

# Best practices guidelines for climate change adaptation of the vulnerable sector Infrastructure/construction/ urban planning

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## Best practices guidelines for climate change adaptation of the vulnerable sector Infrastructure/construction/ urban planning

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**ABBREVIATIONS**

MMAP	Ministry of Environment, Water and Forests
APM SB	Environmental Protection Agency Sibiu
KS	The Norwegian Association of Local and Regional Authorities
ULBS	Lucian Blaga University Sibiu
ANM	NATIONAL METEOROLOGICAL ADMINISTRATION

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## Introduction

This document was produced within the "Calea Verde spre Dezvoltare Durabilă – Greenway to Sustainable Development", financed by funds provided by Iceland, Liechtenstein and Norway through the European Economic Area Financial Mechanism 2009-2014 EEA, on the RO07 adaptation to climate change. The project promoter is the Environmental Protection Agency Sibiu and the following partners: the Norwegian Association of Local and Regional Authorities - KS, National Meteorological Administration, Municipality of Sibiu, Brasov City Hall, Tg. Mures City Hall and "Lucian Blaga" University of Sibiu. The project was carried out between January 2015 and October 2016. The overall objective of the project is to reduce human and ecosystem vulnerability to climate change and aims to develop a set of best practices on adaptation to climate change.

In this project, among other activities, there were created the Strategies and action plans on the adaptation to climate change in three municipalities in Romania: Sibiu, Brasov and Tg. Mures. Also, there were selected four important sectors of priority interest: transport, energy, infrastructure / construction / urban planning and ecosystems. The sectors were selected based on the Local Action Plans and Development Strategies in every county and are considered to have the greatest impact on people's lives, given that people use ways and means of transport, depend on energy and ecosystem and live in buildings. This document is part of a series of guidelines documents created during the the project:

- Guidelines for the preparation of municipal development strategies for climate change adaptation
- Best practices guidelines on adaptation to climate change in the vulnerable sector Energy
- Best practices guidelines on adaptation to climate change in the vulnerable sector Transport
- Best practices guidelines on adaptation to climate change in the vulnerable sector infrastructure / construction / urban planning
- Best practices guidelines on adaptation to climate change in the vulnerable sector Ecosystems

The guide aims to present some methodological aspects, but mainly examples of best practices in the Infrastructure / construction / urban planning sector, referring to already drafted documents: the Strategies and Plans of Action on adaptation to climate change in the three municipalities and the guidelines for the preparation of developing strategies for climate change adaptation. This document is designed primarily for local governments, but also for other relevant actors in the Infrastructure / construction / urban planning sector at local or national level, including citizens.

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## 1. Summary of the methodology proposed in the guidelines

The methodology proposed in the guidelines closely follows the methodology proposed in the general guidelines for the preparation of municipal development strategies on adaptation to climate change, and it provides, in addition to common elements, specific tools for the Infrastructure / construction / urban planning sector.

The same as in the general guidelines, there are three main phases in developing a strategy for adaptation to climate change in the Infrastructure / construction / urban planning sector:

- ✓ **The initiation stage** or preparing the ground for drafting the document, which is designed for building the team that will manage the process, identifying the stakeholders and activity planning
- ✓ **The strategy and action plan drafting stage** aimed at analyzing the main risks and vulnerabilities in the Infrastructure / construction / urban planning sector, setting goals and measures in this sector, defining, evaluating and selecting alternatives and making the Action Plan for the Infrastructure / construction / urban planning sector
- ✓ **The implementation stage** aimed at establishing the implementation and communication mechanism, as well as identifying the monitoring and evaluation indicators and the framework in which these activities will take place

## 2. Details of the process stages

### 2.1 Initiation

As mentioned above, this first phase is dedicated to creating the necessary framework for developing and implementing the strategy and action plan on adaptation to climate change in the vulnerable sector Infrastructure / construction / urban planning.

In the case of this vulnerable sector, the initiator may be the local public administration that can ensure the coordination and integration of knowledge and interests of the various actors in the Infrastructure / construction / urban planning sector, and the involvement of all stakeholders at the local level. Therefore, at the administration level, a coordination team can be formed by people with competences and skills in the planning field (executive coordinator), the climate change and Infrastructure / construction / urban planning (sector experts), the financial and legal fields (support experts). If the locality already has strategies that target the Infrastructure / construction / urban planning sector (eg. integrated urban development strategy, socio-economic strategy, general urban planning etc.), we recommend the involvement of the same people. The departments / services / offices that may give the coordination team

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members are: strategy / development programs / European funds, urban planning / land use / land register, chief architect, asset management / public domain administration, park /green areas / greenhouse landscaping office, technical / public utilities/ transport, environmental protection, economic, legal.

The development of a strategy for adaptation to climate change in the Infrastructure / construction / urban planning sector, should involve, as partners, the representatives of relevant stakeholders (see proposal of partnership structures in the general Guidelines). The working group and the local advisory committee may include: Metropolitan Area IDA (if any), the local environmental protection agency, construction representatives, urban utilities operators, General Inspectorate for Emergency Situations, water management system, forest management authority, local police, representatives of local industry, urban planning and environmental NGOs, property owners associations, research and educational institutions, as well as financial and credit institutions. The advisory committee can extend the list of stakeholders with actors from higher territorial levels such as: Ministry of Environment, Water and Forests, the National Agency of Meteorology, Ministry of Energy, ANRE, Ministry of Education and Scientific Research, MFE, MDRAP, National Water Management Authority, Romanian Order of Architects, the Romanian urban planners association, the Regional Development Agency, County Council, Prefect's Office, as well as the general public.

Once identified the stakeholders and the establishment of partnership structures, the activities of the drafting process will be mutually agreed, mentioning also the officers, deadlines and deliverables, using the Gantt chart tool.

## 2.2 Development stage

### 2.2.1 Analysis of the existing situation in the Infrastructure / constructions / urban planning sector

The first step in this phase presents the existing situation in the Infrastructure / construction / urban planning sector, as well as the weather events that have affected the sector.

Examples of indicators that can be collected and analyzed at this stage, and the sources of information

Indicators	Information sources
- Structure of urban land use (zoning)	- Tempo Online database, INS
- Urban planning and construction regulations in force	- Territorial development balance, GUP
- Construction pace for housing and buildings with other destinations	- Green area register
- Current transport, energy, urban technical-utilities infrastructure	- Water management system
- Number of buildings exposed to natural hazards	- Integrated Urban Development Strategy
- Risk assessment and insurance plans	
- Risk management capacity	

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Once collected and analyzed the data on the Infrastructure / construction / urban planning sector, we can draw conclusions on how this sector is or may be affected by climate change in the future, thus identifying the main challenges and assessing the risks and vulnerabilities of the sector.

For example, the Romanian National Strategy on Climate Change 2013-2020 identified the following challenges in the life environment sector (infrastructure and urban planning):

- Built houses, apartment, office buildings and other structures will face the impact of higher temperatures in summer, lower temperatures in winter, stronger winds, more abundant snowfall, and other potentially hazardous climate change.
- Romania is currently applying the Eurocodes for constructions, and other national standards, based on the specialized weather, earthquake maps etc.
- The energy efficiency of buildings has also become an element that the construction policies in Romania focus on (important for ensuring the residents' comfort throughout the year).
- However, none of these norms and standards do not make direct reference to the climate change, and many of them are based on outdated climate forecasts (eg. technical standards for heating systems are based on climate data from the period 1965-1985).

**Table 1. Risks identified by the European Commission regarding climate impacts on buildings/ construction sector**

<i>Atmospheric pressure</i>	<i>Risks</i>	<i>Impact</i>
<b>Change in precipitation pattern</b>	Flooding due to rivers or drainage system	Pollution Damage to buildings Infrastructure maintenance Public safety
	Heavy snowfall	Structural damage to buildings Infrastructure maintenance Safety issues
	Failure of buildings and infrastructures, and landslides	Structural damage to buildings Infrastructure maintenance Safety issues
	Water deficit, drought and affected water resources	Green roof restrictions Water use restrictions Failure of clay soils and peat affects the building structure
<b>Higher temperatures</b>	Casualties due to heat-cold changes	Lower work productivity, higher cooling costs
	Diseases	Higher emergency & medical care

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	Air quality and casualties	costs Impact on health
<b>Sea level rise</b>	Flooding due to storms Salt water infiltrations	Pollution Structural damage to buildings Infrastructure maintenance Public safety Higher maintenance and upgrading costs for protection installations
<b>Extreme events (storms)</b>	Damage due to storm winds Failure of power supply, communication, and other services	Structural damage to buildings Infrastructure maintenance Inconveniences due to power and water supply failures

The project included such an analysis of the Infrastructure and urban planning sector for the 3 pilot municipalities (Brașov, Sibiu, Tg. Mureș), and the main risks, vulnerabilities, and opportunities are presented below:

<b>Risks/vulnerabilities</b>	<b>Opportunities/ actions</b>
<ul style="list-style-type: none"> <li>- Occurrence and expansion of urban heat islands following: expansion of built-up area to the detriment of non-built-up ones (farming, green), high-density housing, extensive areas of polluted / abandoned industrial sites, asphalt / concrete</li> <li>- Drying vegetation in green spaces during summer due to the lack of irrigation facilities</li> <li>- Damage to degraded buildings due to extreme weather events</li> <li>- Enabled slope instability in built-up areas due to abundant precipitation</li> <li>- Flooding of streets and built-up areas due to the outdated and undersized sewer system and reduced permeable pavement areas</li> <li>- Strengthening of climate change-related phenomena due to the deficit of protective curtains for communication ways and industrial areas, and green belts</li> <li>- Limited mitigation of urban heat islands due to the lack of urban planning regulations on green roofing, use of reflective colors, thermal rehabilitation of buildings, expanded green areas etc.</li> </ul>	<ul style="list-style-type: none"> <li>- Use of urban and strategic planning studies / documents relevant to adaptation to climate change (PUG, PAED, SIDU, PMUD etc.)</li> <li>- Encouraging the citizens to spend longer time outdoor (eg. provision of leisure areas)</li> <li>- Expansion and upgrading of public warning and intervention systems for emergency situations</li> <li>- Strengthening the cooperation between the city hall and the property owners associations for thermal rehabilitation of buildings, support for emergency situations, rehabilitation of buildings, maintenance of green areas, etc.</li> </ul>

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### 2.2.2 Risk assessment for the Infrastructure / construction / urban planning sector

The following phase analyses the risks and prioritize them, based on the results obtained from the analysis, by estimating the impact (the weight of the affected target group – citizens, companies) of climate change on each risk and by considering the probability that a certain change might occur, using a scale from 1 to 5 and building a matrix (where 1 is a very low impact-probability, and 5 a very high impact-probability). After filling out the matrix, we obtain the points for each identified risk, and the score is calculated as the product between Impact\*Probability. A score that exceeds 15 points shows a very high risk, 8 - 12 score points show a high risk, 3 - 6 score points show an average risk, and a score below 2 points shows a low risk.

In the case of Tg. Mureș Municipality, the matrix identified the following risks for the Infrastructure and urban planning sector:

Hazard	Vulnerabilities	Risks	Effects	Probability	Impact	Total score
<b>Heat</b>	Expanded built-up areas; High-density housing; reduced green areas	Expansion of urban heat islands	Health and comfort issues	5	5	25
<b>Extreme temperatures + storms + precipitation &amp; freezing</b>	Old buildings; degraded / damaged facades and roofs	Damage to facades, roofs, structures	Accidents	5	1	5
<b>Drought</b>	Interventions rehabilitation + chlorides	Partial drying of trees	Tree cut down triggering health and thermal comfort issues	5	4	20
<b>Storms</b>		Cut down trees		5	1	5
<b>Extreme precipitation</b>		Landslides		5	1	5

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### 2.2.3 SWOT analysis and defining the alternatives

The third stage in drafting the document for the adaptation to climate change is the development of the SWOT matrix for the Infrastructure / construction / urban planning sector, i.e. identifying the internal and external factors that may be desirable or undesirable. To make the transition to defining the alternatives for the pilot municipalities we used the SWOT analysis on chains, by linking the threats and opportunities to the weaknesses and strengths identified for the analyzed sector, and the fishbone diagrams (for details, see the overall Guidelines).

SWOT analysis by chains for Tg. Mureș City for the Infrastructure and urban planning sector:

<b>Identified risk</b>	<b>Increasing negative impact of heat islands</b>	
<b>Possible impact</b>	Excess thermal comfort	
<b>City weaknesses</b>	<b>Natural threat</b>	<b>City strengths</b>
Urban heat islands have extended and multiplied over the last 30 years	<b>Rising temperatures in summer + heat</b> <i>People / assets affected:</i> population in heat island areas and the passerby <i>Action mechanism:</i> higher temperatures are felt stronger in areas affected by urban heat islands	Creating parks and green areas in neighborhoods
Temperature deviations between city center and the adjacent sub-urban or rural areas might reach 5-6° Celsius		Provision of drinking-fountains and artesian wells
Within the city, the residential neighborhoods generate urban heat islands		Water course in the city
		Existence of greening projects
		Regular street washing and green area watering
		First-aid points for the population
<b>Identified risk</b>	<b>Damage to buildings (facades, roofs, structure)</b>	
<b>Possible impact</b>	Material damage	
<b>City weaknesses</b>	<b>Natural threat</b>	<b>City strengths</b>
Damaged roofs and buildings	<b>Tempests</b> <i>People / assets affected:</i> old constructions and inappropriate new constructions <i>Action mechanism:</i> roofs fall <b>Thunderstorms + excess precipitation+ extreme temperatures</b> <i>People / assets affected:</i> old constructions <i>Action mechanism:</i> water	Higher taxes for landlords who fail to provide building maintenance / tax exemption for private owners with insulated buildings (5 years)
Buildings with legal issues (eg. multiple owners)		The thermal rehabilitation program for buildings in force
Poor population who cannot afford the façade rehabilitation costs		
Limited budget of the local government for interventions to public buildings (the law forbids the local government's interventions to the private ones)		

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Abandoned buildings	affects the facades leading to the detachment of ornaments	
<b>Identified risk</b>	<b>Decreasing aesthetic city look</b>	
<b>Possible impact</b>	Decreasing city attractiveness	
<b>City weaknesses</b>	<b>Natural threat</b>	<b>City strengths</b>
The aesthetic look of the city is already affected by the large number of apartment heating boilers	<b>Rising temperatures + heat</b> <i>People / assets affected:</i> facades of buildings <i>Action mechanism:</i> higher temperatures increase the number of air conditioning mounted, that affect the aesthetic look of buildings	
Air conditioning devices mounted without considering the aesthetic city look		
<b>Identified opportunity</b>	<b>Improving the attractiveness of leisure areas owned by the municipality</b>	
<b>Possible impact</b>	Increasing tourism revenues	
<b>City weaknesses</b>	<b>Natural opportunity</b>	<b>City strengths</b>
Decreasing attractiveness of outdoor leisure areas when temperatures exceed the thermal comfort level	<b>Increasing temperatures in summer + expanding the summer season</b> <i>Benefiting people / assets:</i> tourism and leisure structures owned by the municipality <i>Action mechanism:</i> high temperatures increase the visits to the public pool and zoo park	The municipality owns and operates the most important summer tourism attractions in the city

#### 2.2.4 Setting the goals and measures related to the Infrastructure / construction / urban planning sector

Starting from the risks identified and selected as priorities, according to their hierarchy in earlier stages, we will define the objectives of the Infrastructure / construction / urban planning sector. These objectives should be SMART and will contain an action verb (eg. reduction / increase) and a noun (eg. transport / waiting time). These goals reflect the long-term impact of the strategy on the sector.

**Table 2. Objectives of the life environment sector (infrastructure and urban planning), according to the National Action Plan 2016-2020 on Climate Change:**

Holistic approach to planning weather resistant towns  
Adapting the existing buildings, construction codes and rules in order to prepare them to cope with future climate conditions and extreme events

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Developing disaster management plans, documented in terms of climate  
Strengthening the local capacity

Moreover, starting from the causes identified by the problem tree and the fishbone diagram, we will define the measures that detail the results to be obtained following the implementation of the strategy. Table 3 presents an example of adaptation alternative proposed by the Institute for European Environmental Policy.

**Table 3. Adaptation alternatives proposed by the Institute for European Environmental Policy for the Transportation sector**

<i>Climate threat</i>	<i>Adaptation solution</i>
<b>Extreme temperatures, heat</b>	Energy efficient adaptation of housing to heat (eg. Equipping homes with energy-efficient cooling systems - passive cooling based on renewable energies)
<b>Heat</b>	Energy efficient adaptation of offices and industrial facilities to heat (eg. Equipping homes with energy-efficient cooling systems - passive cooling based on renewable energies: thermal heat exchanger, concrete core activation, night ventilation systems)
<b>Increasing precipitation</b>	Protecting buildings against extreme storms and rainfall (ie. Roofs and external walls must be constructed in a way that provides security at these events, and sewerage systems must be adapted to floods and flash floods)
<b>Water deficit, drought</b>	More efficient construction in terms of water use (eg. The divided rainwater harvesting - drinking water and greywater, rainwater for gray uses - toilet cleaning; efficient design in terms of sanitation or water pressure control)

[http://ec.europa.eu/clima/policies/adaptation/what/docs/sectoral\\_fiches\\_en.pdf](http://ec.europa.eu/clima/policies/adaptation/what/docs/sectoral_fiches_en.pdf)

The following overall, specific objectives, and measures were defined in the climate change adapted strategies on the Infrastructure and urban planning sector for the three pilot municipalities:

Overall objective	Specific objectives	Measures
<b>Reducing the surface of urban heat islands in Brașov city by minimum 10% by the end of 2020, and by minimum 50% by 2050</b>	1. Stopping the expansion of urban heat islands during droughts	1. 1 More green areas
		1.2 Less polluted industrial areas
		1.3 New restrictions on construction and green areas
		1.4 Less paved parking
		1.5 Completion and review of the national legislation on urban planning
	2. Reducing the landslides and alluvial deposits	2.1 Stabilization of instable slopes at risk of becoming active
		2.2 Developing a sewer system for

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	during heavy rainfall	rainwater	
	3. Less damage to facades, structural elements and structure of buildings following weather events	3.1 Increased financial allocation to and staff in urban planning 3.2 Review of legislation on historical monuments and clarifying the legal status of buildings	
<b>Sibiu</b>			
<b>Reducing the surface of urban heat islands in Sibiu by 10%, at least, by the end of 2020, and minimum 50% by 2050</b>	1. Stopping the expansion of urban heat islands and preventing the occurrence of new ones in the municipality	1.1 Ensuring the good management of green areas while increasing their surface, particularly in heat island areas	
		1.2 Thermal and structural rehabilitation of public buildings and housing	
		1.3 Sustainable urban mobility for local adaptation to climate changes	
		1.4 Drafting and implementation of appropriate urban planning regulations	
		1.5 Increasing the permeable surfaces in order to reduce heat build-up	
		1.6 Drafting new construction guidelines / standards	
	2. Reducing the frequency of street flooding during periods of excess rainfall	2.1 Building temporary storage systems (basins) for excess rainwater before entering the sewer system and improving/expansion the rainwater sewer	
		2.2 Proper maintenance and desilting of riverbeds of the local natural emissaries	
		2.3 Provision of proper street cleaning and maintenance of water drainage ditches; building (where possible) street gutters to take over and discharge the rainwater into the natural emissaries	
		<b>Tg. Mureș Municipality</b>	
		1. Reducing the surface of urban heat islands during droughts	1.1 Expansion of green areas
			1.2 Increased number of rehabilitated public and private buildings and fund allocation for this purpose
1.3 Improved urban planning regulations on climate change adaptation, correlated with tax measures			
1.4 Photovoltaic panels for climate change adaptation and encouraging the use of green roofs			
2. Reducing the number of partially drying trees during droughts	2.1 Ensuring the good management of green areas		

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## 2.2.5 Evaluation and selection of alternatives (prioritizing the measures for the Infrastructure / construction/ urban planning sector)

The next step is the evaluation and selection of alternatives, by prioritizing the measures, provided that several decisions on the various intervention scenarios to be approached have been taken in prior. The following are some categories of scenarios for selecting the best one through discussions with the stakeholders.

Possible scenarios:

- ✓ Interventions by the government / public institutions
- ✓ Interventions by citizens/ civil society
- ✓ Interventions by private companies
- ✓ **Mixed interventions** – the most complex, given the interventions undertaken by all categories of relevant actors in the city, thus ensuring their correlation and integration, and, of course, a greater impact on the territory and the sector of interest.

Options for approaching the adaptation:

- ✓ “Soft” non-structural approaches – design and implementation of policies and procedures, land use control, information dissemination, and economic incentives to reduce and prevent the vulnerability to disasters. (Human systems management)
- ✓ “Green” structural approaches – help increase the resilience of ecosystems, aiming at the same time, to stop the loss of biodiversity and the ecosystem degradation, restoring the water cycle, and using functions and services provided by ecosystems to achieve more cost-effective, and sometimes more feasible, adaptation solutions than relying solely on the grey infrastructure
- ✓ “Grey” infrastructure approaches (hard actions) – physical intervention (using engineering services) to make buildings and infrastructures that are essential for the social and economic wellbeing of society, more resilient to extreme events caused by climate change

Some adaptation alternatives are presented below:

- ✓ *No-regrets* – adaptation measures that worth being adopted (provide real social and economic benefits) regardless of future climate change. It includes measures which are justified (in terms of profitability) in the present climate conditions, and are justified for the future, if their adoption is consistent with the risks associated with the forecasted changes. They are suitable in the short term because there is a higher probability of being implemented (provide obvious and immediate benefits) and may provide

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the necessary experience for conducting future assessments of climate risks and adaptation measures: Actions aimed at strengthening the capacity of adaptation as part of a global adaptation strategy; Avoiding construction works in high-risk areas (eg. Floodplains); reducing the water supply network loss; Design / construction of properties and buildings to minimize the overheating in summer months; Reducing the consequences of floods by using waterproof materials (floors, walls); The introduction of multi-seasonal recreation facilities

- ✓ *Low-regrets (or limited regrets)* - adaptation measures for which the associated costs are relatively low and the benefits can be relatively high: Buildings with adjacent spaces to allow future changes (e.g. ventilation, drainage), consistent with the expected changes in temperature and precipitation; Restricting the type and degree of development in flood-prone areas; Promoting the creation and preservation of areas (roadsides, farmland, green areas, roofs) to support the biodiversity
- ✓ *Win-Win* - adaptation measures that lead to the desired result in terms of minimizing climate risks or potential exploitation opportunities, as well as other social, environmental or economic benefits. Win-win options are often associated with those measures or activities addressing the climate change impact, but also contribute to their mitigation or other social and environmental objectives. These types of measures include the primary ones taken for reasons other than climate risks, but also ensure the desired benefits of adaptation: flood management which helps the objectives of biodiversity support and habitat conservation; Improving the response and emergency planning capacity to deal with risks (including the climate-related ones); Improving the cooling capacity of buildings by increasing the solar shading level or adoption of less intensive cooling strategies in terms of energy; Green roofs and walls that have multiple benefits in terms of reducing the temperature of the building, rainwater drainage, extended green areas, and reducing the energy use for both heating and cooling
- ✓ *Flexible and adjustable management* - implementation of progressive adaptation options, and not taking one-time adaptation measures widely, thus allowing the avoidance of mistakes and adaptation to changes that occur over time in terms of knowledge, experience, technologies (eg. postponing the adoption of a measure / set of adaptation measures, provided that this decision is accompanied by a commitment to continue the adjustment, along with the monitoring and evaluation of risk development). Such a decision of deferral is taken when the climate risks are below a certain threshold or when resilience (regulations, institutional circumstances) is insufficient to allow such actions be initiated: Postponing the implementation of specific measures to adapt, while exploring other options and working with the appropriate administrative levels to achieve the necessary standards and regulations; Progressive development and investment in recreation consistent with the forecasted climate changes (eg. progressive investments in the development and promotion of multi-seasonal leisure activities).

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The following criteria may be considered for prioritizing the measures, each being scored with 1 point, as follows:

- ✓ C1. Relevance to large-scale strategies / complementary with other strategies
- ✓ C2. Multiple sectors targeted
- ✓ C3. Multiple risks addressed
- ✓ C4. Emergency (score points above 15 – high risk)
- ✓ C5. Implementation by the local government as the main lead
- ✓ C6. Impact on all three fields: economic, social, environmental
- ✓ C7. External financing options
- ✓ C8. Availability of resources for implementation (human resources, knowledge)
- ✓ C9. Socially accepted
- ✓ C10. The required legal framework exists

The example below presents the risk prioritization matrix for the Infrastructure and urban planning sector in Sibiu Municipality:

Proposed measure	SCORE POINTS										TOTAL	
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10		
<b>Ensuring the good management and increase of green areas (including roofs and facades, brownfield site upgrading), particularly in heat island areas</b>	1	1	1	1	1	1	1	1	1	1	1	10
<b>Thermal and structural rehabilitation of public buildings and housing</b>	1	1	1	1	1	1	1	1	1	1	1	10
<b>Sustainable urban mobility for local adaptation to climate changes</b>	1	1	1	1	1	1	1	1	1	1	1	10
<b>Development and implementation of proper urban planning regulations, including the adjacent communities</b>	1	1	0	1	1	1	1	1	1	1	1	9
<b>Building excess rainwater harvesting systems before the sewer and improving the rainwater sewers</b>	1	1	1	1	1	1	0	1	1	1	1	9

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<b>Proper maintenance of local natural emissaries</b>	1	1	1	1	1	0	1	1	1	1	9
<b>Providing proper street cleaning and maintenance of ditches</b>	1	1	0	1	1	0	1	1	1	1	8

## 2.2.6 Drafting the action plan

This stage identifies the actions necessary to achieve the objectives set in the strategy, while providing the information necessary for implementing the climate change adaptation strategy in the Infrastructure/ construction / urban planning sector. There are several types of adaptation measures: information / educational / awareness actions, institutional action / institutional capacity building, investments, political / legislative actions. The data collected, together with the list of adaptation actions should be structured so that it can carry out a detailed plan showing concretely what should be done, by whom, by when and how to implement a successful adaptation strategy. This information will be presented in a table:

- ✓ measures / actions proposed,
- ✓ connection with the specific objectives of the Strategy,
- ✓ main leads and partners,
- ✓ proposed actions and necessary preparatory activities,
- ✓ expected results,
- ✓ timelines
- ✓ estimated budget
- ✓ possible funding sources

Below, the Action plan on Infrastructure and urban planning for Brașov Municipality:

Proposed measure/ action	Strategic Objective	Main lead / Partners	Summary (proposed activities)	Expected results	Preparatory actions	Implementation period	Estimated budget	Funding source
<b>Increasing green areas and proper management of the existing ones,</b>	Stopping the expansion of UHI during drought	Technical Department Green Areas Office Chief Architect's	1. Landscaping studies; 2. Planting CC adapted trees; 3. Production and dissemination	No. of public buildings with green roofs: 10 No. of buildings	Establishing a green register Partial land registration	2017-2025	3 mil. Euro	POR 2014-2020, A.P. 4 AFM Own funds Local

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including green terraces and facades	Office TU – Faculty of Forestry Consultant s Owners Associatio ns Forestry Authority Kronstadt	of leaflets on trimming trees; 4. Pilot planting of trees in schoolyards; 5. Planting air-cleaning plants; 6. Check visits to real estate developers at the commissioning moment; 7. Study on reconfiguration of spaces between apartment buildings; 8. Pilot project – green roofs on public buildings; 9. Pilot project – green facades to buildings of no architectural value; 10. Public information program on green facades; 11. Underground reservoirs for rainwater harvesting and green area	with green facades: 10 No. of schoolyards: 10 No. of landscaping studies: 1 No. of parks equipped with irrigation system: 3 No. of trees planted: 1.500 No. of tree trimming leaflets produced: 1.000				budget (support scheme for private owners)
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			irrigation; 12. Equipping green areas around schools					
<b>Reconversion of brownfield sites with UHI (RULMENTUL)</b>	Stopping the expansion of UHI during drought	Chief Architect's Office Legal Department Consultants Real estate developers	Zoning Plan on mixed functions for RULMENTUL site (green areas, regulations on green roofs and facades, rainwater tanks – site adapted to climate changes	No. of ZPs produced and approved: 1	Study of opportunities	2017-2020	300 mii Euro	Local budget Other sources
<b>Stabilization of slopes vulnerable to extreme weather events</b>	Reducing the number of landslides and alluvial deposits during intensive rainfall	Technical Department Private owners Environmental NGOs	1. Soil studies, erosion studies, and slope landscaping studies as ZP justifying studies; 2. Performance of stabilization works based on the technical solutions proposed in the justifying studies.	No. of ZP justifying studies produced: 3 Surface of consolidated slopes: 10 ha	Internal needs report	2017-2020	500 thousands Euro	Local budget Other sources
<b>Justifying study on the construction and green area standards</b>	Stopping the expansion of UHI during drought	Chief Architect's Office Technical Department APM Brașov Order of Romanian	1. Elaboration of a justifying study (PUG, PUZ) on the construction and green area standards.	No. of ZP justifying studies produced: 3		2020	100 thousands Euro	Local budget Other sources

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		Architects Universities and Local Council						
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Among potential funding sources for the Infrastructure / construction / urban planning -related actions / projects, we mention: POIM 2014-2020, POR 2014-2020, Own funds of utilities operators, National Budget, Local budgets, POCA 2014-2020, POAT 2014-2020, Environment Fund, Norway grants, private funds.

### 2.3. Implementation of the strategy / action plan

#### 2.3.1 Establishing the implementation mechanism

The implementation of the strategy will be coordinated by the author of the Strategy on adaptation to climate change for the Infrastructure / construction / urban planning sector (coordination team within the City Hall), but this will be successful through the active involvement of all interested stakeholders, identified in the action plan as in charge with this.

For the successful implementation of the strategy, the following concrete actions should be carried out between 2016 and 2020 (at the monitoring stage in 2020, the City Hall and the proposed Monitoring Committee will review these actions in order to continue some of them by 2030, and 2050, respectively):

- ✓ Local Council's approval of the Strategy and Action Plan on adaptation to climate change in the Infrastructure / construction / urban planning vulnerable sector, by adopting decisions in this regard;
- ✓ Development, in collaboration with the relevant bodies (eg. OAR and RUR) and local stakeholders, and adoption by the Local Council of a regulation approving and implementing the local measures on adaptation to climate change, which become mandatory for all real estate developers until the next revision of PUG and RLU. If the process of reviewing the PUG and RLU will not be completed by that time, these measures will be included directly in the new versions of these urban planning documents;
- ✓ Correlation of the Strategy and Plan of Action on climate change adaptation of vulnerable Infrastructure / construction / urban planning with all planning documents (urban, ecosystem-related) that already exist and / or will be further elaborated locally (eg. revision of the Regulation on the organization and functioning of public sanitation service in the sense of using de-icing solutions with less impact on the environment during periods of abundant snow and ice, in compliance with NTPA 002 and NTPA 001 regulations, with no negative effects onto the soil, vegetation and trees - recommendation made by the representatives of APM Sibiu);

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- ✓ Dissemination of the Strategy and Action Plan on climate change adaptation of Infrastructure / construction / urban planning vulnerable sector (in accordance with the proposed communication measures);
- ✓ Development of justifying / opportunity studies needed to implement the measures on adaptation to climate change in the Infrastructure / construction / urban planning sector proposed in the strategy and action plan (eg. Flood studies, building risk assessment reports);
- ✓ Production of technical and economic documents related to the projects identified in the Action Plan;
- ✓ Identification, analysis and selection of the funding sources for the projects proposed for implementation;
- ✓ Identification of public and private partners to develop and implement projects;
- ✓ Signing partnership agreements between the City Hall and the relevant actors at local, county and national levels for the development of the projects in the Action Plan;
- ✓ Identification and information of potential beneficiaries on the existing complementary funding sources, in order to increase the absorption of European funds;
- ✓ Annual budget planning by considering the resources needed to implement projects;
- ✓ Preparing the institutional and human resources for the successful implementation of the projects;
- ✓ Project implementation;
- ✓ Promotion of project results at national and international level (promotional materials, participation in international events, websites, etc.);
- ✓ Monitoring the progress of project implementation and the production of progress reports by the Monitoring Committee (City Hall, other public institutions with Infrastructure / construction / urban planning -related tasks, private companies, NGOs, universities etc.);
- ✓ Interim evaluation of the Strategy and Action Plan on adaptation to climate change in the Infrastructure / construction / urban planning sector;
- ✓ Assessment-based review of the Strategy and Action Plan on adaptation to climate change in the Infrastructure / construction / urban planning sector and corrective actions.

### 2.3.2 Communication and Dissemination Actions

In terms of the communication / dissemination of the strategy on the Infrastructure / construction / urban planning sector's adaptation to climate change to the local stakeholders and the general public, following its approval by the Local Council, some concrete actions that could be envisaged for 2014-2020 are proposed below:

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- Organizing a press conference and issuing a press release by the City Hall, on the City Council `s adoption of the Strategy and Action Plan on the Infrastructure / construction / urban planning sector`s adaptation to climate change;
- Promoting the Strategy and Action Plan on the Infrastructure / construction / urban planning sector`s adaptation to climate change in the virtual environment, through postings on the website and the Facebook page of the City Hall and the partner institutions involved in the development process;
- Organizing, under inter-institutional partnership, an annual international conference on the the Infrastructure / construction / urban planning sector`s adaptation to climate change, that brings together experts from academia and research, government, and practitioners from the public and private sectors active and interested in this field;
- Organizing professional training courses in the field of Infrastructure / construction / urban planning sector`s adaptation to climate change addressing the education personnel, that will be later the vectors of communication with students;
- Developing promotional materials for the strategy and action plan on Infrastructure / construction / urban planning sector`s adaptation to climate change, and a video presentation that will be promoted online, on websites and Facebook pages of the institutions involved. The video will also run at the premises of some institutions and in some public areas;
- Establishment and operation of a Center for Climate Change Adaptation to carry out the activities in the action plan (non-formal education and practice, library, seminars, conferences, debates etc.);
- Running public information and awareness campaigns in the media regarding extreme weather events;
- Concluding partnership agreements with local opinion leaders (NGOs, representatives of the owners associations, family doctors and school head teachers, spiritual leaders, etc.) to carry out information, public awareness campaigns;
- Organization of competitions for ideas and concrete measures to adapt the Infrastructure / construction / urban planning sector to climate change among different categories of local stakeholders (eg. students, retirees, housing associations, companies, etc.);
- Adoption and maintenance by local companies of green areas, playgrounds, transport stops etc. in the city, in exchange for installation of advertising sign boards.

### 2.3.3 Monitoring & evaluation, review & improvement

This activity will identify a set of result and objective indicators to measure the progress in implementing the adaptation measures proposed in the action plan. The monitoring and evaluation framework clarifies the aspects to be monitored and evaluated, considering the timetable for their implementation and helps to establish the tasks for carrying out these activities. The following aspects should

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be clarified through discussions with the stakeholders in the partnership structures: What needs to be monitored and evaluated, Time and frequency of monitoring, Who is responsible for the monitoring and evaluation, Provision of the resources and commitment of those involved in this process.

**Table 4. Result indicators proposed in the 2016-2020 Action Plan on Climate Change:**

Level of discussions on planning issues related to climate change
Number of local authorities participating in the training sessions
Number of local authorities that have consistently integrated the climate change in the planning process
Level of investment (€) in the new infrastructure resilient to climate change effects
Changes in the national and local construction codes
Improved access to local / regional information on climate change risks
Number of people participating at local training programs on changes to the construction codes
Weather stations contributing to data modelling regarding climate change within the National Meteorological Authority
Review of the planning guidelines
No. of local authorities participating at training programs
No of disaster management plans updated in terms of climate change
Number and type of programs developed for various types of persons
Number of participants at training programs on climate changes
Number of students covered by the curriculum on climate changes

Monitoring activities will be carried out on the basis of the indicators proposed for this purpose. Thus, we can speak about at least two categories of indicators: result (short term) and objective (long term).

**Result indicators:**

- measure the progress of the actions and measures set
- indicate the results achieved at the end of each type of project
- are the main indicators used in the ongoing monitoring and evaluation of the Strategy and Action Plan

**Objective indicators:**

- measure the progress of the sectoral objectives set
- obtained after the completion of the strategic projects corresponding to each objective and used in the final evaluation of the Strategy and Action Plan implementation.

The indicators proposed for monitoring the implementation of the adaptation strategy on Infrastructure and urban planning in Sibiu City, are presented below:

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Objective indicators (by sector)	Result indicators (by measure/project)
<p><b>Reducing the surface of urban heat islands in Sibiu Municipality</b></p>	<ul style="list-style-type: none"> <li>No. of green lands registered</li> <li>No. of public buildings with green roofs</li> <li>No. of buildings with green facades</li> <li>No. of upgraded/ expanded parks/ squares</li> <li>No. of new parks/green areas</li> <li>No. of trees planted</li> <li>No. of inventory reports on buildings at risk</li> <li>No. of intervention guidelines produced</li> <li>No. of rehabilitated and consolidated public buildings</li> <li>No. of apartment buildings rehabilitated and consolidated</li> <li>No. of sustainable urban mobility plans elaborated and implemented</li> <li>No. of studies carried out</li> <li>No. of landscaped watercourses</li> <li>No. of landscaped lakes</li> <li>No. of feasibility studies on rainwater management</li> <li>Length of rainwater sewer built</li> <li>No. of excess rainwater harvesting tanks mounted</li> <li>No. of natural watercourses and channels desilted and landscaped</li> </ul>

The monitoring of the Strategy implementation can be run according to the following timetable of activities:

- The monitoring of the implementation of the strategy on the Infrastructure / construction / urban planning sector's adaptation to climate change, will be carried out in 2020, the year when the implementation of measures and actions provided in the strategy should end, be reviewed, in order to select the interventions proposed for 2030 or 2050 (the entire period covered by the vision). Basically, this monitoring action corresponds to a "stage" / interim strategy implementation assessment, given that it refers to three time horizons: short (2020), medium (2030) and long term (2050);
- The results of the proposed monitoring (2020) will be centralized in a monitoring report. The main purpose of the monitoring report is to highlight the status of the strategy and to propose recommendations for its effective implementation. It is recommended that the report has a simple structure, including an introduction (with information about the period covered by the monitoring report, the data sources used for assessing the progress in implementing the strategy, difficulties encountered), a section that describes the monitoring activities

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undertaken chronologically and synthetically, a chapter that provides the measures and actions that have been monitored, and recommendations to streamline the implementation of each measure and action, and a final section that provides a synthetic view of the overall report on the progress made in implementing the strategy for the period 2016-2020;

- The monitoring report will be discussed in the plenum of the City Council to review the progress in implementing the strategy on the Infrastructure / construction / urban planning sector’s adaptation to climate change and identify the recommendations for improving the implementation thereof;
- The City Hall, who will assume the strategic document by HCL, will have the task of documenting the values of the selected monitoring indicators indicators, based on secondary sources: statistical data provided by the National Institute of Statistics (eg. TEMPO Online database), own data, transport operators, other institutions etc. as well as from the Annual Implementation / Progress Reports of the Operational Programmes for 2014-2020, drawn up by the Management Authorities / Intermediary Organisms (based on SMIS data), given that some of the priority projects of strategy’s portfolio are proposed for funding from the Operational Programmes;
- If the information made available by the existing sources is insufficient to reflect the progress of the strategy implementation, monitoring questionnaires may be applied at the organizations that implement projects relevant to the strategy (see the people in charge / partners in the action plan);
- To ensure the representation of the stakeholders at local level, the continuity of the planning process and the success of the monitoring, we recommend, as mentioned above, the setting up of a Monitoring Committee of the strategy, to carry out the interim monitoring activities (eg. yearly or every two years) and to provide direct support to the City Hall representatives (eg. documenting the indicators for monitoring, establishing measures to streamline the implementation, identifying new projects, partners, funding sources, etc.) in the monitoring process which will be implemented by 2020;

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### 3. Best practices of adaptation for the Infrastructure / construction / urban planning sector

Project title	Green roofs in Basel, Switzerland: combining mitigation and adaptation measures
<b>Short description</b>	The city of Basel in Switzerland has the largest area of green roofs per capita in the world. Initiatives aiming to increase the provision of green roofs in Basel were initially driven by energy-saving programmes, and subsequently by biodiversity conservation. The City of Basel has promoted green roofs via investment in incentive programmes, which provided subsidies for green roof installation. This is likely to bring adaptation benefits in the form of lower temperatures and reduced surface runoff.
<b>Challenges</b>	Over the past 40 years rising temperatures and increased frequency of storms were recorded in the whole country, and the future projections show an increase of this trend. In densely built-up areas where providing extensive parks and planting trees may be impossible, vegetated roofs are a feasible greening option. These roofs not only mitigate the urban heat island effect but also act as insulators. These roofs not only mitigate the urban heat island effect but also act as insulators. Green roofs in densely built areas can reduce water leakage arising from storms. Green roofs can also provide 'stepping stones' for migratory species under changing climate conditions
<b>Solutions</b>	Basel's first green roof campaign started in 1996. In the early 1990's the City of Basel implemented a law to support energy saving measures. According to this law, 5% of all customers' energy bills are put into an Energy Saving Fund, which is then used to fund energy saving campaigns and measures. The national Department of Environment and Energy decided to pursue and promote green roofs using this source of funds. By minimising heat gains in buildings, they can lower the indoor temperatures by as much as 5°C and consequently reduce the need for cooling and the associated energy use, thus contributing to climate change mitigation and adaptation. Financial incentives program for companies and inhabitants.

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	Contests on the best looking green roofs are organised regularly.
<b>Stakeholder participation</b>	<p>The Department of Environment and Energy conducted a poll with the Swiss public to determine the level of support for an electricity tax to pay for energy-saving measures.</p> <p>The focus on green roofs was promoted by the researchers from the Zurich University of Applied Sciences (ZHAW) in Wädenswil, Switzerland, who worked to influence decision-makers in Basel to amend the building regulations and offer financial incentives to increase green roof coverage.</p> <p>Various stakeholders were consulted when developing the green roof concept, and in establishing the first incentive programme: the local business association, the horticultural association, the green roof association, the Pro Natura Basel environmental organization, the Department of Parks and Cemeteries in the City of Basel, and the National Department of Environment, Forest and Landscapes.</p> <p>The media played an important role in raising awareness on green roofs and grants that may be received.</p>
<b>Legal aspects</b>	<p>Basel passed a Building and Construction Law requiring green roofs on all new developments with flat roofs.</p> <p>The green roof regulations stated several conditions: the growing medium should be native soil and should be at least 10 cm deep; there should be mounds 30 cm high and 3 m wide to provide habitat for invertebrates, vegetation should be a mix of plant species which characterize the city; design and construction of green roofs and flat over 1000 m<sup>2</sup> must involve consultation with the expert in green roofs of the city.</p>

<b>Project title</b>	<b>Urban storm water management in Augustenborg, Malmo</b>
<b>Short description</b>	<p>The neighbourhood of Augustenborg, during the 1980s and 1990s an area of social and economic decline, was frequently flooded by an overflowing drainage system. It was regenerated in the early 2000. The physical changes in infrastructure included the creation of sustainable urban drainage systems (SUDS), including 6km of water channels and ten retention ponds. Green roofs have been installed on all new developments, and retrofitted. As a result, problems with flooding have ceased and the image of the area has been significantly improved.</p>
<b>Challenges</b>	The Augustenborg neighbourhood suffered from annual flooding caused by the old sewage drainage system

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	<p>being unable to cope with the combination of rainwater run-off, household waste water and pressure from other parts of the city. Resulting flooding was leading to damage to underground garages and basements, and restricted access to local roads and footpaths. Untreated sewage also often entered watercourses as a result of increasing pressure on the sewage treatment works.</p> <p>Under the changing climate, the number of heavy downpours in autumn and winter are projected to increase. This is likely to exacerbate the problems associated with rain water runoff management in urban areas.</p>
<b>Solutions</b>	<p>The project involved retrofitting SUDS within existing development and infrastructure, and with residents in situ. The completed stormwater management system includes a total of 6km of canals and water channels and ten retention ponds. Rainfall is collected in natural ditches and reservoirs before directing it into a conventional sewer system. The rainwater from roofs, roads and car parks is channelled through visible trenches, ditches, ponds and wetlands. These landscape features are integrated into the townscape within 30 courtyard areas, which also provide recreational green spaces for the area’s residents.</p> <p>There are 30 green roofs in the neighbourhood and 2,100 square meters of green roofs are provided on houses. In addition, a Botanical Roof Garden, which covers 9,500 square meters of an old industrial roof, was developed between 1999 and 2001, and remains the largest green roof in Scandinavia.</p>
<b>Stakeholder participation</b>	<p>The key actors involved in the regeneration of Augustenborg were the MKB housing company and the City of Malmö, represented by the Fosie district and the Service Department.</p> <p>As the project progressed, local businesses, schools, universities, the industrial estate became involved, plus one fifth of the tenants in the area have participated in dialogue meetings about the project (regular meetings, community workshops, and informal gatherings at sports and cultural events)</p>
<b>Legal aspects</b>	Urban regulations on the utilities and housing
<b>Project title</b>	<b>Stuttgart: combating the heat island effect and poor air quality with green ventilation corridors</b>
<b>Short description</b>	Stuttgart’s location in a valley basin, its mild climate, low wind speeds, industrial activity and high volume of traffic has made it susceptible to poor air quality. Development

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	<p>on the valley slopes has prevented air from moving through the city, which worsens the air quality and contributes to the urban heat island effect.</p> <p>A Climate Atlas was developed for the Stuttgart region, presenting the distribution of temperature and cold air flows according to the city’s topography and land use. Based on this information, a number of planning and zoning regulations are recommended that also aim to preserve and increase open space in densely built-up areas.</p>
<p><b>Challenges</b></p>	<p>The city's location has a significant influence on its local climate including implications for solar radiation, air temperature, humidity, precipitation and wind.</p> <p>The projections for heat waves suggest that the number of days with heat stress, when people’s thermoregulation is impaired, will increase significantly</p>
<p><b>Solutions</b></p>	<p>Publishing the Climate Atlas, that provides standardised climatic assessments for the 179 towns and municipalities in the Stuttgart region. The Atlas comprises maps which show regional wind patterns, flows of cold air, air pollution concentrations, and other relevant information required to inform planners on what to do for urban climatic optimization that could inform new projects and retrofits. A key element of the Atlas is an area classification based on the role that different locations play in air exchange and cool airflow in the Stuttgart region, based on topography, development density and character, and provision of green space. The Atlas distinguishes eight categories of areas in this manner, and for each of them different planning measures and recommendations are provided.</p> <p>Among the recommendations, we can mention: Vegetation should be placed to surround developments and larger, connected green spaces should be created or maintained throughout developed areas to facilitate air exchange; Valleys serve as air delivery corridors and should not be developed; Hillsides should remain undeveloped, especially when development exists in valleys, since intensive cold- and fresh-air transport occurs here; Saddle-like topographies serve as air induction corridors and should not be developed; Urban sprawl is to be avoided; All trees growing in the urban core with a trunk circumference of more than 80 cm at height of 1m are protected with a tree preservation order.</p>
<p><b>Stakeholder participation</b></p>	<p>The project was developed in close collaboration between the Verband Region Stuttgart (the association of regional cities and municipalities) and the City of</p>

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	Stuttgart (who also offered grants for greening the roofs), and the implementation was done by the Urban Planning and Regeneration Department with the support of the Office for Environmental Protection of the City of Stuttgart.
<b>Legal aspects</b>	<p>The Federal Nature Conservation Act prohibits the modification or impairment of protected green spaces, or changing land use in these protected areas. Protected green spaces comprise: green zones in settlement areas, parks, cemeteries, significant gardens, single trees, lines of trees, avenues or groves in settled or under developed areas; and some plantings and protective wooded areas outside forests.</p> <p>The Nature Conservation Act of the Land of Baden-Württemberg</p> <p>The German Building Code (revised regulations that require precautionary environmental protection in urban zoning and planning practices)</p>

<b>Project title</b>	<b>Climate bond financing adaptation actions in Paris</b>
<b>Short description</b>	Sustainable development has been a major concern for the City of Paris for more than 10 years. When, in 2015, the City of Paris hosted the COP21, the City Hall wanted to send out a strong signal to the international community and to other local and regional authorities and show the diversity of municipal ecological actions and commitments. To emphasize this, the City of Paris erected the climate bond to finance climate and energy projects. The total size of the bond is € 300 million, with a running time until May 2031. The bond aims at private investors who consider it as a secondary advantage to invest in the sustainability of the city of Paris. They will receive a profit rate of 1.75% per year. 20% of the climate bond funds have been assigned to adaptation projects. Currently, two projects with a climate adaptation objective have been included in the bond and are being implemented: planting 20,000 trees in the city and creating 30 hectares of new parks by 2020.
<b>Challenges</b>	<p>Due to climate change Paris expects an increase in average daily temperatures as well as in the number of hot, very hot and extremely hot days and in the occurrence of heatwaves. the Paris Heatwave Plan was drawn up in response to this. Heat stress is, therefore, an important focal point for the city of Paris and measures to prevent it, like green gardens, parks and roofs and use of water for cooling, are being implemented.</p> <p>A trend for more frequent droughts has also been</p>

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	<p>documented by Météo-France, with less summer rainfall, a decreased flow rate of the river Seine and an increased risk of agricultural drought in Île-de-France. This may impact the supply of drinking water from surface waters. The climate projections for Paris also indicate an increase of the frequency of heavy rains in the coming century. Floods, however, are not expected to be more or less frequent due to climate change. But since the consequences of a flood by the Seine overflowing its banks or by rainfall runoff after heavy rains can be in any case significant, there is a need for flood protection</p>
<p><b>Solutions</b></p>	<p>A climate bond is perceived as an interesting and profitable mechanism by the city to finance public projects, because it consists of a wide variety of investor profiles and requires transparency. Transparency is ensured by annual reporting, where the issuer has to justify the allocation of money to projects complying with the set criteria. The process and report is reviewed by the non-financial rating agency Vigeo, thereby providing investors reassurance on the use of their funds.</p> <p>The list of projects to choose from is defined at the start of each election term. After each election, the new Mayor presents his/her political direction to the Council of Paris for approval. This direction is financially translated in an investment programme (defining political priorities and pushes) and corresponding projects. The selection process among these projects was based on several criteria that are a combination of criteria brought forward by SGF and criteria which are usually used for Socially Responsible Investments.</p> <p>Criteria that are applied to the selection of projects: a project should contribute to (one of) the four goals of the Climate and Energy Action Plan, and only new projects are accepted.</p> <p>This step is followed by meetings and discussions with project managers to obtain precise information for each project and to verify that each aspect of the project matches the operating procedures defining the categories of eligible projects and are compatible with the rules of liquidity and project management; verifying that each project contains real and measurable environmental benefits and that the procedures and measuring instruments can be implemented by different departments (for adaptation measures used area of green spaces created and / or number of trees planted). Examples of adaptation projects under implementation: planting 20.00 trees (in the center, on the streets and in</p>

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	public institutions such as the playground of schools, gymnasiums, etc.) and create 30 hectares of new parks (both in areas of regeneration, and in existing neighborhoods, where there are spaces that can be converted to public parks)
<b>Stakeholder participation</b>	The Paris climate bond was initiated by the City of Paris, created both by the Finance and Procurement Department (DFA) and the Parks and Environment Department of Paris. A non-financial rating agency (Vigeo) was assigned to assist the City with sector expertise. Credit Agricole CIB, HSBC and Société Generale CIB acted as joint lead managers on the issue.
<b>Legal aspects</b>	The climate bond is in line with the Paris 'Climate & Energy Action Plan' and the 'Paris Adaptation Strategy' which form the policy and legal basis for the bond.

<b>Project title</b>	<b>Private investment in a leakage monitoring program to cope with water scarcity in Lisbon</b>
<b>Short description</b>	Lisbon is a region that is generally identified as one to be likely affected by droughts if current climate change scenarios do occur. Over the last 40 years, this area has witnessed an increase in the rainfall variability. Projections up to the end of the century agree that these trends will intensify. Leakage reduction at the distribution network arises as one of the most significant adaptation measures to be implemented. EPAL, the oldest water utility company, has developed a leakage monitoring program to optimize the water supply efficiency of Lisbon's distribution network. The program identifies and locates potential leakages by comparing datasets of water use (expected vs. real-time use).
<b>Challenges</b>	Lisbon is likely to face a decrease in annual rainfall and an increase in frequency and duration of drought periods. Due to its subtropical-Mediterranean climate, the city generally experiences short, mild winters and hot summers. It is therefore vital for the city to pay attention to its water efficiency. Portugal has experienced severe droughts in the past. Droughts pose a risk to human health as high temperatures can result in dehydration. An additional stress factor on the water distribution system has been the growing demand for drinking water due to urban population growth.

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<p><b>Solutions</b></p>	<p>To address the water leakages, EPAL set out to develop the water leakage detection program WONE. The program is based on a monitoring system that is able to identify and locate any water leakages in the distribution network. The monitoring system allows the comparison of expected water usage data to real-time water usage. This comparison is carried out by a software that was especially developed for the program.</p> <p>When a discrepancy is found between the two datasets, it alerts the monitoring team that there is a potential leak in the system. The location of the leakage is identified by tracing back the water meter that provided the data that showed a deviation. After the location of the leak is identified, specialized technicians, known as leak detection mechanics, are sent out to carry out a field-based leak detection and repair the problem.</p> <p>The WONE monitoring system is based on a partitioning of Lisbon in water zones defined considering the number of inhabitants (3000-5000 clients) and functions as a strategic metering area. In each zone water pressure is continuous monitored through a passive system with active alarms.</p>
<p><b>Stakeholder participation</b></p>	<p>The project was initiated by Empresa Portuguesa das Aguas Livres, and implemented by the Climate Change Impacts, Adaptation and Mitigation Research Group within Lisbon University</p>
<p><b>Legal aspects</b></p>	<p>National Program for the Efficient Use of Water National Water Law</p>

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## Conclusions and recommendations

The principles underlying the development of a good strategy for adaptation to climate change:

- ✓ involving the relevant stakeholders
- ✓ understanding the risks and barriers
- ✓ defining smart objectives and results and communicating them
- ✓ managing the climate and non-climate risk in a balanced approach, integrating the adaptation measures into existing programs and policies (taking into account the context provided by the general development objectives)
- ✓ focusing on priority climate risk management actions, sector focus
- ✓ addressing the prioritized risks associated with current climate variability and extremes
- ✓ using a flexible management to cope with uncertainties
- ✓ recognizing the importance of no-regret / low-regret and win-win adaptation options in terms of cost effectiveness and multiple benefits
- ✓ ongoing review of the effectiveness of adaptation decisions by monitoring and re-evaluation of risk
- ✓ ongoing process, and the documents to be reviewed and updated to take into account the new developments in the field (science, research, technology)
- ✓ effective communication and awareness

We present below some specific conclusions and recommendations for the Infrastructure/construction/urban planning sector:

- ✓ adaptation of housing (built) is one of the most urgent course of action in the context of climate change in Romania
- ✓ given the increased number of citizens affected by climate change, and taking into account the socio-economic structures concentrated in urban areas, the planning and development must be a priority
- ✓ for adapting the sector to climate change, it is recommended a more rigorous urban planning, integrating the principles of adaptation to climate change, especially in terms of supporting green buildings, green walls and roofs, extending green spaces, mass transportation systems, and centralized heating systems in new residential areas, and regulations on optimal densification in line with the best practices at European level
- ✓ adaptation to climate change may be compatible with climate change mitigation; adaptation can be determined by actions aimed at energy saving and climate change mitigation; Such opportunities to use current and future developments of urban area and infrastructure caused by other adaptation objectives should be sought and best used to avoid the maladaptation

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- ✓ adaptation to climate change requires joint efforts of individuals, businesses, industries and authorities affected by the climate change impacts, which means that we must ensure the involvement of all relevant actors in both the drafting and implementation of the strategy and in its communication process
- ✓ involving the citizens in the design stage might reduce the number of people opposing the identified actions
- ✓ urban landscape management is a complex process subject to conflicting agendas such as housing, transport infrastructure, commercial infrastructure, economy, etc.
- ✓ investment and construction of green infrastructure needs an intelligent and integrated approach to land management, urban design and strategic planning; these facilities must be carefully considered, taking into account the local characteristics and vulnerabilities to climate change
- ✓ according to the Romanian National Strategy on Climate Change 2013-2020, the main climate change adaptation measure for buildings is to rectify the current construction standards and norms, in order to align them to the future climate and extreme weather events.
- ✓ The same document includes the recommendations made by the construction experts, as priority measures to be taken for adaptation to climate changes:
  - updating and regular review of the parameters underlying the technical standards (temperature, humidity, etc.) to ensure that the buildings reflect the reality of climate in Romania
  - cooling measures in each city by providing citizens with more green and/or shaded areas
  - more efficient heating and cooling systems
  - an information of the urban population on climate change risks
  - promoting the construction insurance against natural hazards (floods, landslides etc.)
- ✓ collection of detailed information about the city topography, climate and land uses enabling a more accurate planning of different areas, to improve the air quality and mitigate the urban heat island effects

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\*\*\* Case study –()

For further details on the drafting and implementation methodology and the tools used, please also refer to the Guidelines for developing municipal strategies for climate change adaptation

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The *“Calea Verde spre Dezvoltare Durabilă – Greenway to Sustainable Development”* project, with a total eligible value of EUR 4,628,535, benefits from a grant amounting EUR 3,934,254.75 from Iceland, Liechtenstein and Norway through the EEA Grants 2009 – 2014 and a co-funding of EUR 694,280.25, provided by the Ministry of Environment, Water and Forest, within the RO07 Programme for the Adaptation to Climate Change.

The project develops between January 2015 – April 2017. The overall objective of this project is to reduce the vulnerability of humans and of the ecosystem to the climate change and envisages to create a best practices set on the adaptation to climate change.

“The contents of this material does not necessarily represent the official stand of the Financial Mechanism of the European Economic Area (EEA) grants 2009 – 2014”

For official information regarding the EEA Grants, please access  
[www.eeagrants.org](http://www.eeagrants.org), [www.eeagrants.ro](http://www.eeagrants.ro)

The EEA Grants and Norway Grants represent the contribution of Iceland, Liechtenstein and Norway to reducing economic and social disparities and to strengthening bilateral relations with the beneficiary European countries. The three countries have a close cooperation with the EU by the European Economic Area (EEA) Agreement.

For the period 2009-2014, €1.79 billion has been set aside under the Grants. Norway contribution is approximately 97% of the total funds. The grants are available for NGOs, research and academic institutions and the public and private sector from 16 EU Member States, from Central and South Europe. There is a deep cooperation with the donor states entities and the activities can be implemented before 2016.

The key support fields are the environmental protection and climate change, research grants and scholarships, civil society, healthcare and children, gender equality, justice and cultural heritage.

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