



CREST

Climate resilient coastal urban
infrastructures through digital twinning



CREST

TASK 2.1 STATE OF THE ART



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D2.1 State of the art compact report on regional climate strategies and challenges

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D2.1 State of the art compact report on regional climate strategies and challenges (WP2)

Introduction

Climate change represents a complex issue at a global scale and the idea of its anthropogenic origin is nowadays widely accepted by the scientific community [1]. Global warming generated by greenhouse gas emissions impacts a location or economy at different degrees depending on how vulnerable (how resilient) this location or economy is to its effects. Climate change requires responses of different dimensions - science, economics, society, politics, and ethical ones. Policymakers adopted numerous climate strategies based on mitigation and adaptation rationale.

Mitigation consists mostly of reducing the profusion of greenhouse gas, which absorb infrared radiation, into the atmosphere, by restraining sources of these gases (e.g., using fossil fuels for transport, heat, and electricity production) or enhancing the “sinks” that accumulate and retain these gases (mostly oceans, forests, and soil). The aim of mitigation is to get greenhouse gas levels stabilized “in a timeframe sufficient to allow ecosystems to adapt naturally to climate change, ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner” [2]. There are different yet complementary approaches to mitigate climate change that have been developed within international organizations and at the national level: adoption of emissions reduction targets, setting up a carbon tax, and creating a voluntary set of processes to promote emission reduction through sharing information and progress reviews. The result of these policies is expected in a long term and at a global scale.

Adaptation consists of adjusting to actual or expected future climate conditions with the aim of reducing risks from the harmful effects of climate change (e.g., sea-level rise, more intense extreme weather events, or food insecurity). Adaptation includes as well taking advantage of any potential opportunities resulting from climate change (e.g., longer growing seasons or increased yields in some regions). Compared to mitigation, adaptation seems more a local matter as different parts of the world face different threats and opportunities from climate change and adapt accordingly.

The notion of resilience has a wide range of meanings, yet adaptation represents its keyword as the capacity of transformation to maintain essential function, identity, and structure. Resilience (...) is defined as the capacity of social, economic and ecosystems to cope with a hazardous event or trend or disturbance, responding or reorganising in ways that maintain their essential function, identity, and structure as well as biodiversity in case of ecosystems while also maintaining the capacity for adaptation, learning and transformation. Resilience is a positive attribute when it maintains such a capacity for adaptation, learning, and/or transformation [3]. Resilience embeds adaptation and mitigation strategies.

Adaptation, mitigation and resilience have sometimes been treated as three different pillars of the response to global warming [4]. In that case, the relationship between these notions seems vertical: adaptation and mitigation strategies aim to build resilience. This relationship and the notion of resilience vary depending on the level of regulations policymakers adopted. At the international organizations level, we will focus on resilience-orientated climate strategies and policy based on adaptation rationale.

International organisations level: global and regional frameworks

Intergovernmental organisations' involvement in negotiating multilateral agreements lead to the establishment of international guidelines followed by states and regional organizations to adopt regulations focused on climate change mitigation and, more recently, adaptation to this process.

United Nations

International resilience-orientated regulations adopted within the UN come from two separate yet complementary approaches, disaster risk reduction (DRR) and climate change adaptation (CCA).

Climate change agreements

The United Nations Framework Convention on Climate Change (UNFCCC) adopted in 1992 constitutes the main agreement that set up the objective of “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened” [5].

Although focused on mitigation objectives, UNFCCC mentions the necessity of measures adopted at the country level “to facilitate adequate adaptation to climate change” [6] and calls for wide cooperation between countries and other legal entities in order to achieve its objectives. UNFCCC set up the obligation for developed countries to assist the developing countries “vulnerable to the adverse effects of climate change in meeting costs of adaptation” [7].

The Kyoto Protocol (1997) set up the Adaptation Fund so to materialize this financial commitment to support developing countries and to provide them with technology to develop adaptation projects and programs.

Considering both adaptation and mitigation as equally important pillars of response to climate change, the Paris Agreement (2015) provisions establish “the global goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response” [8].

Paris Agreement seeks for a holistic approach in dealing with climate change underlining that adaptation actions “should follow a country-driven, gender-responsive, participatory and fully transparent approach, taking into consideration vulnerable groups, communities and ecosystems, and should be based on and guided by the best available science and, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems, with a view to integrating adaptation into relevant socioeconomic and environmental policies and actions, where appropriate”[9].

Disaster Risk Reduction

Sendai Framework for Disaster Risk Reduction (2015–2030)

Disaster Risk Reduction (DRR) has been defined as “the concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events” [1]. No matter these adverse events are of directly human or natural origin.

Endorsed in June 2015 by the UN General Assembly, Sendai Framework for Disaster Risk Reduction (2015–2030) provides a comprehensive foundation for States to improve disaster risk management at the national, sub-national and local levels. This document provides the policymakers with a guideline helping them to build up disaster risk management systems and structures in order to anticipate, plan and reduce disaster risk so to, in fine, effectively protect people, “communities and countries, their livelihoods, health, cultural heritage, socioeconomic assets and ecosystems, and thus strengthen their

resilience” [2]. The Sendai Framework recommendations aim on disaster risk reduction and resilience building measures.

United Nations Office for Disaster Risk Reduction (UNISDR) defines the notion of resilience as: “the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions” [3]. In disaster risk reduction, the notion of resilience expresses a goal of disaster prevention and response.

The Sendai Framework considers “the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience”[4] will bring a substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets.

The Framework underlines four priority areas which States are invited to act in at local, national, regional and global levels. Understanding disaster risk (1), strengthening disaster risk governance to manage this risk (2), investing in disaster risk reduction for resilience (3) and enhancing disaster preparedness for effective response and to “Build Back Better” (4). While all of these areas are invested by the concept of environmental and community resilience, a particular attention seems paid to it in areas 2 and 3.

In order to build up an efficient management of disaster risk, the Framework calls for adoption and implementation of “national and local disaster risk reduction strategies and plans, across different timescales, with targets, indicators and time frames, aimed at preventing the creation of risk, the reduction of existing risk and the strengthening of economic, social, health and environmental resilience” [5].

Disaster risk reduction and prevention through structural and non-structural measures are considered essentials to enhance the economic, social, health and cultural resilience of persons, communities, countries and their assets, as well as the environment. The Framework formulate recommendations to States in a wide approach, among others, to set up strategies, policies, plans, laws and regulations focused on disaster risk reduction[6], to promote mechanisms for disaster risk transfer and insurance, risk-sharing and financial protection for public and private investments, to strengthen disaster-resilient public and private investments, through disaster risk prevention and reduction measures in critical facilities. On global and regional levels, the Framework invites States, among other recommendations, to “promote the development and strengthening of disaster risk transfer and sharing mechanisms and instruments in close cooperation with partners in the international community, business, international financial institutions and other relevant stakeholders” [7].

Global Initiatives based on DRR approach

Making Cities Resilient 2030 (MCR2030) represents a global campaign for public awareness and education on disaster prevention, resilience and responsible citizenship, generating understanding of disaster risk, support mutual learning and share experiences at the local, national, regional and global levels. The campaign aims to improve local resilience through advocacy, sharing knowledge and experiences, establishing mutually reinforcing city-to-city learning networks, injecting technical expertise, connecting multiple layers of government and building partnerships.

Through delivering a clear 3-stage roadmap to urban resilience, providing tools, access to knowledge and monitoring and reporting tools, MCR2030 supports cities on their path to reduce risk and build resilience.

MCR2030 aims to ensure cities become inclusive, safe, resilient and sustainable by 2030, contributing directly to the achievement of Sustainable Development Goal 11 (SDG11) “Make cities and human settlements inclusive, safe, resilient and sustainable”, and other global frameworks including the Sendai Framework for Disaster Risk Reduction, the Paris Agreement and the New Urban Agenda [8].

There are currently [9] 1442 cities which joined MCRS2030 initiative.

UNDRR Private Sector Alliance for Disaster Resilient Societies (ARISE) [10], launched in 2015, is a global network of private sector entities led by UNDRR, involved in helping to implement the Sendai Framework. ARISE mobilizes and help the private sector to carry out risk-informed investments and to apply business practices that reduce and prevent the creation of risk, build resilience and enhance recovery from disasters, in line with the Sendai Framework. Organized into 28 national networks worldwide, ARISE focuses on four priorities: SMEs, integrating DRR into investment decisions, incentivizing DRR within the insurance industry, and resilient infrastructure.

The final goal of ARISE is to create risk-resilient societies by energizing the private sector in collaboration with the public sector and other stakeholders to deliver on the targets of the Sendai Framework. ARISE facilitates exchange of experience and knowledge on how to implement disaster risk reduction projects through Disaster Risk Management strategies, investment metrics, benchmarking and standards, education and training, legal and regulatory, urban risk reduction & resilience, and insurance.

[1] United Nations International Strategy for Disaster Reduction (UNISDR), 2009, pp. 10-11.

[2] Sendai Framework for Disaster Risk Reduction (2015–2030), 5 (Preamble)

[3] “2009 UNISDR Terminology on Disaster Risk Reduction”, Geneva, May 2009, (<http://www.unisdr.org/we/inform/terminology>)

[4] Sendai Framework for Disaster Risk Reduction (2015–2030), 17 (Expected outcome and goal)

[5] Ibidem, 27 (b).

[6] Ibidem, 30 (a).

[7] Ibidem, 31 (b).

[8] <https://mcr2030.undrr.org>

[9] in October 2022

[10] <https://www.ariseglobalnetwork.org>

European Union

International organization sui generis [1], built up to enhance political and economic integration between 27 member States, the European Union put the adaptation action as a key component of a wide set of policy initiatives focused on climate change, implementing directly the global agreements, such as the Paris Agreement, the Sendai Framework for Disaster Risk Reduction and the Sustainable Development Agenda.

Adopted in December 2019, the European Green Deal [2] announces a wide set of measures implying a significant acceleration of emission reductions, contributing to reach the major aim of carbon neutrality in Europe by 2050 (with an interim target of 55% emission reduction by 2030), which reflects the goal set up in the Paris Agreement of achieving “a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases”[3]. If this aim seems taking part of climate change mitigation approach, (for ex., EU Emissions Trading System clearly pursues this objective), the Green Deal encloses several policies which appear to seek for adaptation or for both adaptation and mitigation effects and thus, it is due to be considered as a general European climate change adaptation policy framework.

The Green Deal emphasises on the necessity to rethink policies concerning clean energy supply across the economy, industry, production and consumption, large-scale infrastructure, transport, food and agriculture, construction, taxation and social benefits [4].

Several action plans and strategies have been adopted within the Green Deal.

The European Green Deal as a framework

Circular Economy Action Plan

Circular economy is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible. It requires implementation of the three base principles of the model: eliminating waste and pollution, circulating products and materials, and the regeneration of nature. The Green Deal considers circularity as a prerequisite for climate neutrality, calling member States to carry out activities so to change their economies into circular economies.

The Action Plan [5] introduces circularity into industrial processes and the sustainable product as a future standard, calls for improvement of the waste policy so to make it fit for the circular economy and the digital age and prevent waste exports out of the EU. The Action Plan expresses belief in job creation linked to the circular economy. Within this Plan, member States are invited to adopt their national circular economy strategies, plans and measures in the light of its ambition.

A Farm to Fork Strategy

Considered an important part of food produced is wasted [6], either at the harvest level or the consumer and retail level, A Farm to Fork Strategy recommends solutions that reduce food loss and waste while not increasing emissions associated with production. The Strategy addresses four key areas of supply chain management in the food industry: production, practices, consumption, and waste, taking into consideration its social aspect as well, as an important part of low-income working adults across the world rely on agriculture.

On the industry and agriculture side, the Strategy aims to stimulate sustainable food production, processing, wholesale, retail, hospitality and food services practices. On the consumers' side, it promotes sustainable food consumption and facilitates the shift to healthy, sustainable diets. On the food loss and waste issue, the European Commission intends to halve per capita food waste at retail and consumer levels by 2030 integrating this issue in other EU policies [7].

Within the Strategy, the transition to sustainable approach in this domain comes through research, innovation and technology. Through EU budget guarantees, the InvestEU Fund will foster the investments in innovation and creating sustainable food systems.

New EU Forest Strategy for 2030

Emphasising the context of accelerating climate and biodiversity crises, this strategy aims to improve forest conservation and encourage a sustainable forest economy in the European Union. Considering the socioeconomic aspects of forest policy (asserting the cascade and circular economy principles), the strategy aims to preserve biodiversity and provide critical ecosystem services, yet to mitigate climate change and increase forest resilience as well. To fill the gap in forest monitoring, reporting and data collection since the Forest Focus Regulation (2152/2003) expired, the European Commission set up a proposal for the Forest Observation, Reporting and Data Collection framework, which will create an EU-wide integrated forest monitoring system. Relying on Horizon Europe as a main funding programme for research and innovation, the strategy seeks to stimulate common research and innovation on European forests. The strategy has been adopted as a Commission's communication which is legally non-binding, yet its implementation and enforcement relies on several directives eg. the Habitats Directive [8], the Birds Directive [9], the Environmental Liability Directive [10], the Environmental Crime Directive [11].

Sustainable And Smart Mobility Strategy

Considering mobility, a key challenge in achieving the climate targets set up in the European Green Deal, this strategy draws the basis for Europe's transition to a more sustainable, smart and affordable transport system with the aim of a 90% reduction in the transport sector's emissions in 2050. This transition requires, among others, a digital transformation of the EU transport system and the development of sustainable alternatives available in a widely multimodal transport system. To achieve it, the strategy describes ten key areas for action (called "flagships"), around the main ideas: sustainable (e.g. boosting the uptake of zero-emission vehicles and related infrastructure, greening

freight transport), smart (e.g. improving connected and automated multimodal mobility, boosting innovation and the use of data and artificial intelligence), resilient (eg.. making mobility fair and just for all, stepping up transport safety and security across all modes).

New EU Strategy on Adaptation to Climate Change

Following to the Green Deal recommendations, the European Commission published in February 2021, the new EU Strategy on Adaptation to Climate Change [12] which improves, enlarges and develops the previous Adaptation Strategy adopted in 2013. Following global agreements, particularly to Paris Agreement, The EU Strategy promotes external cooperation with other countries on climate adaptation at the local, sub-national and national levels based on the economic, environmental and societal development model of the UN Sustainable Development Goals and the European Green Deal, [which aims to develop resilience, planning, support for local groups, prevention and well-informed decision-making.](#)

Despite its focus on building up a climate-resilient EU through ambitious set of measures, the new Strategy is perceived by some observers as failing to set out concrete, measurable and time-bound targets for the EU and Member States to become climate resilient [13] as the Commission choose a legally non-binding instrument lacking quantifiable targets in contradiction with the EU Parliament resolution [14].

The Adaptation Strategy summarizes the acquis realized under the 2013 document - all Member States set up a national adaptation strategy or plan, and adaptation has been mainstreamed into the EU's policies and long-term budget, and the Climate-ADAPT platform has become a key reference for knowledge on adaptation. The Adaptation Strategy is organized around three ideas, calling all stakeholders to a smarter, more systemic and faster adaptation.

The smarter adaptation to the climate change requires to improve knowledge which inform effective action. Anchoring decision-making in the latest science is crucial and several domains involve better understanding, eg. adaptation costs, benefits and distributional effects; nexus between climate hazards and socioeconomic vulnerabilities and inequalities; modelling to more accurately estimate future damage and customise adaptation measures, the cascading effects from simultaneous or sequential climate impacts. More widely, the Adaptation Strategy emphasizes on a gap in understanding the interdependencies between climate change, ecosystems and the services they deliver which is a prerequisite to build up "a science-based, robust ecosystem restoration and management that helps to minimise risks, improves resilience, and ensures the continued delivery of vital ecosystem services and features: food provision, air and water purification, flood protection, biodiversity, and climate mitigation" [15].

The smarter adaptation to the climate change demands more and better data quantifying climate-related risk and disaster losses, which are recorded, collected and shared in a comprehensive and harmonised way. The European Commission intends to promote common rules and specifications for the recording and collection of data on climate-related losses and physical climate risk and support the central recording of this data from the public and private sector at EU level through the Risk Data Hub [16].

The Adaptation Strategy makes Climate-ADAPT [17] key European climate knowledge platform with the mission of boosting the exchange of knowledge, good practices and solutions, including from EU-funded projects, involving a growing network of users. Collecting and processing data from all relevant sources, Climate-ADAPT will subsequently develop high-quality information.

The more systemic adaptation recovers the goal of integrating climate resilience considerations in all relevant policy fields applicable to both the public and the private sectors. In this systemic approach, adaptation strategies and plans at all levels should be improved following the progress of science and subject to monitoring, reporting and evaluation in order to measure progress on adaptation. National and local adaptation strategies are required to integrate climate resilience into macro-fiscal policy, to develop nature-based solutions for adaptation, and to stimulate local adaptation action.

In the scope of the macro-fiscal resilience, the Adaptation Strategy recommends including climate change and natural disaster fiscal risks into national fiscal frameworks in order to address ex-ante climate related risks and to reduce ex-post disaster consequences in budgetary planning, with an assessment of the main economic and fiscal impacts from natural risks reflected in the budgetary planning process.

In the scope of building climate resilience, the Adaptation Strategy promotes implementation of the nature-based solutions on a larger scale, which provide benefits of adaptation to climate change in a cost-effective way, for eg. “protecting and restoring wetlands, peatlands, coastal and marine ecosystems; developing urban green spaces and installing green roofs and walls; promoting and sustainably managing forests and farmland” [18]. In this line, the European Commission announces to develop a certification mechanism for carbon removals. Nature-based solutions have to be implemented in land-use management and infrastructure planning so to provide climate-resilient services.

The Adaptation Strategy emphasizes on the positive impact of nature-based solutions inland, restoring sponge-like function of soils and reducing risk of flooding; and in coastal and marine areas, enhancing coastal defence and reducing risk of algal blooms.

The Adaptation Strategy underlines the key role of the local level in strengthening resilience, describing instruments of financial support to local entities and individual Europeans intending to take direct adaptation action. A policy support facility will be developed under EU Covenant of Mayors so to provide technical assistance in developing and implementing local adaptation strategies and plans. Equity is not left behind within the Adaptation Strategy, benefits of climate adaptation which translated into economic, societal and environmental resilience, have to be equally and widely shared. Adaptation measures need to take into consideration the exposure and vulnerability to climate impacts of different regions and socio-economic groups. In order to build up resilience, long-term economic diversification policies will be introduced so to enable workers to requalify in green growth sectors.

Taking into account, the progress in adaptation planning remains slow, and implementation and monitoring even slower, the European Commission points out the need for a faster adaptation. “Current measures mostly focus on awareness raising, institutional organisation or policy development, but actually rolling out physical solutions, such as creating more green spaces to reduce the impacts of heatwaves or adjusting sewerage systems to better cope with storm overflows, is lagging behind.” [19]

The Adaptation Strategy recommends several ways to accelerate the adaptation action, as supporting the rollout of solutions through stimulating innovation; helping farmers and land managers to better integrate adaptation considerations in their activity, better use of genetic diversity and non-harmful plant genetic resources; development of rapid decision support and response solutions for decision-makers and adaptation practitioners.

Another way to get adaptation process faster is to reduce climate-related risks through investing into climate resilient infrastructure, durable and adapted to the changing climate. In this way, the European Commission developed climate proofing guidelines for new major infrastructure projects. The same approach is applied to the building stock which can contribute to large-scale adaptation as well, for ex. local water retention with green roofs and walls. Integration of climate resilience considerations into the construction and renovation of buildings through Green Public Procurement criteria for public buildings, but also into directives and regulations on energy performance of buildings and construction products.

The Adaptation Strategy calls for a better coherence in terms of practices, standards, guidance, targets, resources and knowledge which will create synergies on climate adaptation action.

Another aspect which impacts on a slow adaptation action is the share of non-insured economic losses caused by climate-related disasters. The European Commission considers that “using insurance as a risk-transfer mechanism to absorb financial losses related to climate risks can be a first step from crisis reaction towards risk management and anticipation” [19] and the private sector participation can help

to mitigate destabilizing risks to assets and to business. Therefore, the Adaptation Strategy promotes increase of natural disaster insurance penetration in Member States and invites to dialogue and innovation in setting up best practices between the insurance sector's stakeholders - insurers, reinsurers, public authorities, and other actors such as real-estate developers and infrastructure operators.

The Adaptation Strategy points out the importance of access to freshwater in a sustainable manner as nature-based solutions are particularly well suited for climate resilience to water impacts. The adaptation action requires reducing water consumption in all sectors through the use of drought management plans, measures to increase the water retention capacity of soils and safe water reuse. The European Commission intends to raise the requirements for products subject to eco-design and energy labelling, energy production, housing and buildings, agriculture and industry and promotes the transition to water-saving technologies and practices by setting a price that correctly reflects the value of water. The adaptation actions should also take into consideration all risks impacting on a stable and secure supply of drinking water as climate change increases the probability of contamination or acute pollution of freshwater following low flows, increased water temperatures, flooding or forest loss.

[1] Hlavac, M. "Less than a State, More than an International Organization: The Sui Generis Nature of the European Union", Central European Labour Studies Institute. Rochester, N.Y., 2010.

[2] COM(2019) 640 final

[3] The Paris Agreement, art. 4.1.

[4] The European Green Deal, 2.1.

[5] https://ec.europa.eu/environment/circular-economy/pdf/new_circular_economy_action_plan.pdf

[6] <https://www.un.org/en/observances/end-food-waste-day/background>

[7] A Farm to Fork Strategy, 2.1., COM(2020) 381 final.

[8] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora., Off. J. Eur. Union 1992, 206, 7–50.

[9] Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the Conservation of Wild Birds. 2009

[10] Directive 2004/35/EC of the European Parliament and of the Council of 21 April 2004 on Environmental Liability with Regard to the Prevention and Remedying of Environmental Damage.

[11] Directive 2008/99/EC of the European Parliament and of the Council of 19 November 2008 on the Protection of the Environment through Criminal Law.

[12] Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change, COM(2021) 82 final

[13] European Environmental Bureau, https://eeb.org/wp-content/uploads/2021/02/EEB_First-Assessment-2021-Adaptation-Strategy_24-Feb-2021.pdf

[14] European Parliament resolution of 17 December 2020 on the EU strategy on adaptation to climate change (2020/2532(RSP), P9_TA(2020)0382.

[15] Ibidem, p. 5.

[16] <https://drmkc.jrc.ec.europa.eu/risk-data-hub#/>

[17] <https://climate-adapt.eea.europa.eu>

[18] <https://www.fao.org/faolex/results/details/en/c/LEX-FAOC208302/>

[19] <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021DC0082&rid=7>

National and local level

France

2.1.1. Plan National d'Adaptation au Changement Climatique (PNACC)

The National Climate Change Adaptation Plan (PNACC) outlines a set of areas of intervention by the public authorities to adapt the French territory to the expected effects of climate change, to

protect the French people from extreme weather events, to adapt the economic sectors impacted by climate change (e.g., agriculture), and to improve the resilience of these sectors.

The expected effects of climate change are increased temperatures and heat waves; increased precipitation and the risk of flooding; rising sea levels increasing the risk of coastal flooding; increased frequency of extreme events (e.g. storms).

5 areas of intervention are defined.

The "Governance" action area consists of "structuring and strengthening the management of adaptation to climate change". First, the State's role is to ensure consistency between the various adaptation policies conducted at the national and local levels, by leading regional committees to provide input for the development of local plans, such as the SRADDET (see below). The State contributes to the collection of relevant data on climate change to feed the reflections of regional committees. Secondly, the State's role is to revise certain technical standards so to adapt them to the consequences of climate change, particularly for the transport, construction and energy infrastructure sectors.

The "Prevention and Resilience" action area consists of "protecting the French people from risks related to climate-related disasters". The first objective is to reduce the risk of forest fires, and to increase resilience to this risk: by identifying areas sensitive to fire risk, by proposing more resilient tree species, by modifying forest management and by increasing surveillance and rescue resources. The second objective is to develop tools to prevent natural risks, for example by adapting urban planning to climate change, particularly in the context of new projects: new building forms, reuse of materials, adaptation of public spaces to limit urban heat islands, etc. The third objective is to adapt development practices in a long-term perspective: limiting the consumption of space (objective of "Zero Net Artificialization"), reducing soil sealing, etc. It is also necessary to adapt the existing infrastructure and essential networks (transport, energy, telecommunications, etc.).

The "Nature and Environment" action area consists of "strengthening the resilience of ecosystems to enable them to adapt to climate change and building on the capacities of ecosystems to help our society adapt to climate change". The goal is to keep ecosystems functioning well and build resilience. It is necessary to encourage sobriety (demand) and efficiency of use (supply) of water resources, and to propose solutions adapted to local needs and contexts (e.g. winter water storage). The coastline, which is particularly vulnerable, will have to be adapted from a geomorphological point of view.

The "Economic sectors" action area consists of strengthening the resilience of economic activities to climate change. The objective is to identify the vulnerabilities of the various economic sectors and to identify or strengthen priority actions to improve the resilience of economic actors. The tourism sector, in particular, must integrate the challenges of climate change by developing activities that respect ecosystems. Other sectors, such as fishing, agriculture, or wood production must also integrate the challenges of climate change.

The "Knowledge and information" action area consists of improving knowledge of the impacts of climate change and disseminating relevant information to the various stakeholders. The objective is to develop scientific knowledge on the subject of climate change, but also to disseminate it through education and training.

2.1.2. Programmation pluriannuelle de l'énergie (PPE) and Plan Climat National (PCN)

The pluriannual energy planification (PEP) defines the French energy policy. It is based on the following objectives, defined in the National Climate Plan.

- Promote the emergence of a competitive and job-rich economy, particularly in the "green" sectors
- Ensure the security of supply
- Maintain a low energy price
- Controlling consumers' energy expenses
- Preserve human health and the environment

- Guarantee access to energy for all without excessive cost
- Fight against energy insecurity in households

It sets numerical targets for energy consumption, greenhouse gas emissions, renewable energy production and energy efficiency. By 2050, France must be carbon neutral.

The PEP lists all the economic sectors and determines for each one the actions to be implemented to reach these objectives. The potential of each possible energy source is then studied, with objectives of increase or reduction for each. A particular aspect is the promotion of local energy sources, such as geothermal energy. The SRADDET is the reference document for implementing this strategy at the local level.

2.1.3. Stratégie nationale bas carbone (SNBC)

The National Low Carbon Strategy is France's roadmap for fighting climate change. It provides guidelines for implementing the transition to a low-carbon economy, with two ambitions: to achieve carbon neutrality by 2050 and to reduce the carbon footprint of French consumption.

It provides strategic guidelines for implementing the transition necessary to meet the objectives of the fight against climate change. It defines a long-term trajectory for reducing greenhouse gas emissions, and sets "carbon budgets", i.e. caps on greenhouse gas emissions that must not be exceeded over a five-year period. The successive 5-years carbon budgets decrease over time in order to reach carbon neutrality by the year 2050.

The SNBC is based on a reference scenario developed jointly with the PPE. This scenario makes it possible to define the public policy measures that would enable France to meet its climate commitments, in particular carbon neutrality in 2050.

To achieve this, it is necessary to:

- Completely decarbonize energy production
- Strongly reduce energy consumption in all economic sectors
- Reduce as much as possible the emissions not related to energy consumption

The SNBC must be taken into account in local planning acts (SRADDET and PCAET). The main orientations of the SNBC are:

- Reducing emissions related to the consumption of goods and services
- Redirecting financial flows for an ecological and inclusive transition
- Developing technical, social and organizational innovations that will contribute to reducing France's emissions
- Limiting land development and making urban forms resilient and carbon-efficient
- Educate and raise awareness among citizens about the transition to a "low-carbon culture"
- Making the transition an opportunity for the economy and employment

Transport, construction, agriculture and forestry, industry and energy production are the sectors with the greatest potential to reduce France's carbon footprint. The strategy will be monitored and periodically evaluated through a set of performance indicators. It is due to be reviewed every 5 years.

2.1.4. Sub-national level

2.1.4.1. Schéma Régional Climat Air Énergie (SRCAE)

The Regional Climate Air and Energy Plan (Schéma Régional Climat Air Énergie, SRCAE) has been integrated into the SRADDET since 2015.

2.1.4.2. Schéma Régional de Raccordement aux Réseaux des Énergies Renouvelables électriques (S3REnR)

The Regional grid connection plan for renewable electrical energy (S3REnR) is essentially a technical document. It defines the energy production or distribution facilities to be created or

reinforced in order to achieve the objectives set by the SRADDET. It also defines the distribution of supply stations on the territory, as well as the connection links.

2.1.4.3. Schéma régional d'aménagement, de développement durable et d'égalité des territoires (SRADDET)

The regional plan for development, sustainable development and territorial equality (schéma régional d'aménagement, de développement durable et d'égalité des territoires – SRADDET) is the main planning act at the regional level. Since 2015, it has replaced sectoral regional plans, such as the SRCAE. Its objectives are binding on local documents (PCAET). It addresses, in a complementary and combined manner, development solutions aimed at designing sustainable urban planning that is low in land use, promoting new forms of mobility, strengthening territorial balances, adapting territories to the effects of climate change and preserving and restoring biodiversity

In terms of energy, the SRADDET (regional plan for development, sustainable development and territorial equality) sets two medium- and long-term objectives:

- controlling energy consumption, particularly through energy renovation
- development of renewable energies and energy recovery solutions

The SRADDET of **Nouvelle-Aquitaine** (which encompasses Bordeaux), adopted in 2020, includes a dozen of themes, including the fight against climate change and energy management. The 4 main priorities for New Aquitaine are as follows:

- Living well in the territories
- Fighting against depopulation and improving mobility
- Producing and consuming differently
- Protecting the environment and people's health

More specifically, the SRADDET of New Aquitaine sets the following strategic objectives:

- Create jobs and economic activity by developing the potential of each territory while respecting natural resources
- Develop the circular economy
- Encourage innovation
- Develop a more environment friendly passenger and freight transport services
- Combining space saving, social mix and quality of life in terms of urban planning and housing
- Preserve and enhance natural environments, agricultural and forestry areas, and guarantee water resources
- Accelerate the energy and ecological transition for a healthy environment, and, in particular, reduce energy consumption; improve air quality; develop alternative modes of transportation to the automobile; develop heating networks; develop organic agriculture
- Reduce the volume of waste generated annually
- Strengthen cooperation between cities and rural areas
- Ensure equitable access to services and facilities
- Guarantee the digital coverage of the territory

2.1.5. Local level

2.1.5.1 Le Plan Climat Air Energie Territorial (PCAET)

The Territorial Climate Air and Energy Plan (Plan Climat Air Energie Territorial – PCAET) sets 3 objectives at the intermunicipal level:

- Mitigation, by limiting the impacts of the territory and its activities on global warming
- Adaptation, in order to reduce the territory's vulnerability to climate change
- Improvement of air quality

The PCAET must be compatible with the objectives set out by the SRADDET. Through these two acts, local authorities define their energy trajectory for 2050, and commit to undertake the necessary actions. The main actions of the territories are:

- Developing energy-efficient urban forms
- Limiting energy consumption in buildings by promoting their renovation
- Encouraging low-carbon mobility practices and developing an alternative transport supply to the car
- Mobilizing economic actors to control their energy consumption
- Encouraging the development of renewable energies
- Encouraging changes in practices

2.1.5.2. Synthesis - Major Orientations of Bordeaux Metropolis (BM) against Global Change

4 ambitions (global objectives):

1. A peaceful metropolis serving the living environment of its inhabitants and of sustainable development
2. A territory that is resilient face to risks and that promotes sober use in a logic of preservation of natural resources
3. A territory in transition that fights against inequalities and exclusion, and promotes responsible and inclusive economic development
4. A territory concerned with preserving the good health of its inhabitants

The central issue is *the adaptation of the urban environment to climate change*, which means:

- (1) Reducing carbon footprint
- (2) Preserving ecosystems and biodiversity.

Several monitoring tools have been developed, such as Bilan Carbone, Budget Transitions

This Bordeaux Metropolis' resilience strategy stems from the analysis of several documents (see references below). It has 4 main ambitions.

Ambition 1 - A peaceful metropolis serving the living environment of its inhabitants and sustainable development

To achieve this, a number of policies have been implemented, mainly oriented towards the renaturation of the city and the fight against greenhouse gas emissions:

- Use local urban planning acts (in France: "PLU - Plan Local d'Urbanisme – Local Urbanism Plan):
 - Encourage land sobriety in urban planning documents, as the National Level has set the objective of ZAN (Zero Net Artificialization) by 2050
 - Preserve natural and agricultural areas (Bordeaux Metropole is proud to have half of its territory in natural areas), preserve ecological continuity, maintain agricultural activity
 - Public spaces: fight against "heat islands" through vegetation, "living sidewalks" (vegetation of sidewalks by residents), prevent soils to be waterproof ("désimperméabilisation")
 - Renaturation of the city: the objective is to plant "1 million trees" in public spaces, but also by encouraging individuals to do so
 - Action on mobility: encourage soft mobility (bicycle paths), invest in public transport, etc.

Ambition 2 - A territory that is resilient in the face of risks and that promotes sobriety of use in a logic of preservation of natural resources

Territorial resilience is "*the capacity of a territory to sustainably preserve the well-being of its population in the face of all types of crisis*".

This is achieved through the following program:

- Energy renovation of housing, offices, public buildings
- Local production of renewable energy, development of heating networks
- Waste plan: reduce and valorise
- Animation, information, communication
- Takeover of water management
- Strategy against floods

The “energy strategy” is more detailed in a planning act called the PCAET (Plan Climat Air-Energie Territorial – see above), which specifies the objectives in terms of energy. The objective is twofold: (1) carbon neutrality by 2050 and (2) positive energy territory, by developing renewable energies and preserving air quality.

Ambition 3 - A territory in transition that fights against inequalities and exclusion, and promotes responsible and inclusive economic development

The planning tool for this ambition is the Economic Development Plan. One of the main objectives is the development of the social and solidarity economy on the metropolitan territory. Tourism has to be sustainable and responsible (ISO 20210 certification).

Ambition 4 - A territory concerned with preserving the good health of its inhabitants

The issue of food independence is important in Bordeaux: cooperation contracts with neighbouring agricultural territories, development of an agricultural and food resilience strategy is currently under development.

Establishment of a Low Emission Zone (LEZ): ban on traffic for the most polluting vehicles (will come into force by 2024).

References

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2.2. Norway

2.2.1 National level

Norway's climate action plan was approved on the 8th of January 2021 to meet climate targets under the Paris Agreement and promote green growth. The government presented a plan to reduce emissions in all sectors.

Norway has entered into an agreement with the EU to take part in EU climate legislation for the period 2021-2030. The climate cooperation covers the EU Emission Trading System (EU ETS), the Effort

Sharing Regulation for non-ETS emissions (ESR), and the land-use, land-use change and forestry regulation (LULUCF).

Norway aims to be carbon neutral by 2030. From 1 January 2030, Norwegian greenhouse gas emissions will be offset by emission reductions in other countries either through the EU Emission Trading Scheme, international cooperation on emission reductions, emissions trading, or project-based cooperation. One central document for this effort is the [Strategy for climate change adaptation, disaster risk reduction and the fight against hunger](#).

At its national level, Norway's target is to reduce emissions by at least 55% by 2030. This target is an enhanced emission reduction target under the Paris agreement and was presented at the COP27 in Egypt in November 2022.

A Government White Paper on Climate Adaptation is under way and expected to be presented later in 2022. A whole range of other White Papers and Government Strategies also touch upon different aspects of climate change mitigation, environmental policies and climate adaptation measures.

National expectations regarding regional and municipal planning

An important document for imposing national level policies on the local and regional levels is the ["National expectations regarding regional and municipal planning 2019-2023"](#). This document sets out national expectations regarding regional and municipal planning with the goal of promoting sustainable development throughout the entire country.

Among key points (in this context) are that:

- The UN Sustainable Development Goals is the foundation and basis for the regional and municipal planning. The county and municipal authorities are to base their social and land-use planning on the United Nations' sustainable development goals.
- Usage of digital tools in planning is to be increased. The document claims that: "The use of digital solutions for dialogue with citizens can increase their understanding of the planning processes and result in better participation"
- The county and municipal authorities are expected to:
 - "Attach importance to work to reduce greenhouse gas emissions, including emissions from changes in land use, more efficient energy use, and environmentally friendly energy conversion. Up-to-date knowledge about expected climate changes and consequences are used in planning."
 - "Attach importance to climate change adaptation and civil protection in their planning, basing their work on figures from the high end of the range in national climate projections. Risk and vulnerability analyses form the basis for planning and processing of building applications."
 - "Assess land use in the shoreline and in and along watercourses in a coherent, long-term perspective, with special regard for natural diversity, cultural heritage environments, outdoor recreation, landscapes and other public interests."
 - "Safeguard the use and conservation value of watercourses in their planning. The potential of watercourses for safe diversion of surface water and nature-based flood prevention is exploited."
 - "Pursue an active, coordinated policy for development of town centres with a focus on improving urban centres. Housing, business activities, workplaces and service offerings are to be located in or near the town centre, with good arrangements for public transport, cycling and walking."
 - "Play a leading role in the development of urban centres and gives priority to long-term, binding collaboration with private operators and residents."

A revised version of this document is expected in Spring 2023.

2.2.2 Local level

2.2.2.1 *The County Plan for Møre and Romsdal*

The current County Plan – “The County Plan for the Sustainability County Møre and Romsdal 2021-2024” – is a regional plan organised in accordance with the UN’s 17 Sustainable Development Goals, and it also meets the requirements of the Planning and Building Act. This means that the plan, including its underlying documents, forms the basis for the work of municipalities and regional government agencies. The county plan consists of 24 objectives that follow up on four long-term development goals outlined in the Regional Strategic Plan 2020–2024.

The four long-term development goals are as follows:

1. Møre and Romsdal is to take lead on cooperation (UN goal nr. 17) to reach the goals.
2. Møre and Romsdal is to become the most environmentally friendly county in the country (UN goal nr. 6, 13, 14, and 15).
3. Møre and Romsdal is to be an attractive and diverse county where people choose to live (UN goal nr. 1, 2, 3, 4, 5, 11, and 16).
4. Møre and Romsdal is to take an international lead across our industries and have an innovative public sector (UN goal nr. 7, 8, 9, 10, and 12).

Among the 24 objectives in the County Plan most relevant to resilience measures are the following: Møre and Romsdal is to:

- reduce greenhouse gas emissions so that the county is climate neutral in 2030 and contribute to a 55 percent cut in the non-ETS sectors.
- manage the sea and land area so that sustainable value creation is facilitated, based on a land use that limits the need for transport, and prevents unnecessary landscape interventions.
- have 90 percent of the ecosystems in good condition both on land and in water and stop the loss of natural types and species.
- prevent unwanted events, and have a physical, digital, and organizational infrastructure that is equipped to cope with climate change and acute crises.
- have a leading position in the development of a green circular economy with a high degree of reuse and good waste management.
- have neighbourhoods and a community that promotes good physical and mental health, and is characterised by trust, belonging, safety and universal access.
- have inclusive and safe cities and towns with a distinctive character, which offer a good living environment and public spaces, attractive workplaces, a varied cultural and service offer, and environmentally friendly transport.
- ensure that businesses seize the opportunities in the green shift and maintains and strengthens its international competitiveness.
- have a transport system that is safe, smart, and environmentally friendly, and is adapted to the needs of citizens and businesses.
- have the necessary power supply infrastructure and good access to climate-neutral energy for the further development of business and social life.

2.2.2.2 *The Sustainability County Program*

One overarching initiative initiated by the County Council, is a joint regional program for sustainability – called “The Sustainability County Møre and Romsdal”. The goal is for the program to contribute to a coordinated and methodical effort to achieve the UN's Sustainability Goals by 2030.

Activities in the project:

- Give everyone knowledge about the status (of sustainability) in their local community.
- Develop plans for societal development that show how to achieve the sustainability goals.

- Mobilize and support citizens, businesses, organizations, and researchers that contribute to sustainable development.
- Measure and evaluate the effect of the effort.

Cooperation and networking are central to the investment and therefore the project involves several actors in the county. An important starting point for this program has been the completion of a thorough measurement of sustainability for each municipality in the County (26 in total).

This has been done by using the United for Smart Sustainable Cities (U4SSC) key performance indicators, an indicator set of 92 indicators that together give an overview of how a municipality fares in the economic, environmental, and social dimensions of sustainability.

Through this mapping process, six different areas that need a joint regional effort have been highlighted:

- Sustainable food and food security
- Circular economy
- Smart and sustainable water and sewage systems
- Poverty and social inclusion
- Public buildings – sustainability certifications
- Digitalization of public sector

These areas are being followed up through designated efforts addressed to improve the regional sustainability status.

A regional strategy for environment, climate change mitigation and energy policy are due in summer 2023 and will contain important measures for the regional approach to these topics.

2.2.2.3 Other examples of regional efforts to address climate change and facilitate climate adaptation

There are several projects that could be mentioned, and of very different level of ambition and scope:

- A major measure to reduce the carbon emissions from the County Council's own activity – and reduce air pollution – has been replacing fossil fuel-based ferries and buses with electric counterparts. This has been a major investment for the County, and clearly results in reduced carbon emissions. Also, it is an important investment in technology development.
- Another project Møre and Romsdal County Council are working with is developing a major wind power plant in the municipality of Smøla, by using free space in the wind power plant for solar panels. Rather than using virgin land, the energy output of an area with already existing energy production infrastructure, is increased. This also contributes to more stable energy production under different weather conditions, as well as reducing the need for importing energy into the Møre and Romsdal region.
- In addition to fighting climate change through cutting carbon emissions, the County is also working with adapting to a different climate. Through the County Program for Sustainable Urban Development, the County collaborates with the municipalities through concrete urban development projects. The County encourages taking climate change adaption seriously – making sure that Urban green areas can cope with more heavy rain and flooding.

2.3 Poland

2.3.1 National level

Poland, as a member state of the European Union, is "triggered" to undertake adaptation measures in its national order. The basis for adaptation activities was outlined for the first time in the EU White Paper of 2009. The strategic document on adaptation to climate change outlined the framework and provided the basis for the preparation of the EU Adaptation Strategy of the European

Union. The result of the commitments developed at the EU level was a formulation of a Strategic Adaptation Plan for climate-sensitive sectors and areas up to 2020 with an outlook to 2030 (SPA) [10]. This plan was adopted in October 2013 by the Council of Ministers, and its implementation was preceded by a two-year KLIMADA research project. The main objective of the SPA is to ensure sustainable development and the effective functioning of the economy and society under climate change conditions [11].

The main objective also includes the following sub-objectives:

- Objective 1 Ensure energy security and good environmental status
- Objective 2 Effective adaptation to climate change in rural areas
- Objective 3 Develop transport under climate change conditions
- Objective 4 Ensure sustainable regional and local development considering climate change
- Objective 5 Stimulate innovation conducive to climate change adaptation
- Objective 6 Shaping social attitudes conducive to climate change adaptation

To be able to achieve the main and specific goals, adaptive actions are needed in categories such as legal and political actions (legislation), organizational actions (strategic planning), information actions, scientific research, and the creation of research programs. What is important, this strategy in its assumptions must be consistent with other national strategies, and those that also treat the discussed topic can mention a number, and so they will be:

- National Urban Policy (the obligation to update it is provided by law at least every 7 years) current one is 2030
- Strategy for Responsible Development for the period up to 2020 (including the perspective up to 2030)
- National Strategy for Regional Development 2030[12]
- The National Environmental Policy 2030
- National Energy and Climate Plan for the years 2021-2030
- Energy Policy of Poland until 2040 (EPP2040)
- Concept for Spatial Development of the Country 2030 [13]

It should be noted that these strategies, although dealing with climate issues, are drawn up by various ministries or government offices. Naturally, mainly by the Ministry of Climate and Environment, but also by the Ministry of Development Funds and Regional Policy or the Ministry of Agriculture and Rural Development.

In terms of climate resilience and actions in the field of adaptations to reduce the risks associated with climate change, the following strategies will be particularly relevant:

a) SPA - objectives stated above

b) National Energy and Climate Plan, Targets to the year 2030:

- 7% reduction in greenhouse gas emissions in non-ETS [14] sectors compared to 2005 levels,
- 21- 23 % share of Renewable Energy Sources in gross final energy consumption (the 23% target will be achievable if Poland is granted additional EU funds, including those earmarked for a just transition),
- a 23% increase in energy efficiency compared to PRIMES2007 forecasts,
- reduction of the share of coal in electricity production to 56-60%.

c) National Environmental Policy

The main objective of the policy is stated as developing the environmental potential for citizens and undertakings (SOR). There are also the following specific objectives:

- Improving the quality of the environment and environmental safety
- Sustainable management of environmental resources
- Climate change mitigation and adaptation to them along with managing the risk of natural disasters

Horizontal objectives: Developing the environmental competences of the public (knowledge, skills, and attitudes). Improving the functioning efficiency of environmental protection instruments.[15]

Another example of adaptation, activities can be National Recovery and Resilience Plan (KPO-Krajowy Plan Odbudowy). It is a program that consists of 54 investments and 48 reforms. It will strengthen the Polish economy and make it easier to withstand any crisis. In line with EU targets, we will allocate a significant portion of the budget to climate goals (42.7%) (of PLN 158.5 billion PLN). The plan covers reforms and investments that started after 1 February 2020 and will end by August 31, 2026.

The National Recovery and Resilience Plan is an instrument that has mobilized the Polish government to develop reform directions: an in-depth analysis of the challenges, an assessment of how to mitigate them, and the reprocessing of legal changes within a specific timeframe. [7]

List of selected good practices implemented in Poland:

1. A series of climate hackathons - events during which participants develop technological solutions (Słupca, Zamość, Kraków, Gdańsk)
2. Preparation of Climate Change Adaptation Plans for cities with population over 100,000 (44 cities)
3. ClimCities trainings, addressed both to self-governments and inhabitants of small and medium towns in Poland, concerning adaptation to climate changes (trainings take place in 10 cities in Poland) (<http://climcities.ios.gov.pl/>)
4. Climate Cities - urban workshops aimed at improving the quality of life of citizens and supporting cities in their transformation towards climate neutrality and resilience to climate change + Climate-Friendly Cities (Miasto z Klimatem)
5. Creation of a regional network of energy advisors by NFOŚiGW <https://doradztwo-energetyczne.gov.pl/kontakt>
6. Urban Lab - a pilot tool for improving the quality of life of city dwellers in line with the smart city idea". (Rzeszów, Gdynia).

Poland is in last place among all 28 European Union countries meeting climate goals.

Poland is responsible for 96% of the EU's coal production

Poland has allocated 105 billion PLN for climate goals from 2013 to August 2022.

2.3.3 Local level

Based on analysis, it can be concluded in the topic of resilience is slowly growing at the local level. While the issues of adaptation to environmental changes are getting noticed and more widely applied in large cities, the smaller ones usually stop at environmental protection programs, various types of low-emission economy plans, or municipal development strategies that often treat climate issues superficially. It should be noted that municipalities are obliged by law to develop such documents, and even so, there are situations where such documents are missing or not available. The above-mentioned large urban centres have municipal adaptation plans, which result from the strategic document that the 44 largest cities in Poland developed by 2019. This fact should be evaluated as a plus, especially since the largest ones were followed by smaller centres and developed such plans (for example the municipality of Kowary with a population of 11,000, the municipality of Wołomin with a population of 37,000).

At the micro level, an interesting initiative is the Covenant of Mayors on Climate and Energy, which is the main channel of support from EU funds for cities to adapt to climate change. The Covenant of Mayors was launched by the EU in 2008 and 84 entities take part into initiative in Poland (from our coastal chosen there are 9 Władysławowo, Słupsk, Ustka, Łębork, Puck, Krokowa, Hel, Gdynia, Sopot). Most local government units in the coastal area take minimal actions and steps to adapt or mitigate climate change. There are only a few coastal towns with comprehensive and extensive studies (Gdansk-Gdynia-Sopot, Hel). Preliminary analysis generally shows that there are no major differences between coastal and non-coastal locations in terms of resilience policies, with exceptions as for the example above.

Climate-Friendly Cities (Miasto z Klimatem)

- 1st edition 2020 (among winners and laureates 3 coastal cities – Sopot, Gdynia, Gdańsk)
- 2nd edition 2021 (sustainable transport Elbląg and Gdynia)
- 3rd edition 2022 (Development and transformation of district heating in cities with more than 70,000 inhabitants- Koszalin, “Deconstructing” urban spaces in cities with populations over 70,000- Gdynia, Słupsk)

The environmental protection policy is implemented by voivodeship, county and commune environmental protection programs which should take into account the principles of sustainable development (Article 8 and 14 par. 2 of the Act of Environmental Protection Law).

2.3.4.1 Municipal Adaptation Plans (MPA) under “MPA 44” programme

The Polish Ministry of Climate and Environment has initiated a programme for municipal adaptation plans to climate change in cities with more than 100,000 citizens as a pilot implementation. The programme began in 2017 and lasted two years, and the document horizon was set on 2030. As a result, the core cities now have a tool for triggering adaptation and mitigation to both local urban challenges and global threats. Phenomena and processes resulting from changes in: thermal conditions in urbanised areas; the occurrence of extreme phenomena, in particular precipitation (heavy rains) causing local flooding (i.e. flash floods) and disturbances in the functioning of infrastructure; as well as the occurrence of drought and the resulting water deficits, pose a particular threat to cities. Specific urban threats also include disturbances in air circulation enhanced by its pollution. Particularly dangerous for cities is the projected increase in the frequency and intensity of extreme phenomena and, consequently, their adverse effects.

Development of Municipal Adaptation Plan consisted of 6 steps, and its methodology was adapted from The European Climate Adaptation Platform Climate-ADAPT, which is a partnership between the European Commission and the European Environment Agency (EEA). Climate-ADAPT is maintained by the EEA with the support of the European Topic Centre on Climate Change Impacts, Vulnerability and Adaptation (ETC/CCA).



The urban adaptation tool by ADAPT. Source: Climate ADAPT, online: [AST Step 0 — English \(europa.eu\)](https://climate-adapt.europa.eu)

Programme was aimed to create framework documents within 20 months, and cooperation of interdisciplinary teams (cooperation of inter public offices; both municipal and county [pol. *powiat*] level). Representatives of municipal departments such as: a/ environmental protection, b/ urban planning and development, c/ communal services, d/ health care, e/ crisis management, f/ water management. County level offices were invited for co-participation in municipal board of the MPA, starting with: a/ the State Sanitary Inspectorate, b/ County Construction Supervision Inspectorate, c/ Regional Water Management Board, d/ Drainage Management Fund, e/ Regional Directorate for Environmental Protection, f/ Regional Mining Authority.

An important element of the initial assumptions of the adaptation plan was to define the method of the vision shaping and the overarching (strategic) goal. The activities assumed the implementation of the plan in a participatory mode with various stakeholders. The first stage had a more expert character. The second one, participatory-workshop oriented. MPA board is elaborating milestones with co-participation with the president of a city, and consulting with stakeholders.

Predefinition of stakeholder's groups:

- NGOs (oriented to climate, ecology, and environment),
- Entrepreneurs (especially those who might interrupted by urban/environmental challenges of mitigation process),
- Dwellers (especially those, who might be in danger due to urban challenges or environmental threats).

Participation tools, that might facilitate stakeholders' participation in MPA:

- Open meetings,
- Public debates,
- Workgroups meetings based on peculiar social/professional groups (quasi-expert groups),
- Focus groups,
- E-consultations,
- Surveys and questionnaires,
- Citizens' assembly,
- Deliberative poll,
- Participative planning,
- "Future city game".

Assessment of urban areas sensitivity to potential environmental threats and urban challenges. A key point to assess the exposition to climate and environmental question.

Furthermore, addictiveness capacity of urban tissue.

Sources of local action of adaptation/mitigation:

• city/commune development strategy, • environmental protection programs and/or sustainable development program, • local spatial development plans, • study of the conditions and directions of spatial development of the commune, • plans for the supply of heat, electricity and gaseous fuels, • water and sewage management programs, including rainwater management, • small retention programs, • low-emission economy programmes; • eco-physiographic studies.

2.3.4.2 Follow-up on MPA's programming:

Phase 1: Initiation phase:

- Whether declaration of MPA elaboration was invoked on city council assembly?
- Did the interdisciplinary MPA board was set up?
- Whether frame schedule is existing?
- Did the participation process was included in the frame schedule of MPA implementation?
- Did the minimal scope of MPA was set up?
- Is there a various time span of action considered in the frame schedule?
- Are there legibility criteria of contractor selection set (apart from price tag)?
- Is there a predefined list of stakeholders including list of a key organisation?

Phase 2: Assessment of vulnerability:

- Have the sources of information necessary to perform the vulnerability assessment been identified?
- Has all available information on the effects of climate change in the given area been analysed?
- Have local climate change trends been identified?

- Has the analysis included all available information on socio-economic conditions in the analysed region?
- Has information been collected on the main needs and priorities of stakeholders?
- Have the existing strategic and planning studies concerning the study region been analysed in terms of exposure to and vulnerability to the effects of climate change?

Phase 3: Assessment of risk:

- Were the risks related to climate change identified in the given city?
- Have the identified risks been weighted according to the level of expected damage and the probability of occurrence?
- Have the opportunities associated with the impact of climate change on the analysed city been identified?
- Were gaps in knowledge about climate change risks identified?

Phase 4: Elaboration of adaptation possibilities (solutions varianting):

- Have specific objectives been defined for the MPA?
- Have priority functional areas for the city been established?
- Has the proposed option included activities promoting national technologies & know-how?
- Has an option been proposed with actions to create and strengthen green&blue infrastructure?
- Has an option that includes both technical and soft measures been proposed?

The specific objectives of the MPA and the priority functional areas of the city designated for them should concern increasing the city's resilience, primarily to:

- "urban" floods associated with sudden and intense rainfall,
- long-term droughts and the related lack or limitation of access to water,
- floods related to the flooding of the river,
- heat waves,
- violent wind.

A technique helpful in identifying goals and priorities may be, for example, conducting a SWOT analysis.

Phase 5: Assessment of options feasibility and final selection:

- Has the set of adaptation options been consulted with stakeholders/experts? Do the selected actions provide solutions to all identified threats?
- Were the sources of funding for selected activities indicated?

Phase 6: Final MPA elaboration:

- Does the prepared MPA contain all the items indicated in the table of contents?
- Were the sources of financing the activities selected in the decision-making process indicated?
- Has a strategic environmental impact assessment been carried out in the area covered by the adaptation measures?
- Has a public consultation been carried out during which the views of stakeholders have been consulted on the choice of options?
- Were there informal consultations of the draft MPA with the Ministry of the Environment as the entity responsible for coordinating the adaptation policy in Poland?

Box 1. Matrix of urban challenges and threats. Source: Based on *Metodyka opracowania projektu Miejskiego Planu Adaptacji*, Ministerstwo Środowiska, pp. 17-21, 33-34.

| Filed | Actions on climate resilience | Threat |
|---------------|-------------------------------|-----------------------------|
| Precipitation | Flood resilience | To flood |
| | | To flood from the sea water |
| | | To flash flood |

| | | |
|----------------|-----------------------------|--|
| | | To urban flood |
| | Drought resilience | To long-term periods without rainfall |
| | | To long-term periods without rainfall with high temperature (mid temp. -5 – +2,5 and rainfall) |
| | | To low water periods |
| | | To water shortages |
| | Extreme rainfall occurrence | To heavy rains |
| | | To heavy snowfalls |
| | | To negative effects of landslides |
| Thermic | Air temperature | To higher maximum temperatures |
| | | To lower minimum temperatures |
| | | To waves of heat (≥3 days) |
| | | To waves of cold air (≥3 days) |
| | | To interpass temperatures |
| | | To surface urban heat island effect |
| | | To increase of sea level |
| Air | Air pollution | To extended period of non-crossed air pollutant concentration |
| | | To smog |
| Wind | Wind | To strong winds and gale |
| | | To storm and hail |

Climate Change Performance Index 2022 – ranks 61 countries on their progress in reducing greenhouse gas emissions, energy consumption, renewable energies and climate policy.

6. Norway

13. Germany

17. France

52. Poland (very low rating, 4 places down from previous year rank)

Poland has the fifth-highest greenhouse gas emissions in the EU, behind only Germany, the UK, France, and Italy.

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