTERN EUROPE

In **Western Europe (Germany, France, Belgium)** progress on climate adaptation in housing is moderate. Germany has established favourable regulatory and funding conditions at the national level to help housing providers integrate adaptation measures, although the climate risk profile of the existing building stock remains largely unknown. In France, adaptation measures are mostly driven by a few frontrunners, with a coordinated long-term national strategy for the sector still under development. Belgium, especially Wallonia, has implemented post-disaster policies following severe flooding, but systemic adaptation financing remains a challenge. Across these countries, housing federations play a key role in supporting providers with capacity building efforts.

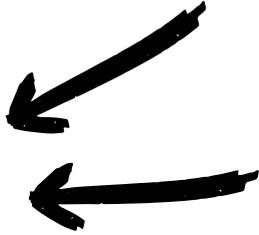
RECOMMENDATIONS⁶²

A set of recommendations to enhance the resilience of public, cooperative, and social housing across Europe:

- ➔ **Allocate new EU funds specifically for climate resilience and adaptation in public, cooperative, and social housing**, and ensure that any EU-level adaptation targets are matched by clear obligations for Member States to invest in resilience measures in the sector.
- ➔ **Reduce administrative damage reporting requirements and actively support the development of affordable, reliable insurance solutions for public, cooperative and social housing.** It should provide financial backing to Member States to help cover rising insurance costs and facilitate the creation of collective or public insurance schemes tailored to affordable housing providers, ensuring the long-term financial resilience and insurability of the sector.
- ➔ **Establish clear regulatory frameworks at national level, but accompany them with technical assistance, financial incentives and targeted funding for public, cooperative and social housing providers.** Strengthen in-house expertise through training, peer learning and technical support, to effectively enable housing providers to design, implement and monitor adaptation strategies effectively.
- ➔ **Adopt collaborative governance approaches to climate resilience and adaptation at national level ensuring public, cooperative and social housing federations are involved** and receive clear regulatory frameworks from Member States. They must be accompanied by technical support, financial incentives and/or funding for adaptation action.
- ➔ **Promote and support local partnership frameworks between regional and municipal authorities and public, cooperative and social housing providers** to ensure coordinated planning, financing and implementation of climate-resilient housing solutions.
- ➔ **Improve access to interoperable climate risk data tailored to public, cooperative and social housing by enabling cross-matching of heat, flood and other hazard data with housing stock information.** Authorities should support housing providers regularly with updated exposure maps and establish standardised indicators to monitor adaptation progress, ensuring that investment is directed to areas where climate risks and social vulnerability intersect.
- ➔ **Standardise climate risk assessments and integrate them** into EU renovation and cohesion programmes to make them interoperable across the built environment and help housing providers in identifying risks and adopting adaptation strategies and measures.
- ➔ **Create stronger links between energy efficiency requirements and climate adaptation measures.** Revise EU legislation to prevent requirements that risk triggering maladaptive outcomes. **Strengthen guidance and standards on overheating prevention and indoor thermal comfort in housing**, promoting passive-first solutions to avoid energy poverty linked to increased cooling demand.
- ➔ **Support and invest in nature-based and public health solutions in the public, cooperative and social housing sector** by supporting the large-scale deployment of nature-based solutions in neighbourhoods (e.g. shading, green roofs, urban trees, sustainable drainage systems); support the designation or repurposing of buildings as climate shelters for vulnerable resident; and promote clear protocols and awareness-raising campaigns for housing providers to help residents prepare for heatwaves and floods, especially vulnerable groups.

⁶² As explained above, since this briefing does not cover natural disasters such as seismic activity or tsunamis, the recommendations do not mention emergency response mechanisms nor contingency plans by housing providers (even in the case of floods for instance).

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Housing Europe is the European Federation of Public, Cooperative and Social Housing

Established in 1988, it is a network of 46 national and regional federations which together gather about 43,000 public, social and cooperative housing providers in 25 countries. Altogether they manage over 25 million homes, about 11% of existing dwellings in the EU.

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