



Developing ambitious local long-term climate neutrality strategies

CHARTING THE COURSE: CRAFTING FORWARD-THINKING
LOCAL CLIMATE NEUTRALITY STRATEGIES

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LIST OF CONTENTS

INTRODUCTION	6
CHAPTER 1: GOVERNANCE INSIGHTS AND STRATEGIC MILESTONES IN THE DESIGN PROCESS	9
1.1. GOVERNANCE.....	9
INTRODUCTION.....	9
THE IMPORTANCE OF GOVERNANCE FOR LOCAL LONG-TERM CLIMATE STRATEGIES (LLCS)....	10
BUILDING COLLABORATIONS FOR EFFECTIVE GOVERNANCE IN DESIGNING AND IMPLEMENTING LONG-TERM CLIMATE STRATEGIES (LLCS)	11
IMPORTANCE OF POLICY COHERENCE IN LOCAL LONG-TERM CLIMATE STRATEGIES	13
PROMOTING CREDIBILITY AND LEGITIMACY THROUGH EFFECTIVE GOVERNANCE ARRANGEMENTS.....	14
SETTING THE INTERNAL SCENE.....	17
1.2. DEVELOPING AND ACHIEVING A LONG-TERM VISION WITH CLEAR OBJECTIVES	26
THE VISION: TOWARDS A SUSTAINABLE FUTURE	26
EU CLIMATE POLICY FRAMEWORK.....	27
CONSIDERATIONS TO DEVELOP A LLCS VISION AND SMART GOALS.....	27
HOW TO DEVELOP A LONG-TERM VISION?	28
STRATEGIC AND DETAILS OBJECTIVES.....	33
1.3. PARTICIPATION AND STAKEHOLDERS' ENGAGEMENT	40
INTRODUCTION.....	40
IMPORTANT CONSIDERATIONS FOR DESIGNING PARTICIPATORY LLCS.....	42
TOWARDS EFFECTIVE PARTICIPATION IN THE DESIGN OF LLCS.....	43
DELIBERATIVE LOCAL CLIMATE ASSEMBLIES	45
PARTICIPATORY BUDGETING	46
1.4. BASELINE SETTING AND ACTION PLANNING	55
A STARTING POINT AS A KEY TO PLANNING THE NEXT STEPS	55
IDENTIFYING A STARTING POINT AND OTHER TIPS FOR ACTION PLANNING.....	56
STEPS FOR CONDUCTING A BASELINE REVIEW (BORSBOOM-VAN BEURDEN et al., 2021)	57
1.5. FINANCING THE STRATEGY.....	60
FINANCING THE STRATEGY.....	60



STEPS IN CRAFTING A CLIMATE NEUTRALITY FINANCING STRATEGY: ESSENTIAL MEASURES FOR EMISSION MITIGATION	61
EXPLORING FINANCING OPPORTUNITIES: THE SECOND PILLAR IN CRAFTING AN LLCS FINANCING STRATEGY	63
1.6. MONITORING & EVALUATION	73
INTRODUCTION	73
CREATING A MONITORING DATABASE AND EMISSION INVENTORY	74
IDENTIFYING OBSTACLES AND POTENTIAL SOLUTIONS IN EACH SECTOR AND MEASURE	76
ASSIGNING RESPONSIBILITIES, CONNECTING MEASURES, AND IDENTIFYING RESPONSIBLE PARTIES	77
1.7. JUST TRANSITION	86
INTRODUCTION	86
HOW TO LEAVE NO ONE BEHIND IN ACHIEVING CLIMATE GOALS?	87
ROLE OF LOCAL AUTHORITIES AND DIALOGUE WITH THE SOCIETY	90
CHAPTER 2: CRAFTING CLIMATE NEUTRALITY MEASURES	101
2.1. HORIZONTAL MEASURES	102
CHANGES IN CITIZENS’ BEHAVIOR	103
EDUCATION	104
COMMUNICATION	105
LOCAL REGULATIONS	107
GREEN PROCUREMENT — LOCAL PRODUCTS, CLIMATE ASPECTS, AND LIFE-CYCLE APPROACH	107
MAINSTREAMING — INCORPORATE CLIMATE CONSIDERATIONS IN PLANNING AN ANNUAL MUNICIPAL BUDGET OR LOCAL MUNICIPAL INVESTMENTS	108
URBAN PLANNING	108
2.2. BUILDING SECTOR	109
IMPLEMENTATION OF SIMPLE ENERGY EFFICIENCY MEASURES AND CONSUMPTION MANAGEMENT	110
IMPLEMENTATION OF ENERGY EFFICIENCY MEASURES ON BUILDING ENVELOPE	111
INSTALLATION OF RENEWABLE ENERGY SOURCES FOR HEATING (AND COOLING)	112
INSTALLATION OF SOLAR PANELS	113
GREEN INFRASTRUCTURE	113
ADAPTIVE RENOVATION	114
2.3. WASTE MANAGEMENT	115
SMALL-SCALE WASTE MANAGEMENT	116

WASTE INCINERATION PLANTS	117
OTHER WASTE-TO-ENERGY TECHNOLOGIES	118
REUSE AND REPROCESS WASTEWATER	119
ADAPTING LANDFILLS	120
2.4. MOBILITY SECTOR	121
ATTRACTIVE PUBLIC TRANSPORT SERVICES	122
MOBILITY AS A SERVICE (MAAS)	122
HEALTHIER AND SAFER MOBILITY: A RENEWED FOCUS ON WALKING, CYCLING, AND MICRO-MOBILITY	123
ZERO-EMISSION CITY FREIGHT LOGISTICS AND LAST-MILE DELIVERY	124
DIGITALIZATION, INNOVATION AND NEW MOBILITY SERVICES	125
TOWARDS CLIMATE-NEUTRAL CITIES: RESILIENT, ENVIRONMENTALLY FRIENDLY AND CLEAN ENERGY-EFFICIENT URBAN TRANSPORT	125
INCREASED AMOUNT OF ROADSIDE PLANTING ALONG ROADS/SIDEWALKS/CYCLE PATHS ...	126
PERMEABLE PAVEMENTS	127
BUILDING SOUNDPROOF BARRIERS	128
CHAPTER 3: URBAN PATHWAYS TOWARDS LONG-TERM CLIMATE NEUTRALITY	131
3.1. WHY START THINKING IN TRANSFORMATION PATHWAYS?	132
3.2. CIRCULAR CITY	133
3.3. DOUGHNUT ECONOMY	136
139	
3.4. SMART CITY	139
3.5. COMPACT CITY / URBAN SPATIAL PLANNING	143
3.6. RESILIENT CITY	145
3.7. SHARING CITY	150
3.8. BLUE-GREEN CITY / SPONGE CITY	152
3.9. ZERO-ENERGY CITY	154
3.10. HEALTHY CITY	157
CLOSING REMARKS	161
ANNEX 1: FUNDING OPPORTUNITIES PROVIDED BY THE EU (EUROPEAN COMMISSION, N.D.)..	165
REFERENCES.....	168



INTRODUCTION

In the face of the European Union's commitment to becoming the first climate-neutral continent, the role of cities is undeniably crucial. Local governments are at the forefront of this transformative journey.

This guidance serves as a comprehensive roadmap for administrative staff in these municipalities as they navigate the complexities of becoming climate neutral. It is structured to facilitate a clear understanding of the necessary cross-cutting measures for developing effective Local Long-Term Climate Strategies (LLCS), including realizing a long-term vision, establishing baselines, fostering participation, planning action, financing, monitoring, evaluation, and ensuring a just transition. The document is divided into three main chapters, each addressing a key aspect of climate neutrality strategies.

1st chapter explores cross-cutting issues essential for successful climate action and the attainment of net-zero goals. It examines the necessary governance frameworks, participatory approaches, financial mechanisms, and critical evaluation processes that ensure effective and equitable strategies.

2nd chapter assists cities in identifying and implementing a wide array of local mitigation and adaptation measures, along with important considerations for their effectiveness and appropriateness.

3rd chapter outlines transformation pathways, charting the course for cities to transition to their goals for climate neutrality by 2050. These pathways provide a flexible framework that cities can adapt to their local context and capacities. As you explore this guidance, it is important to recognize that the path to climate neutrality is complex, iterative, and unique to each city and municipality. It requires continuous learning, adaptation, and collective effort.



The recommendations draw upon the collective expertise of project partners and insights from a Ready4NetZero needs assessment survey among municipalities in Poland, Hungary, Croatia, and Romania. This ensures that the guidance is theoretically sound and practically relevant, providing context-specific recommendations that resonate with the realities of European municipalities.

In conclusion, this guidance invites cities to become sustainability leaders and to chart their course towards a climate-neutral future boldly.



CHAPTER

1

**GOVERNANCE INSIGHTS AND STRATEGIC
MILESTONES IN THE DESIGN PROCESS**

CHAPTER 1: GOVERNANCE INSIGHTS AND STRATEGIC MILESTONES IN THE DESIGN PROCESS

1.1. GOVERNANCE

INTRODUCTION

Cities have emerged as powerful agents in combating climate change, equipped with specific capabilities to drive positive change. Their ability to swiftly implement policies, engage the public, and leverage data has made them key players in tackling the urgent climate challenge (Forman, 2014). From shaping housing and transportation to energy use, urban planning, and local infrastructure development, cities have the power to make a significant impact. Recognizing the vital role of cities, the Paris Agreement has emphasized their importance in shaping climate governance (Adriázola, Dellas, & Tänzler, 2018).

To maximize their contribution to climate action, cities must establish clear objectives and proactively overcome potential obstacles (C40, Arup, 2017). Strengthening their role requires expanding partnerships at the local, national, and international levels, seeking data-driven feedback from various governance tiers to inform their strategies. By leveraging their position within the governance system, cities can exert significant influence on the achievement of global sustainability goals and transforming the climate challenge into an opportunity for growth.

In this context, local long-term climate strategies (LLCS) emerge as a powerful tool to drive meaningful change and address climate change head-on. LLCS provide a framework for establishing a clear vision and setting milestones towards its achievement. By focusing on specific areas, LLCS offer practical opportunities for effectively reducing greenhouse gas emissions. Furthermore, these strategies foster

long-term thinking, enabling transformative shifts in decision-making processes. They create a platform for innovative solutions that transcend conventional boundaries, allowing for comprehensive evaluation of decisions over extended periods. Additionally, LLCS promote inclusivity by listening to and amplifying the voices of marginalized groups, empowering them to address important yet often overlooked issues and contributing to more effective climate action (Mabey, n.d.).

With the immense potential of LLCS in mind, this chapter explores the governance approach involved in their design. It delves into the considerations that policy makers should keep in mind to promote good governance practices and ensure the successful implementation of these strategies.

THE IMPORTANCE OF GOVERNANCE FOR LOCAL LONG-TERM CLIMATE STRATEGIES (LLCS)

The field of political science has evolved its perspective from a narrow focus on government to a broader understanding of governance. This shift recognizes the involvement of multiple actors beyond the state, including civil society, networks, partnerships, and private entities. Governance now encompasses the state's role as a facilitator and enabler, in addition to its traditional command and control functions (El Haite, 2018). The discourse on governance highlights the state's potential to promote democracy, enhance policy making legitimacy, and encourage active participation from non-state actors and communities for more inclusive and effective policies (Gupta, 2007).

The governance approach plays a crucial role in designing and implementing LLCS as it involves various actors from governmental, non-governmental, and civil society sectors. The successful execution of LLCS thus heavily relies on mobilizing and coordinating these actors throughout the planning and implementation stages (El Haite, 2018).

Achieving the goals of the Paris Agreement through the successful implementation of LLCS depends on several factors such as: a) including political leadership, b) institutional



organization, c) legal tools, d) financial and other policies, and e) social transition plans. In addition, the long-term nature of LLCS, coupled with uncertainties and dependencies on international regulations, makes designing and implementing these strategies challenging. Moreover, the necessary reforms may not align with politicians' immediate agendas, making them potentially unpopular (El Haite, 2018). Therefore, fostering governance arrangements and collaborations at various levels (international, national, and local) becomes crucial to establishing a comprehensive and interconnected implementation strategy that considers the economic and social necessities of the transition (Mabey, n.d.).

BUILDING COLLABORATIONS FOR EFFECTIVE GOVERNANCE IN DESIGNING AND IMPLEMENTING LONG-TERM CLIMATE STRATEGIES (LLCS)

To better comprehend and address the complexities associated with planning for climate action, decision-makers can adopt a **multi-level governance perspective**. This approach acknowledges the diverse interactions and dynamics between different levels of government and governance systems, enabling a more comprehensive and integrated approach to sustainable urban development (Adriázola, Dellas, & Tänzler, 2018: 15; Bulkeley & Betsill, 2005).

The concept of multi-level climate governance recognizes that urban sustainability and climate neutral development are shaped and challenged by different tiers of government and their corresponding governance structures. **Effective implementation of LLCS requires collaboration and involvement of local, regional, and national governments, along with non-state actors** (Corfee-Morlot et al., 2009).

Box 1: Multi-level Climate Governanceful tips

Multi-level climate governance encompasses the structural and institutional setting in which different levels of government distribute roles and responsibilities, coordinate and cooperate on climate action; as well as the specific instruments that are implemented at different levels of government to support and implement local climate action (Adriázola, Dellas & Tänzler, 2018: 17).

In this context, embedding long-term planning processes and outcomes into executive, legislative, regulatory, and stakeholder governance systems involves employing various approaches. Each approach has its strengths and weaknesses in shaping political debates and influencing the transition (Mabey, n.d.). While the choice of methods for integrating LLCS in governance systems may vary depending on the specific context, there are several important considerations to keep in mind. The subsequent paragraphs will delve into these important considerations in designing LLCS focusing on three key topics.

Firstly, it is crucial to determine how the results of the strategy will be utilized in decision-making processes, promoting policy coherence. By aligning the LLCS with existing policy frameworks, such as climate adaptation and mitigation strategies and national and local sectorial plans, and integrating its objectives into relevant decision-making mechanisms, coordination and effectiveness can be enhanced.

Secondly, it is important to consider the existing governance systems at different scales, such as relevant institutions, existing networks and working groups. Designing a process that allows a diversity of stakeholders to provide input into strategy development is vital for ensuring credibility and legitimacy, as it incorporates diverse perspectives and engages relevant actors with the strategy implementation.

Lastly, successful implementation relies on an internal team that is prepared, trained, and adaptable to meet the challenges posed by LLCS. Building the team's capacity and equipping its members with the necessary skills and knowledge will enable them to



navigate the complexities of long-term planning and effectively coordinate with stakeholders involved in the implementation process.

By considering these important aspects of governance, cities can build strong collaborations and ensure effective governance in the design and implementation of LLCS. In the following paragraphs, we will explore these topics in detail, providing insights and recommendations for fostering effective governance in the pursuit of sustainable urban climate neutral development.

IMPORTANCE OF POLICY COHERENCE IN LOCAL LONG-TERM CLIMATE STRATEGIES

Policy coherence is a key aspect of successful LLCS. Embedding long-term road maps into broader governance processes, independent from short-term political changes, is crucial to ensure impactful outcomes, even if it may make the processes more complex (Mabey, n.d.).

Keep an eye on the Nationally Determined Contributions (NDCs): The NDCs are crucial for implementing the Paris Agreement and achieving carbon neutrality. NDCs involve strategies updated every five years, providing a roadmap for countries' climate actions. Many countries have incorporated long-term strategies and policies into their climate laws to establish stable frameworks for a national transition (Duwe & Iwaszuk, 2019). The aggregation of NDCs at the international level helps monitor progress towards the agreement's goals. Therefore, aligning local strategies with NDCs is vital as they determine the direction and national framework for successful climate action.

National policies and strategies: LLCS create a framework for planning and implementing climate actions at the local level. Consequently, there arises a need to align objectives, goals, actors, procedures, and instruments (including organizations and administrative procedures) across different governance levels to effectively address climate challenges (Darjee et al., 2021). For example, National Energy and Climate Plans

(NECPs) detail how countries plan to meet their 2030 climate and energy targets, therefore, they become a key input in the LLCS design process (Duwe & Iwaszuk, 2019).

Local Sectorial strategies: It is important to note that LLCS cannot simply erase existing sectorial strategies and plans. Instead, they should be developed based on a strategic assessment of existing sectorial strategies and then analyzed and revised to align with the goals of carbon neutrality, resilience, and sustainability (El Haite, 2018). Considering these factors ensures policy coherence and enhances the effectiveness of local long-term climate strategies.



Keep in mind the local-level policies that are relevant in different cross-cutting topics and measures such as infrastructure policies, green infrastructure, sewage treatment plants, energy policies, disaster risk reduction, adaptation, biodiversity, food and sustainable agriculture, public procurement, and urban planning.

PROMOTING CREDIBILITY AND LEGITIMACY THROUGH EFFECTIVE GOVERNANCE ARRANGEMENTS

When preparing effective LLCS, it is essential to consider the existing governance systems at different levels. This entails identifying who to collaborate with, how and under which type of arrangements. It involves designing a process that allows stakeholders to provide input into the strategy development, ensuring credibility and legitimacy (see box 2).



Box 2: Example of the city of Austin, Texas

The city of Austin has taken several key actions to ensure credibility and legitimacy of their LLCS:

Steering Committee: Is created with representatives from academia, environmental NGOs, faith groups, community organizations, and the business community. The committee regularly meets and works closely with the city's Office of Sustainability. Public input is also sought through open meetings and opportunities for public comment.

Technical Advisory Groups (TAGs): The city has established four TAGs led by municipal staff to address specific emission sectors. These groups consist of experts and professionals who collaborate to develop strategies for reducing emissions in these sectors.

Joint Sustainability Committee (JSC): This committee includes representatives from various city boards and commissions related to climate change. Its role is to promote cooperation among stakeholders and advise the local government. The JSC acts as a bridge, facilitating collaboration and communication across different sectors and action domains.

For more information on the Austin example see Iwaszuk, Mederake, and Knoblauch (2019).

Additionally, desirable characteristics such as flexibility, openness to revisions and dialogue contribute to good governance and the achievement of sustainable development objectives.

Open spaces for revisions: Defining revision terms and intermediate goals is key to providing investors and other stakeholders with a credible plan. An effective Long-Term Climate Strategy (LTCS) should be durable yet nimble, capable of accommodating changing circumstances while providing certainty to stakeholders beyond election cycles. Balancing flexibility and certainty is crucial, as both have associated costs. Experience suggests that revising detailed plans every five years within a broad 30–40-year framework strikes a reasonable compromise given technology and investment life cycles. Clarity on how regulators and authorities should use road maps ensures consistency, lowers costs, and helps avoid stranded assets (Mabey, n.d.).

Binding regulations play a significant role in embedding long-term plans into policy: At the European level, there was a failure to establish its 2050 roadmaps (Roadmap for

moving to a competitive low carbon economy in 2050; Energy Roadmap 2050; Transport 2050) as legal policy, which has resulted in high costs and inconsistent decision-making in energy matters. At the National level, countries like the United Kingdom's embedded long-term plan into the independent Committee on Climate Change, supported by the Climate Change Act, has proven effective in promoting 'joined-up government' and shaping public debates with Parliament and stakeholders (Mabey, n.d.). At the local level, it is important to align the LLCS with national and European policies to ensure effective and coherent decision-making.

Participation is crucial in the development of LLCS: A wide conversation and stakeholder mapping reduce the power of incumbent interests, facilitate progress, and optimize investments. Constructing a broader conversation that includes new voices ensures transparency and accountability. Sector-specific dialogues involving operators, legislators, trade union representatives, and civil society stakeholders are necessary to ensure the buy-in of all partners (Mabey, n.d.; El Haite, 2018).

Share your experience internationally: Local Long-Term Climate Strategies (LLCS) also serve as valuable tools for international dialogue. Sharing these strategies on an international level enables collective evaluation, identifies investment opportunities, fosters innovation and capacity building, and helps maintain engagement, trust, and solidarity established through the Paris Agreement (El Haite, 2018).



Several European and international city alliances are ideal platforms for sharing your advance: EU Covenant of Mayors, Climate Alliance, C40 Cities Climate Leadership Group and the Carbon Neutral Cities Alliance.

By considering existing governance systems, promoting policy coherence, utilizing binding regulations, and fostering stakeholder participation, LLCS can effectively address the complexities of sustainable development and drive positive change. A city's civil society can play a pivotal role by harnessing the skills and expertise that exist,



extending the competencies of the municipality's workforce exponentially. This paradigm shift positions municipalities as policy or practice leaders and enablers, fostering collaboration and coordination (Polk, 2015).

SETTING THE INTERNAL SCENE

Successful implementation of sustainable urban development processes relies on an internal team that is prepared, trained, and adaptable to meet the challenges. Local and regional governments face extreme challenges in planning for sustainable urban development, often constrained by pro-market policies that leave little room for global considerations of environmental conservation and social justice (Polk, 2015).

To overcome these challenges, it is crucial to increase the capacity of local and regional governments. However, in resource-limited environments, investment decisions in one area may have consequences in another. Therefore, building capacity should focus on areas where the most benefit can be gained with the least investment, even though change is rarely without disruption (see box 3).

Box 3: Which capacities are needed?

Wretling & Balfors (2021) provide considerations on what time Local Capacities are needed for acting on environmental and climate action, based on the example of Sweden:

Knowledge Resources: Ensure a diverse range of accessible knowledge, integrate policy and planning processes, and foster a willingness to learn from new information.

Relational Resources: Engage various actors and establish networks to enhance collaboration and coordination.

Mobilization Capacity: Encourage stakeholders to embrace institutional change, participate in different arenas, and identify change agents who can drive transformation.

Organizational Learning: Promote a process where actors critically reflect on past knowledge and practices to adapt and improve their actions.

Adaptive Capacity: Integrate climate change considerations into the structures, practices, and behaviors of organizations at different levels and sectors.

Individual vs. Collective Learning: Recognize that organizations can influence individual learning based on their culture and structure and that collective learning is more than just the sum of individual learning.

Single-Loop and Double-Loop Learning: Distinguish between instrumental single-loop learning, which seeks to improve plan-making and problem-solving, and transformative double-loop learning, which questions and changes values, norms, and structures.

Team building and commitment are vital for successful coordination and collaboration across multiple sectors at the local level. Spearheading radical changes towards climate neutrality requires unprecedented collaboration and coordinated action across various domains. Establishing a neutral intermediary, such as a local university or dedicated agency, can facilitate coordination between actors and actions, fostering trust and enabling the development of long-term financing and governance models for decarbonization (Wainwright et al., 2022).

Strengthening the Coordination Unit is a key element of success. Governments must demonstrate climate leadership, often through reorganization, and establish new governance instances to facilitate the convergence of policies and prioritize



intervention plans. Understanding the role of the climate or environmental department in the municipality is an important step to take. Asking how to make it stronger, and what alliances with the office of the mayor can be made is crucial in driving cross-departmental collaboration. The involvement of the unit responsible for finance is also vital for adopting optimal development scenarios that are technically valid and economically viable (El Haite, 2018).

Try innovation. Adopt an approach that allows flexibility for long-term planning changes while also having the mandate to drive short-term actions. Network governance, innovation in learning processes, and participatory methods are crucial components for the success of the group. Process focus, portfolio approach, network governance, and transition management should replace linear planning, project-based approaches, and traditional governance to address uncertainties and enable adaptability (Wainwright et al., 2022).

Effective cross-sectoral cooperation within local governments necessitates a thorough understanding of the activities, priorities, interests, and goals of other departments. Building collaborative relationships between departments requires extensive political and legal negotiations, but dedicated working groups can be established to identify shared goals and cooperation opportunities. Breaking silos and establishing interdepartmental working groups are essential steps for reconciling public policies, saving time, increasing effectiveness, and avoiding unsustainable investments (Vandergert, 2022; El Haite, 2018).

The role of the climate or environmental department is crucial in driving cross-departmental collaboration. Governments must demonstrate climate leadership, often through reorganization, and establish new governance instances to facilitate convergence of policies and prioritize intervention plans. The involvement of the unit responsible for finance is also vital for adopting optimal development scenarios that are technically valid and economically viable (El Haite, 2018).

In summary, by **building internal capacity, fostering coordination and collaboration, breaking silos, and establishing cross-departmental working groups**, local governments can overcome the challenges of sustainable urban development and drive positive change towards long-term environmental conservation and social justice.

Box 4: Considerations for Effective Governance in Designing and Implementing Long-Term Climate Strategies

Governance Checklist for Decision-Makers:

Consider the political context: Implement political and institutional changes that support structural reforms, using the long-term strategy as evidence. Be mindful of the political landscape when integrating long-term climate roadmaps into governance systems.

Encourage broad participation: Involve stakeholders from different sectors and levels in the discussions about the road map. This includes not only government officials but also individuals and organizations from various areas. Emphasize the importance of diverse perspectives and input. Be clear and communicate the goal of the participation (expectation management), to avoid frustration through false expectations.

Seek independent feedback: Engage independent reviewers or bodies to provide recommendations to the government. It ensures reliable guidance for companies and investors, as the government is accountable for justifying the acceptance or rejection of these recommendations.

Foster open dialogue and transformation: Create a platform for discussing long-term choices rather than getting lost in the specifics of the road map. Encourage a national conversation that considers long-term development options holistically, moving beyond individual project-based analyses.

With these policy considerations, decision-makers can promote effective governance and ensure the successful design and implementation of LLCS.



MITIGATION AS ONE OF FIVE STRATEGIC GOALS IN THE CITY OF KEMPTEN



Introducing climate mitigation as one of only five strategic goals in the city of Kempten, Germany paved the way to mainstream climate protection measures in all the activities of the city administration.

Figure 1: View of Kempten old town

SHORT PORTRAIT

Kempten lies 646 m to 915 m above sea level on the northern edge of the Alps on the banks of the river Iller. The Bavarian capital Munich is about 110 km away. In terms of natural space, Kempten belongs to the pre-alpine moor and hill country. The average inhabitant's age is 44,2 years (2020). Many people commute to the city to work there.



SIZE

68.907 inhabitants (2019), 63,28 km² and 1.107 inhabitants/km²

CITY'S EMISSION REDUCTION TARGETS

Reduce 95% of GHG emissions until 2035

LEAD INSTITUTION/ACTOR

City of Kempten

INTERNAL AND EXTERNAL PARTNERS

eza! (Energy and Environment Centre)

DURATION/TIME PERIOD

2020–2035

FINANCING

City of Kempten

OBJECTIVE/VISION

In 2012, the city of Kempten decided to become climate neutral by 2050. In 2013, a 'Master Plan 100% Climate Protection' was adopted by the city council. In 2019, the city council decided to adapt this goal to an even more ambitious one, i.e., to become climate neutral by 2035 compared to 2010 levels (2010: 588 kt CO₂-eq.). This 'climate plan 2035' was adopted in 2022. In addition, the city of Kempten commits itself not to use the still available CO₂ budget of 3.7 million tons of CO₂ from 2020 onwards. It corresponds to the remaining budget for Kempten to reduce global warming to 1.5 °C with a 67% probability.

With the 'Climate Plan 2035', Kempten has succeeded in better integrating the strategic climate protection goal by integrating a vision level (strategic climate protection goal), a strategic level and a measured level. The 'Climate Plan 2035' is thus much better anchored in administrative decisions, and since the Ukraine war and the ensuing energy crisis, the city is getting enormous support with the implementation of measures.

ACTIVITIES

The city defined clear measures in the 'Climate Plan 2035', divided into fields, e.g. 1) sustainable development planning (e.g., shift electricity and heat supply for the city to renewable energy from the region); 2) climate neutral municipal properties (e.g., solar power plants on all suitable roofs); 3) climate-friendly energy supply (e.g., the local energy provider only offers energy from renewables); 4) sustainable mobility (e.g., all means of transport are powered by renewable energy and are CO₂-neutral); 5) climate-neutral city administration (e.g., climate mitigation is considered in all political discussions and decision-making processes); 6) climate-conscious citizens and businesses (e.g., the majority of local businesses operate climate-neutral). The progress is monitored every three years.

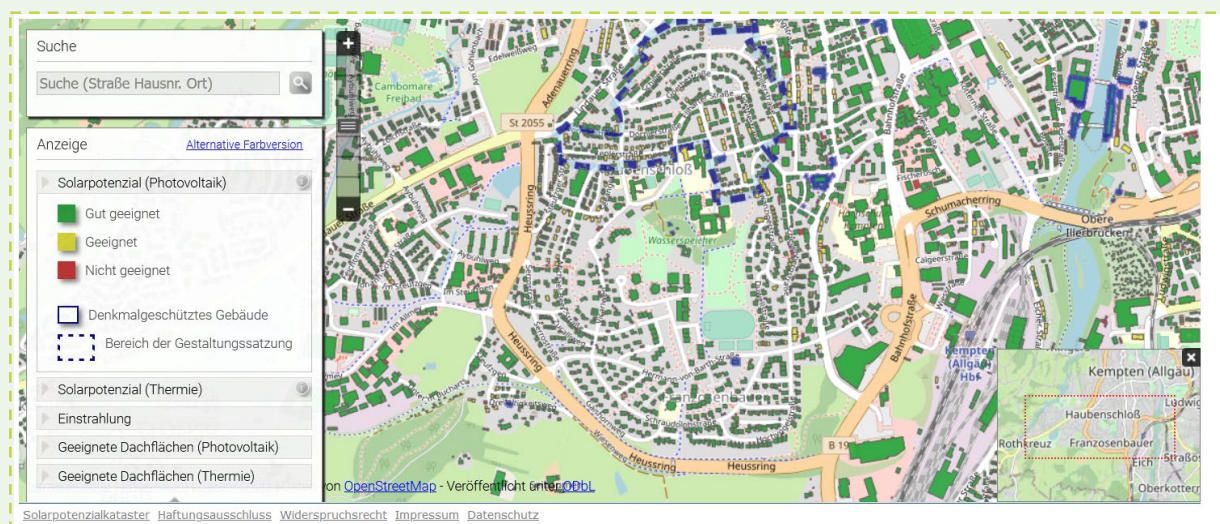


Figure 2: Solar registry tool for the citizens of Kempten.

FUNDED BY

The city of Kempten leads the process and financially supports the eza!, which in turn supports the city (and other actors in the region) with their know-how. The city also supports businesses and citizens, e.g., through funding cargo bikes for businesses or by providing an online tool where citizens can check whether their private rooftop is suited for solar power panels or photovoltaic plants. Since the city will probably have to go into new debt in 2024 or 2025, it is questionable whether they will be able to continue the private funding programs. However, as of August 2023, they are still in place.

FINDINGS

The main achievement of the city of Kempten is to mainstream mitigation aspects in all the city's activities, independent of the political party ruling the city. Crucial to achieving this was introducing the five strategic goals, which all policies have to reflect upon. Since mitigation is one of them, the topic was gaining momentum and more weight within the city's activities. Furthermore, the 'Climate Plan 2035' measures for every sector and every actor were introduced so that the aim is truly anchored in the heart of the city and its administration.

CASE STUDY CONTACT/FURTHER INFORMATION

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City of Kempten (2022) Klimaplan 2035. Vision – Strategie – Maßnahmen. Klimaschutz in der Stadt Kempten (Allgäu) (Climate Plan 2035. Vision – Strategy – Measures. Climate mitigation in the city of Kempten (Allgäu), in German: https://www.kempten.de/file/2022-09-20_Klimaplan2035_Kempten-final.pdf.

INTEGRATED OFFICE AS KEY TO EFFICIENT ENERGY MANAGEMENT IN THE CITY

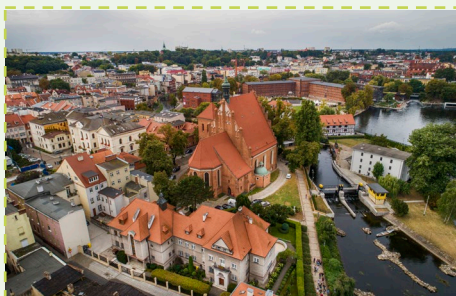


Figure 3: Old Market Square in city
Bydgoszcz

The city of Bydgoszcz, Poland has been an active signatory of the Covenant of Mayors since November 2011 and has been implementing a lot of comprehensive environmental and climate protection measures. It has developed and implemented a SECAP (Sustainable Energy and Climate Action Plan) and has had its own municipal energy officer since 2012.

SHORT PORTRAIT

Bydgoszcz is the largest city in the Kuyavian-Pomeranian Voivodeship, located on the Brda River, the Bydgoszcz Canal and the Vistula River.



SIZE

It ranks 8th in Poland in terms of population density (1,875.6 inhabitants per km²)

EMISSIONS

2.090.801 Mg CO₂ (based on emission inventory for 2020)

LEAD INSTITUTION/ACTOR

Bydgoszcz City Hall, Energy Management Team

CITY'S EMISSION REDUCTION TARGETS (40% IN LINE WITH SECAP)

- 🌿 reduction in final energy consumption by 960.084 MWh/year
- 🌿 reduction of CO₂ emissions by 521.862 Mg CO₂/year
- 🌿 increase in the share of energy from RES by 199.350 MWh/year

DURATION/TIME PERIOD

From 2013

OBJECTIVE/VISION

In 2013, a one-person position of Municipal Energy Manager was created. Furthermore, thanks to the participation of the City of Bydgoszcz in the international projects CitiEnGov and ENERGY@SCHOOL under the INTERREG Central Europe program, an Energy Management Team was established in 2016. Currently there are 5 people working in the Energy Management Team.

ACTIVITIES

Thanks to the operation of this team in the city, energy-saving measures in the public sector of the City of Bydgoszcz are coordinated by a single department, which is incredibly helpful in managing the city. Their tasks include:

- ✔ Organizing tenders for the group purchase of electricity and gas for the Bydgoszcz Purchasing Group (the City of Bydgoszcz and municipalities of the Bydgoszcz Metropolis Association)
- ✔ Concluding contracts for the supply of heat, electricity, and gas
- ✔ Analyzing the demand of municipal establishments for utilities, to properly select tariffs and optimize consumption
- ✔ Monitoring internal temperatures in public buildings and external temperatures
- ✔ Striving to automate the collection of renewable energy data of municipal buildings
- ✔ Participation in EU and international programs and projects in the fields of energy efficiency, water use, and environmental protection
- ✔ Investing in energy efficiency and RES

ACHIEVEMENTS

Thermal energy accounts for about 65% of the incurred costs of operating facilities in the city. Thanks to the measures taken by the team, there has been a reduction in ordered power by 1.569 MW compared to 2018 contributing to a reduction in heating costs by PLN 227,421.08 per year. The estimated savings as a result of thermal energy management is 5%, which translates into PLN 767,610 (based on 2018).

LESSONS LEARNED

The implemented activities that kicked off the team have contributed to strengthening institutional know-how and creating new, more qualified, and technical positions in the city. They have also made it possible to secure a long-term approach and a formal commitment for the years to come.

SUCCESS FACTORS

Especially important for the successful start of such initiatives is to find appropriate funding to enable (as in the case of Bydgoszcz) the establishment of this team and to support the development of employees' competencies through participation in international exchanges, networks, working with experts and other municipalities, etc.

CASE STUDY CONTACT/FURTHER INFORMATION

Bydgoszcz City Hall, Energy Management Team, St. Wojska Polskiego 65, 85-825 Bydgoszcz
phone: +48 52 58 59 490; e-mail: h.lewandowska@um.bydgoszcz.pl

<https://bip.um.bydgoszcz.pl/artykuly/895/zespol-ds-zaradzania-energia-zze>

1.2. DEVELOPING AND ACHIEVING A LONG-TERM VISION WITH CLEAR OBJECTIVES

THE VISION: TOWARDS A SUSTAINABLE FUTURE

An important step to undertake in developing LLCS is establishing a vision. The vision for a net-zero future is the guiding principle of the local authority's planning work. Every city needs a strong and interesting vision, which acts as the basis for its long-term strategy.

A long-term vision points out the direction towards which the local authority aims. Comparing this vision with the current situation of the local government forms the basis for determining necessary actions and developments to achieve desired goals. Additionally, a vision serves as a unifying element, crucial for all stakeholders, including leading politicians, citizens and interest groups, to relate to. Some cities and individuals view vision and strategy merely as symbolic documents or political tools. However, involving stakeholders and their ideas in shaping the city's vision can prevent such a perception. It is crucial to encompass perspectives from various fields and engage the general public to build enthusiasm and foster identification with the vision. By considering all groups' interests and encouraging active participation from citizens and discussion groups, the vision can be enriched with fresh ideas. This collaborative approach will serve as a starting point for implementing necessary changes in the city. The vision should be realistically achievable rather than overly idealistic – but, at the same time, ambitious. It should describe the desired future of the city to be achieved. It would also be advisable to express it in a visual form to make it more understandable to residents and stakeholders (Maček & Bobek, 2015).



EU CLIMATE POLICY FRAMEWORK

The European Union climate policy framework is committed to an ambitious climate policy and offers valuable insights supported by legally binding decisions that should be considered in the design of LLCS vision. In December 2019 the European Commission presented the European Green Deal and under it the EU aims to become the first continent to eliminate as much CO₂ emissions as it produces by 2050. This goal became legally binding when the European Parliament and the Council adopted the 2021 climate law. The EU's interim 2030 emissions reduction target was also updated from 40% to at least 55% (European Committee of Regions, 2023).

The European Green Deal can only be achieved by empowering local and regional authorities and encouraging them to implement activities at the local level. In order to accelerate the green transition, and to ensure that territorial approaches are observed in the landmark EU strategy, the European Committee of the Regions established the Green Deal Going Local initiative. One of the goals of this initiative is to change and improve EU policy making to give a stronger voice to cities and regions, enabling them to be more effective in implementing the European Green Deal and ensuring the delivery of EU climate-change targets. Among the activities of CoR, such as Working Groups and dedicated events, is a collection of best practices – a map which showcases how local and regional communities are transforming their way of living, working, producing and consuming, and how they are trying to achieve environmentally sustainable and socially just economic growth. By sharing successful initiatives, other cities and regions can be inspired to adopt similar practices and accelerate the transition towards a sustainable future (European Committee of Regions, 2023).

CONSIDERATIONS TO DEVELOP A LLCS VISION AND SMART GOALS

From a consensual vision, capturing long-term expectations for the city, a political commitment/decision of the city and the stakeholders is required to start preparations, which work out the vision in a strategy and proposed actions. This

commitment/decision also ensures a coherent alignment of priorities through a holistic approach.



A vision is a future-oriented concept, an aspiration for the future. A vision is a picture of a possible and desired future status. Creating a strategic vision is an exercise in thinking about a city's destination (Rivas et. al., 2018).

If an overall long-term city vision is not in place, this first stage creates a vision that is shared with and supported by other internal and external stakeholders. Otherwise, an overall long-term city vision or specific plans might need to be updated. Its output describes the long-term objectives for the climate-neutral city plan(s).



Setting a longer-term target is considered a key success factor for LLCS as it clearly shows the local authority's political commitment and sends a strong message to citizens and stakeholders on how the local authority wants to develop in the future, paving the way for more substantial investment in sustainable infrastructure.

HOW TO DEVELOP A LONG-TERM VISION?

1 DEFINE OPPORTUNITIES AND CHALLENGES

First, determine which ambitions the city wants to realize, which opportunities should be seized, and which challenges and issue(s) the city would like to tackle with one or more smart city projects. As these ambitions and challenges are usually interlinked, they should be addressed in an integrated way. Long-term objectives, related to prioritized opportunities or issue(s), can also be adopted from an existing overall plan or vision.



The focus should then be on selecting the main opportunities or challenges in which programs and projects need to be better aligned. In case an overall city vision or urban strategy, SECAP (Sustainable Energy and Climate Action Plan) or SUMP (Sustainable Urban Mobility Plan) is in place, it is probably not necessary to identify which problems the city wants to address from scratch. If not, you should consider the use of tools that help assess the problem (KPMG International Cooperative, 2016).



Some resources to make this process easier can be found [on the Global Covenant of Mayors website](#), such as a summary of the IPCC report for urban policy makers or the Climate Action for Urban Sustainability tool – an interactive scenario planning tool that helps cities take action on climate change.

Note, however, that tools can only be supportive of building a vision: They will not generate a vision by themselves.

2 TAKE STOCK OF WHAT YOU ALREADY HAVE AND WHAT YOU WOULD NEED

Through public hearings, informal consultations and engagement of staff and professionals, information can be gathered on the main financial and organizational aspects of the problem(s), as well as who in the city is needed to solve it. A preliminary list of people and organizations to be contacted should be compiled, e.g., citizens, contractors, users or organizations representing them, agencies, financial service providers, research institutions and consultants.

3 START ORGANIZING LOCAL ECOSYSTEM

It is necessary to ensure continuous cooperation on the previously identified problems. The success of the project depends on mutual collaboration between local

administrations and businesses, research institutes, industry, citizens and other locally-based actors. Three main groups can be distinguished:

- 🌿 The city administration and its employees,
- 🌿 Strategic allies and additional initiators of plans, who are indispensable for preparing and implementing the project,
- 🌿 Parties enabling a successful planning and implementation in their capacity as advisors, financiers or consultants.

In addition, remember to identify internal and external stakeholders, involve them and consult the most relevant ones (i.e., citizen focus groups), and determine their specific roles.

4 BRAINSTORM

Next, you should explore various aspects with the stakeholders identified so far to listen to their opinions and understand their interests. This usually means holding one or more brainstorming sessions. In addition to face-to-face consultations, different methods can be used: cafes, roundtables, focus groups, public hearings, surveys, workshops, mind mapping, citizen panels, serious games, assemblies in temporary meeting spaces or neighborhood festivals. In addition, internal cooperation within the city administration should be organized. For more details on how to organize stakeholder engagement meetings see the [toolkit released by the King Baudouin Foundation & Flemish Institute for Science and Technology Assessment](#).

5 EXPLORE LEGISLATION AND COMMITMENTS

Current legislative frameworks and ongoing obligations from binding commitments must be investigated, as these determine what can be done – and what the city administration is allowed to do. Planned activities within a specific legislative and political context might change. These changes can result in new issues emerging, such



as the need for new negotiations, reassessment of expectations and adjustment of the intended project (KPMG International Cooperative, 2016).

6 CAPTURE THE VISION

Lastly, the city's vision on its smart, sustainable and climate-neutral future must be captured in a document, website, video or other medium. A set of compelling key messages and communication materials that can be used to communicate consistently with urban stakeholders, must be created and integrated into this captured vision (KPMG International Cooperative, 2016).

In Växjö, for example, the vision is to live and act in a way that contributes to sustainable development, where our consumption and production are resource-efficient and free of pollution. The future vision is for Växjö to become a city where it is easy and profitable to live a good life without fossil fuels (Växjö, Sweden).

Box 1: Keeping a city vision on track

ESTABLISH GEOGRAPHIC, DEMOGRAPHIC AND THEMATIC PRIORITIES.

Remember that various areas and types of activities are not isolated from one another. Interactions between initiatives or program areas may support or hinder the ability to implement a new vision. If a plan focuses on energy, for example, it is important not only to avoid becoming distracted by a waste recycling program or the national energy policy but also to consider the impact these other areas of activity can have on the city's approach to its vision implementation.

BUILD IN WIDE AND REPEATED CONSULTATIONS ON THE PLAN.

Make sure to confer with the appropriate people, and do so frequently. Too often a city's vision fails because people don't feel any ownership of it.

GIVE KEY DECISION-MAKERS AND INFLUENTIAL STAKEHOLDERS A SEAT AT THE TABLE.

Some city plans can fail because the most influential stakeholders are not at the table during planning and their influence is not considered. Know where the money comes from.

BE AWARE OF THE RESOURCES AT YOUR DISPOSAL.

Some plans can be so ambitious that they become unrealistic. It is important to have a clear plan and estimate costs. However, a long-term plan does not need to be fully costed at the outset. The success of early projects can encourage further investment as the plan progresses, making new sources of funding available.

FOCUS ON FEASIBLE ACTIONS.

It is important to turn ideas into a practical action plan. A good vision helps to turn theory into reality.

ONCE A PLAN IS LAUNCHED, STICK TO IT.

It seems tempting to constantly change and come up with new plans and policies. It is better to spend your planning time elsewhere and not confuse others with constant changes.

CHECK PROGRESS REGULARLY AND ADJUST COURSE IF NECESSARY.

Sticking to the plan does not mean blindly following it. Control and monitor the implementation of the vision and plan (KPMG International Cooperative, 2016).



STRATEGIC AND DETAILS OBJECTIVES

Once the vision has been established, it needs to be translated into more concrete objectives for the various sectors in which the local government intends to take action.

These targets should follow the principles of the SMART acronym: Specific, Measurable, Achievable, Realistic and Time-bound. The concept of SMART goals became popular in the 1980s as a concept for effective management. To set these goals, the following questions must be answered:

1 SPECIFIC (well-defined, focused, detailed and concrete): What do we want to achieve? Why is it important? Who should do it? When do we need to do it? How will we do it?

2 MEASURABLE (kWh, time, money, % etc.): How will we know when this goal has been achieved? How can we make the appropriate measurements?

3 ACHIEVABLE (feasible, attainable): Is it feasible? Can we achieve it in the given timeframe? Do we understand the constraints and risk factors? Has it been done before (successfully)?

4 REALISTIC (in terms of resources that can be made available): Do we currently have the resources required to achieve this goal? If not, can we provide additional resources? Do we need to reprioritize the allocation of time, budget and human resources to achieve this?

5 TIME-BOUND (defined deadline or schedule): When will this goal be achieved? Is the deadline unambiguous? Is the deadline achievable and realistic? (Rivas et. al, 2018).



In practice, a potential SMART target could be: "15% of the dwellings will be audited between 1/01/2018 and 31/12/2020."

In the following paragraph, we verify the compliance with each SMART condition: It is Specific because our action (energy audits) and target group (dwellings) are well defined. It is Measurable because it is a quantified target (15%) and because we have a system in place to determine the number of audits carried out. It is Achievable because there is a financial incentive scheme that allows people to be reimbursed and because we will organize communication campaigns about audits. It is Realistic because we have trained 25 auditors who are now well-qualified, and we have verified that this number is sufficient. It is Time-bound because the time frame is well-defined (Rivas et. al, 2018).

The nature of the activities, e.g., long timeframes or involving multiple sectors, makes it more difficult to set targets. Successful adaptation can mean avoiding adverse outcomes, which can be difficult to measure. Therefore, each step described for SMART goals should be carefully evaluated and considered.

Useful tips

- ✔ Avoid putting "raising awareness" as a goal. It is too broad, unspecific and very difficult to measure.
- ✔ Add the following requirements:
 - ✔ understandable – so everyone knows what they are trying to achieve.
 - ✔ ambitious – so everyone has something to strive for.
- ✔ Define specific targets for a concrete year for the different sectors and define intermediate goals, e.g., at four-year intervals (Rivas et. al, 2018).



BRAȘOV 2050 ROAD MAPPING PROCESS TO CLIMATE NEUTRALITY



Figure 1: MOBILITAR research, analysis & co-design coordinated by Brasov Design Centre

The current state of limited energy resources has compelled political decision-makers to take action towards prioritizing policies that support efficient solutions and technologies. We must decrease our reliance on fossil energy consumption and increase support for renewable energy source (RES) projects in both public and private sectors. By backing an ambitious roadmap towards a sustainable community, we can work towards a brighter future.

Agency of Brașov for Energy Management and Environment Protection (ABMEE) invited Brașov citizens to engage in dialogue, analyzing bottlenecks and identifying necessary changes. In doing so, we hope to inspire citizens to join in supporting the efforts of the public administration on the path to climate neutrality.

SHORT PORTRAIT

Brașov is the capital of Brașov County and is located in central Romania. It is a popular tourist destination known for its historical attractions, Renaissance architecture, and green spaces. The city is surrounded by the Carpathian Mountains, and Tâmpa Mountain lies in the southern part of the Eastern Carpathians, almost entirely surrounded by the city. Tiberiu Brediceanu Park, at the foot of Tâmpa, is ideal for relaxing walks and other outdoor activities.



SIZE

237,589 inhabitants (metropolitan area 371,802 residents), surface 267.3 km², density approx. 94,2 loc/kmp.

CITY'S EMISSION REDUCTION TARGETS

In 2021, Brașov aligned its commitments to the Green Deal and renewed its Covenant of Mayors pledge, aiming to reduce CO₂ by 55% before 2030 and reach climate neutrality by 2050.

EMISSIONS (TOTAL)

1.388.956 MWh/year to be reduced by 2030

LEAD INSTITUTION/ACTOR

Brașov Municipality & ABMEE — Agency of Brașov for Energy Management and Environment Protection

INTERNAL AND EXTERNAL PARTNERS

Cities of TOMORROW — Brașov (Romania), Brest (France), Dublin (Ireland), Mouscron (Belgium), Nis (Serbia), Valencia (Spain), Energy Cities - a network of 1 000 local governments in 30 countries and DRIFT — a research institute in the field of sustainability transitions.

DURATION/TIME PERIOD

01/09/2019 – 31/08/2022

FUNDED BY

Horizon 2020

OBJECTIVE/VISION

TOMORROW project aimed at empowering local authorities to create low-carbon, resilient, and livable cities. Six cities develop 2050 transition roadmaps with citizens and stakeholders. Braşov aimed at developing SECAP, involving civil society, and creating a roadmap to climate neutrality by 2050, focusing on energy sufficiency, circular economy, awareness, and reducing CO₂ impact.

ACTIVITIES

Efforts focused on developing the 2030 SECAP, using various methodologies such as stakeholder mapping, X-Curve, reflexive thinking, participatory co-design, empathy maps, role-playing, ideation, co-creation, and prototyping.

Transition Team: Braşov, a TOMORROW pilot city, has formed a team dedicated to Energy Transition and Climate Neutrality. The Transition Team covers strategic areas and aims to reduce CO₂ emissions towards climate neutrality by involving citizens in the process. It includes representatives from various organizations and professionals in architecture, communication, technology, sociology, and economics.

Braşov 2050 Roadmap: Focus groups were developed to hear the citizens' opinions and reveal what they want and need for Braşov 2050. The gathered opinions align with the priorities of the 2030 SECAP for Braşov 2050. Citizens' ideas are incorporated into the SECAP sectors under the municipality's authority, along with private-sector projects identified by the transition team.

Green Cities Forum: ABMEE invited Braşov citizens to discuss how to support the public administration's efforts to achieve climate neutrality. Participants reflected on maintaining Braşov as a Green City, envisioning Braşov in 2050, addressing current air quality problems, proposing solutions for climate neutrality by 2050, and supporting local actors to overcome identified challenges. Certain solutions with a high potential for CO₂ reduction were included in Braşov SECAP.

FINANCING

Approx. EUR 148 000 funded by the Horizon 2020 Programme of the European Union.

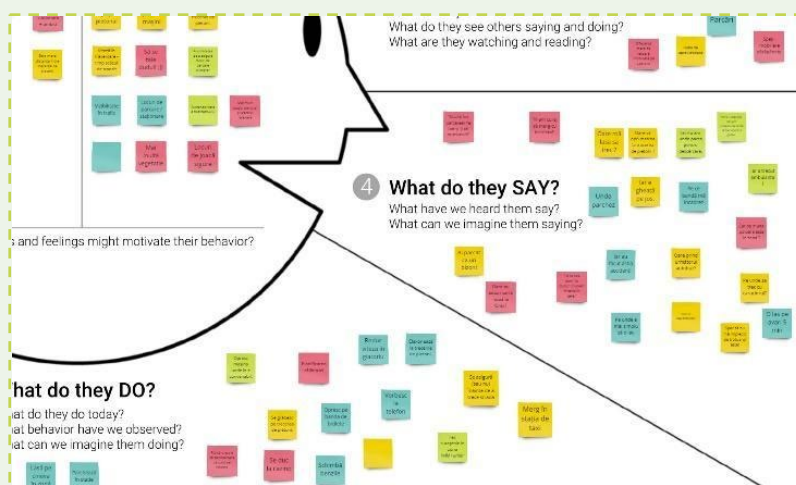


Figure 2: Braşov Empathy Map

ACHIEVEMENTS

The TOMORROW project's assessment of RES production for public institutions helped turn a vision into a project. It contributed to the community's 2030 targets and resulted in 27 schools benefiting from self-produced electricity, saving 22,836 MWh and reducing 19,744t of CO₂. The project evaluated public buildings as a vital part of SECAP, and its long-term retrofitting strategy formed the basis for municipal investments in the sector during 2021–2022. The project also created a roadmap to 2050 Climate Neutrality for municipal investments in public buildings.

RESULTS OF THE ENGAGEMENT PROCESS

Braşov Municipality engaged citizens, civil society, and local public administration to identify collective actions for energy transition and climate neutrality. The process involved 53 participants and 35 civil servants/experts. Additionally, 38 citizens and 2 experts participated in 6 focus groups, and 412 citizens and 2 experts participated in surveys. This engagement process helped develop plans and ideas for a better and cleaner future.

SUCCESS FACTORS

Engaging decision-makers from the beginning, continuously communicating progress and outcomes, and developing databases for tracking energy consumption were critical success factors. By prioritizing projects and communicating with citizens, we gained their support and involvement in developing the 2050 Climate Neutrality Roadmap, promoting a new way of thinking and planning with citizens' needs at the forefront. These efforts have inspired us to work towards a sustainable future, one where we prioritize the health of our planet and the well-being of all its inhabitants.

CASE STUDY CONTACT/FURTHER INFORMATION

ABMEE, office@abmee.ro, www.abmee.ro

<https://www.citiesoftomorrow.eu/what-tomorrow/>

<https://www.abmee.ro/proiect/tomorrow/>

<https://www.abmee.ro/echipa-de-tranzitie-a-municipiului-Braşov/>

INTEGRATION OF SECAP INTO SPATIAL PLAN, LUŠČIĆ, KARLOVAC



Figure 3: City of Karlovac

This case study describes the integration of SECAP into the spatial plan of the Lušćić district of the city of Karlovac, a pioneering pilot project aimed to decarbonize city districts by incorporating energy and climate aspects into the spatial plans.

SHORT PORTRAIT

Karlovac, located in the heart of Croatia, is known for its strategic geographical position and rich history. As a significant transportation hub, it serves as a gateway to numerous tourist attractions. Karlovac is situated at the confluence of four rivers and surrounded by forests and parks, making it a green oasis in the heart of Croatia. 64% of the city area is forest and agricultural land, 16% is land under water, and the rest is built area or building land.



SIZE

49 377 inhabitants (2021), 401 km² and 123 inhabitants/km²

TARGETS

At least 40 % reduction by 2030

EMISSIONS

113 677,79 tCO₂ (SECAP, for year 2014)

LEAD INSTITUTION/ACTOR

City of Karlovac

INTERNAL AND EXTERNAL PARTNERS

North-West Croatia Regional Energy and Climate Agency (REGEA)

DURATION/TIME PERIOD

2022

FUNDED BY

Interreg Europe project LC DISTRICTS

OBJECTIVE/VISION

The integration of SECAP into the spatial plan of the Lušćić district was a pioneering pilot project under the Interreg Europe LC DISTRICTS. The primary objective was to take significant strides towards decarbonizing city districts by incorporating energy and climate components into the spatial plans. Unlike SECAPs and other strategic documents, urban plans are mandatory in nature. Once the measures from SECAP are seamlessly incorporated into the spatial plan, they transcend mere recommendations and assume the status of obligations for all stakeholders involved.

The initial phase involved conducting a comprehensive analysis of the area and generating a guidance document. This document presented the relevant measures from SECAP that needed to be incorporated into the spatial plan alongside a detailed guide on how to implement these measures. This crucial task was successfully undertaken by REGEA. Subsequently, REGEA collaborated closely with various entities including city offices, city-owned companies, academic institutions, business organizations, and NGOs to facilitate the implementation of the recommended energy and climate elements into the spatial plan.

Upon the completion and acceptance of the updated spatial plan by the City Council, the Lušćić district proudly secured the distinction of being the first low-carbon district in Croatia.

LESSONS LEARNED

The successful integration of SECAP into spatial plans hinges on the widespread acceptance and active engagement of the city and relevant stakeholders involved in the process.

SUCCESS FACTORS

District analysis, relevant measures, stakeholder cooperation, integration

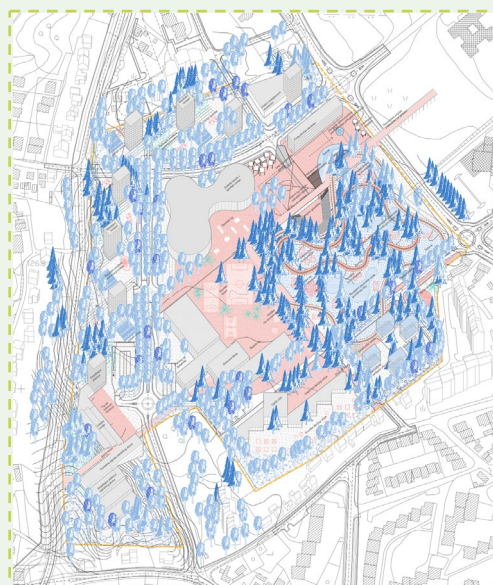


Figure 4: The final proposal of the Lušćić spatial plan.

CASE STUDY CONTACT/FURTHER INFORMATION

North-West Croatia regional Energy and Climate Agency (REGEA), info@regea.org

<https://www.karlovac.hr/urbanizam-zastita-okolisa/prostorni-planovi-92/u-izradi/upu-luscic-centar/14297>

1.3. PARTICIPATION AND STAKEHOLDERS' ENGAGEMENT

INTRODUCTION

While there's widespread scientific agreement on human-driven climate change, addressing this complex issue remains a challenge. Disinformation, often fueled by special interest groups and even some experts, is prevalent (Brody, Godschalk & Burby, 2003). Common climate misconceptions, such as the belief that Earth's climate has always changed, the notion that plants needing carbon dioxide means global warming isn't

a concern, or the idea that global warming isn't real because of localized cold regions, are debunked. Debunking these myths underscores the urgent need for action and information sharing (WWF, n.d.). To combat climate change effectively, we must collaborate and provide citizens with comprehensive data and information for informed decision-making.

The idea that 'public participation recognizes that everyone has something important to say and gives everyone a voice' emphasizes the importance of including diverse perspectives in decision-making processes. Over the past few decades, there has been a shift from a dominance of scientists and technical experts in discussions on environmental change to a more inclusive approach where the private sector and civil society also play a significant role in providing new, vocal, and innovative perspectives (UNFCCC, n.d.b).

Political institutions need to take climate mitigation measures based on democratic processes. This entails consulting citizens and other stakeholders. Public participation is crucial for long-term climate strategies for a variety of reasons, such as ensuring transparency in decision-making, promoting openness of governance, and giving the public a sense of ownership over the decisions. Engaging the public in climate action helps build trust, inclusivity, and accountability in the pursuit of sustainable solutions.



Participation stimulates society to be more engaged in the decision-making processes that impact the local community. Furthermore, in the matters of environment, climate, air, water, resources, our lives and our future, decisions and measures can no longer be dictated by authorities, rulers or leaders. Major common efforts coming from administrations, the private sector, academia and civil society are indispensable both in terms of resolutions and commitments, as well as in daily individual choices and unprecedented changes in every step thereafter (Ammann & Bousat, 2023).

The European Commission emphasizes the significance of maintaining stable, long-term strategies to accomplish economic transformation and broader sustainable development objectives. Additionally, it underscores the importance of aligning these strategies with the long-term goal outlined in the Paris Agreement, which aims to restrict the global average temperature rise to well below 2°C above pre-industrial levels, with a strong effort to keep it within the 1.5°C threshold (UNFCCC, n.d.a).

EU primary law (the Treaty on the Functioning of the European Union, consolidated Provisions on Democratic Principles art. 10, 11) **contains a strong commitment to civil society participation**. Moreover, the Aarhus Convention, which the EU ratified in 2005, provides that **the public must be able to participate in environmental law-making**.

According to the Maastricht Recommendations on Promoting Effective Public Participation in Decision-making in Environmental Matters prepared under the Aarhus Convention (2015): 'Allowing the public **to express its views and requiring public authorities to take due account of those views in the decision enhances the accountability and transparency of environmental decision-making and may strengthen public support for the decisions taken.**'

The following section presents definitions, explores various types of participation processes, and provides examples of relevant participation methods from different EU countries for the inclusive design of LLCs.

Box 1: What is public participation?

Active public **participation is the main key that can assure a better quality of decision-making**. This process is an important source of additional, customized information at the local level to provide valuable assistance in making the most informed decisions.

Public participation **enhances the quality and effective implementation** of decisions concerning the environment.

When all the stakeholders are part of the process it's a clear **improvement for policy implementation by increasing the legitimacy** of the decision-making process and, in so doing, reducing conflict. Case studies, various experiences and specific studies have demonstrated that, even when the public accepts or does not make a decision, they see **the decision-making process as fair** when they are directly involved.

IMPORTANT CONSIDERATIONS FOR DESIGNING PARTICIPATORY LLCs

There is no universal approach to participatory climate action nor should such an approach exist. Various tools and methods can help overcome structural and personal obstacles hindering meaningful engagement in climate action. However, selecting the appropriate method based on the specific objective is crucial. What's equally important is the process's effectiveness, as this is what ensures positive social and environmental results. Public participation is a valuable process when striving towards climate neutrality. To achieve the desired impact, engagement must be conducted in a meaningful manner (Andersson & Kambli, 2020).

Participatory policy making means involving individuals or groups in the various stages of policy development to ensure accountability, transparency, and active citizenship as part of the policy cycle (Michels & De Graaf, 2010). Similarly, participation in law-making involves unelected individuals or groups in decision-making processes, which is particularly important in environmental and climate law. The Aarhus Convention stresses the importance of early public participation in such matters (Rauschmayer, Paavola & Wittmer, 2009).

For participation to be democratic, it must ensure equal representation and inclusive consultation. Environmental and climate issues involve conflicting interests, making



consultations crucial for political compromise. The term 'stakeholder' in climate change studies refers to various actors such as policy makers, scientists, and communities. Stakeholders from both the public and private sectors can collaborate to understand and address climate issues (UNFCCC, n.d.a).

By applying good governance principles such as inclusivity and transparency extends the Local LLCS process to involve society at large. The European Commission also considers participation to be a key principle of good governance in its efforts to reform the EU and rebuild citizens' trust (European Commission, 2001).

TOWARDS EFFECTIVE PARTICIPATION IN THE DESIGN OF LLCS

Limited policies and planning tools hinder citizen participation in climate action. This structural obstacle restricts citizens from actively engaging in climate change adaptation and planning efforts. While engagement and participation are crucial to addressing climate change, traditional methods such as limited discussions and sporadic public meetings are no longer adequate. Several approaches can be implemented and adapted to effectively address these issues:

1 DELIBERATIVE EVENTS: These events showcase citizens' active role in decision-making and consensus-building processes on complex issues like climate change. An example is the Citizen Involvement in Nantes, France (see box 2).

2 PARTICIPATORY BUDGETING: This involves community members in making decisions about the distribution of public funds. This approach has been recognized for engaging citizens in local governance and decision-making. For instance, Participatory Budgeting in Brasov, Romania. (see box 5).

3 CONSTRUCTIVE DIALOGUE AND PARTICIPATORY PROCESSES: To empower citizens and enable them to bring about change, constructive dialogues and participatory processes are equally essential. The French Citizens' Convention for Climate (CCC) is a case in point (see box 3).

4 CITIZEN SCIENCE: It empowers citizens to exercise their influence. Citizen science provides an avenue for individuals to be heard and make a difference (Andersson & Kambli, 2020).

While **participation revolves around those who take part (the participants), consultation focuses on the act that triggers participation.** This distinction is relevant because soliciting participation usually means defining the terms (and therefore the design) of the participation in question. To be fruitful, **consultations must enable participants to understand the issue at hand, to submit feedback and to understand how their submissions were processed.** Stakeholder engagement approaches range from rather passive interactions, where stakeholders provide information, to ‘self-mobilization’, where the stakeholders themselves initiate and shape the process. At the stage of formulating an LLCS, stakeholders can determine the scope of the issues of interest and identify the links between climate and the sector or region under consideration. They may consider the future climate and socio-economic scenarios and discuss these implications for the sector or region. They may undertake a cost-benefit analysis, or other evaluation and prioritization processes for the adaptation measures suggested to assess the feasibility of implementing such measures (UNFCCC, 1992).

Box 2: Citizen Involvement in Nantes, France

The metropolis of Nantes turned the energy transition into an opportunity to work on the future of its territory by **opening the energy debate and enabling the collaboration between citizens, municipalities, companies, NGOs and other stakeholders.** In 2014, Mayor Johanna Rolland and 23 fellow mayors in the Metropolitan Council decided to mobilize a broad range of stakeholders to co-create a common vision to accelerate the energy transition. On April 29, 2016, the council unanimously voted to develop ‘Le Grand Débat’ (The Great Debate), taking local stakeholders’ perspectives into account and promoting initiatives related to the energy transition (TOMORROW Project, n.d.).



DELIBERATIVE LOCAL CLIMATE ASSEMBLIES

Climate action has emerged as a central focus in citizens' assemblies acting as a link between deliberative democracy and addressing climate change. Deliberative democracy is considered a valuable approach for overcoming challenges (Dryzek & Stevenson, 2011; Burnell, 2012; and Baber & Bartlett, 2021). Notably, climate assemblies foreground a critical examination of the role of experts in deliberative democracy. Given the enormous scale and technical complexity of the climate crisis, the contribution of experts is recognized essential for informed citizen deliberation. More specifically, experts' contributions can serve as a 'selectively convergent' foundation for judgment, fostering trust among citizens (see box 3), (Giraudet et al., 2022). However, to reap these benefits, the interests of the experts must be made transparent and their interaction with citizens must be carefully monitored.

Box 3 : French Citizens' Convention for Climate (CCC)

- ✎ This is the largest-scale experiment to date with climate assemblies to reduce France's carbon emissions by 40% compared to 1990 in the spirit of social justice. Duration: 9 months, 2019–2020. Funding: EUR 6.7 million.
- ✎ 150 randomly selected citizens designed to be representatives of the French public across six demographic dimensions: Gender, age, socio-economic background, education level, location type, and province.
- ✎ The implementation was led by the Economic, Social and Environmental Council (CESE), at the initiative of the President of the Republic of France.
- ✎ Nine months later, the selected participants submitted 150 policy proposals, including the criminalization of ecocide, the reduction of VAT on rail tickets, the regulation of advertising on polluting products, and banning domestic flights on journeys that can be done by train in under four hours, some of which have been included in a new law (Convention Citoyenne pour le Climat) following intense parliamentary debate.

Deliberative local climate assemblies **involve randomly chosen lay citizens invited to come together, deliberate, and produce policy recommendations**. Citizens' assemblies are a specific form of deliberative assemblies involving a sufficiently large number of participants and lasting long enough for them to submit policy proposals to government representatives or elected authorities (Giraudet et al., 2022), (see box 4).

Box 4: Local Climate Assemblies

There have been local climate citizens' assemblies in Amsterdam, Barcelona, Berlin, Brussels, Budapest, Frankfurt/Main, Glasgow, Kawasaki, Cracow, Lisbon, Paris, Stuttgart and Vienna, in the Swiss Canton Geneva as well as in the US State of Washington, among others.

Climate assemblies are currently running in the London Borough of Barnet and the English city of Blackburn with Darwen, in Lodz, Poland, in Vienna and Wattens/Volders, Austria. Likewise, such **citizens' assemblies on climate policy** are planned in Southampton, England, in the French city of Bordeaux, in the Italian cities of Bologna and Bolzano in the state of South Tyrol, in the Austrian cities of Ferlach and the Austrian regions Kaunergrat, Leutasch/Reith, in the Dutch cities of Rotterdam and Zwolle, as well as in the German city of Edermünde (Bürgerrat, 2019).

PARTICIPATORY BUDGETING

Under this mechanism, a municipality allocates part of its annual budget to projects proposed by citizens to improve their community, be it a street, a neighborhood or a larger area. The public administration's responsibilities include informing citizens about the mechanism, guiding them through the process, and assessing the feasibility of the submitted projects. Eligible projects undergo a voting process, and the projects with the highest votes receive the corresponding budgets. **It's important to note that the objective of participatory budgeting is not to distribute funds directly to citizens as in a grant program. Instead, the aim is to involve citizens in a dialogue about their living area, to show them ways of utilizing the space and to encourage their contribution to its development. Unlike some EU Member States where participatory budgeting is legally regulated, its implementation is not yet regulated at national level in countries such as Romania. Its prevalence and effectiveness depend on the local leadership it. It**



is currently being practiced successfully in cities such as Bucharest, Cluj-Napoca, and Brasov (see box 5).

Box 5: Participatory Budgeting in Brasov, Romania

The process is based on the joint approach of a participatory role in defining and addressing the problems of Brasov's community, with the aim of:

- ✔ Adapting local public policies to the needs and expectations of citizens;
- ✔ Increasing the degree of ownership of the urban development process;
- ✔ Strengthening democracy by involving citizens in the decision-making process;
- ✔ Increasing the transparency of the local public administration activity.

The participatory budgeting committee is formed by **Brasov Mayor** (1), **specialists from the administrative apparatus in areas such as technical, procurement, architecture, urban planning, legal, economic or community relations** (2), **members of the Local Council** (3) and **representatives of the civil society** (4) and/or **independent experts** (5). The committee verifies whether the citizens' proposals comply with the standards of the participatory budgeting regulation and other legal regulations in force. The committee analyses the technical and financial feasibility of each project proposal.

To be eligible and feasible, proposals should:

- ✔ Be assimilated to an expenditure of Brasov Municipality competence;
- ✔ Concern premises or assets under Brasov Municipality administration;
- ✔ Not fall in the scope of other programs/investments carried out by the Municipality;
- ✔ Not be incompatible with plans, projects or strategies the Municipality implements;
- ✔ Not be commercial, promotional, political or discriminatory;
- ✔ Be delimited spatially and fall within the max. EUR 100 000 per project;
- ✔ Have a realistic budget in line with the market offers, detailed by types of expenditure (Braşov City Hall, 2024)



Figure 1: Waechter Grenoble Community discussions

Box 6: Summary

- ✦ The EU's primary law and the Aarhus Convention mandate public participation in environmental law-making. The Maastricht Recommendations emphasize that considering public views enhances transparency and accountability, and can increase public support for decisions made.
- ✦ Participatory LLCS are a powerful tool to achieve climate neutrality. To make a real difference, engagement with stakeholders must be conducted meaningfully and effectively. Good governance principles like inclusiveness and transparency allow the Local LLCS process to extend its reach and involve society at large. By working together through Participatory LLCS, we can build a better future for ourselves and for generations to come.
- ✦ Limited supportive policies, regulations, and planning tools (at the national level) restrict citizens from actively participating in climate change adaptation and planning efforts and implicitly in designing LLCS. However, various approaches, including Deliberative Events, Participatory Budgeting, Constructive Dialogue, and Citizen Science, have already been tested and implemented in different European cities and can be adapted and implemented elsewhere.
- ✦ Incorporating principles of inclusivity and transparency into the Local LLCS process is crucial for engaging the wider community and ensuring its participation. By doing so, we can create a governance system that is truly representative of all stakeholders involved.



VISION WORKSHOP IN SZTUM AS AN INSPIRING EXAMPLE OF COLLABORATION ON CLIMATE NEUTRALITY



Figure 2: The city of Sztum

The city of Sztum, Poland has been implementing several climate-friendly activities — starting with the use of wind and solar energy in the city and municipality, and support of energy production from renewable sources in 125 households, through joining the new Covenant of Mayors, developing the Climate and Energy Action Plan and the Low Emission Programme, to creating a new position for the integrated city and municipality development and the implementation of numerous climate projects.

SHORT PORTRAIT

Sztum is an urban-rural municipality located in the Pomeranian Voivodeship. It covers an area of 181.06 km², which accounts for almost 25% of the total area of Sztum County. The population density is 101 persons/km², which is higher than in other municipalities of the County. In the area of Sztum municipality, subsistence farming and family farms are developing dynamically (in terms of their number and level of advancement).



CITY'S EMISSION REDUCTION TARGETS (40% IN LINE WITH SECAP)

- 🌿 reduction in final energy consumption by 91 641 MWh
- 🌿 reduction of CO₂ emissions by 21 931 Mg
- 🌿 increase in the share of energy from RES by 15 173 MWh

EMISSIONS

2,16 Mg/year/per capita

LEAD INSTITUTION

The Association of Municipalities Polish Network "Energie Cités"

DURATION/TIME PERIOD

7th October 2021

OBJECTIVE/VISION

The idea behind the Vision Workshops is to bring together representatives of different groups (the general public, city administration, and/or schools) in their local context to make the concept of climate neutrality accessible to the population and to develop a common vision for a climate-neutral future. It is a suitable approach to generate more public participation on the topic of climate change. The results provide a valuable basis for developing or revising a long-term climate action strategy or the municipal mission statement. Individual components can also inform the work of respective departments (i.e., city planning, energy, transport, building construction).

ACTIVITIES

The interactive workshop format allowed the organizers to bring about the development of innovative, locally rooted visions for climate neutrality based on a varied, bespoke mix of methods and materials. The workshop is divided into 6 modules that are differently oriented, however, they share the overall goal of developing and presenting a shared vision by the end of the workshop. The tasks carried out during the workshop engaged different senses, encouraging creative thinking, empathy and engagement and helping participants to achieve a common goal.

FUNDED BY

The methodology and developed toolbox for organizing the Vision Workshop were part of the results of the Bridging European and Local Climate Action (BEACON) EUKI project and are available to a wide range of stakeholders. The town used accessible resources to organize the meeting.

CHALLENGES

The successful execution of this workshop depends on selecting the methods best suited to the local context, as well as timely and sufficient preparation by the organizers.

LESSONS LEARNED

The outcome can serve as a basis for the further development of the municipal climate strategy and increase the acceptance of related implementation measures. In addition, the workshop results can help to set priorities for local development and climate policies.

SUCCESS FACTORS

At the end of the workshop, the participants had the opportunity to present their results: The jointly developed vision for the future of the city along with the possible paths to climate neutrality, so that the conclusions could reach the widest possible audience. The participants actively worked on developing a shared vision of Sztum's climate neutrality, which they then presented.

CASE STUDY CONTACT/FURTHER INFORMATION

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<http://www.pnec.org.pl/en/3-aktualnoci-kat/799-warsztaty-wizyjne-w-sztumie-inspirujaca-wspolpraca-na-rzecz-neutralnosci-klimatycznej>

<https://www.euki.de/en/media/?cpt=publications&search=Vision%20workshop>

<https://www.youtube.com/watch?v=aIX9RxVwyNo>

IT IS EASIER TOGETHER: PARTICIPATION IN BUDAÖRS



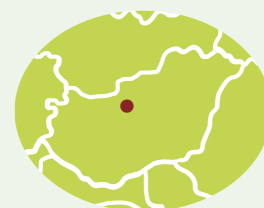
Figure 3: The city of Budaörs

The leaders of Budaörs realized early on that the involvement of different actors and stakeholders of the civil and service sector is essential when creating balanced, multi-aspect, bottom-up strategic documents, especially related to climate aspects that affect everyone's life and future.

By organizing a series of in-person meetings, public workshops and forums, and circulating questionnaires to gather information and suggestions from residents, Budaörs' leaders actively contributed to the involvement of the community's stakeholders from the very beginning of the process.

SHORT PORTRAIT

Budaörs is located in the suburbs of the capital of Hungary, Budapest. The town went through many significant changes after the regime change in 1989: The number of local businesses increased, and many multinational commercial and industrial companies settled in the city. Parallel to the economic growth, the town's population is constantly growing and the town regularly ranks among the richest towns in Hungary, which continuously creates new development and planning needs.



SIZE

29 119 inhabitants, 23,59 km²

CITY'S EMISSION REDUCTION TARGETS

40% CO₂ emission reduction until 2030

EMISSIONS

5,9 tCO₂/capita (2018)

LEAD INSTITUTION/ACTOR

Municipality of Budaörs

ADDRESSED ELEMENTS OF A LLCS/FOCUS

Participation, stakeholder involvement, bottom-up planning

INTERNAL AND EXTERNAL PARTNERS

Pro Regio Közép-Magyarországi Regionális Fejlesztési és Szolgáltató Nonprofit Kft., Energiaklub Climate Policy Institute, GreenDependent Institute; HBHE

DURATION/TIME PERIOD

2016–2022

FUNDED BY

Municipal and EU financial sources (European Union Cohesion Fund)

OBJECTIVE/VISION

In the 2010s, due to the continuous expansion of the town and the changes in external circumstances (e.g. market, economic, legislative conditions, more prominent environmental protection aspects), the urban development documents of Budaörs became increasingly outdated, so the city management considered, that the renewal of the Urban Development Concept, and a few years later, the development of a Sustainable Energy and Climate Action Plan and a local Climate Strategy were necessary.

A government decree states that the development of key documents such as these must be conducted in a manner that ensures that residents and other local interest groups are not only informed by the municipality, but also involved in the development process, as there is no effective climate protection without the **cooperation of local communities**. The Municipality of Budaörs has taken community involvement seriously and launched the new Integrated Urban Development Program (Budaörs Távlatok 2030 program) in 2016, based on these guidelines.

In addition to the aforementioned urban development concepts, climate-conscious strategic planning has also gained an increasingly important role in the city. In 2011, Budaörs joined the Covenant of Mayors community, and, in the following years, they developed a SEAP as one of the first settlements in Hungary. The SEAP was developed into a SECAP in 2020, in addition, they developed a Climate Strategy in 2021 and participated in the EUCLF's concept for the establishment of a Positive Energy District in 2022. In the case of all of these documents, it was necessary to actively involve residents, civil organizations and business sector representatives, to incorporate their opinions, individual plans and goals into these climate-related documents.

The programs and events for extensive partnership involvement throughout the creation of these climate-related documents were organized by a professional communications partner. This ensured efficiency and professionalism.

Various communication interfaces were used to facilitate adequate participation: The creation of a new municipal website to support the development of the local strategic documents; The provision of online questionnaires; In-person meetings (both professional and broader), The collection of suggestions via e-mail; Press conferences and public workshops, The creation of a SWOT analysis and a problem map, The organization of a focus group and roundtable discussions, etc.

At stakeholder workshops, where the creation of the problem map and the SWOT analysis took place, the participants came from different areas and backgrounds: Representatives of companies, employees of municipal institutions, managers of condominiums, external experts responsible for concept development, etc.

Note that, in addition to the prominent synthesizing and controlling role of the municipality throughout the process, one of the important conditions for successful community participation was the vibrant civic life of Budaörs: Nearly 150 civil organisations are present in the town.

Local climate strategy and action plan implementation is a very long and challenging process. The city's management wants to continue in the set direction, with active stakeholder involvement and community planning that supports the implementation of common interests and goals.

LESSONS LEARNED

'It's easier together'

- ✦ The more participants are involved in local strategy creation, the more they will feel that it belongs to them and will help its implementation.
- ✦ It is advisable to organize stakeholder involvement on as many levels as possible and target as many target groups as possible, to give space to different perspectives.
- ✦ For a municipality, the involvement of external experts (both from the communications sector and from the professional world) can be a great help for the appropriate level of stakeholder involvement, and in organizing the proposals.

SUCCESS FACTORS

- ✦ Deep involvement of citizens, municipal and business sector representatives and civil organizations in strategic planning, supported by:
 - ✦ a website,
 - ✦ collection and processing of proposals,
 - ✦ press conference,
 - ✦ stakeholder workshops,
 - ✦ SWOT analysis,
 - ✦ focus group roundtable discussions,
 - ✦ problem map.
- ✦ Bottom-up development of local strategic documents.
- ✦ Successful communication, mainly based on internal (municipal) personnel and financial sources.
- ✦ Setting 2030 climate goals and long-term climate goals.
- ✦ Planning of a Positive Energy District together.

CASE STUDY CONTACT/FURTHER INFORMATION

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<https://www.2030tavlatok.budaors.hu/>

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<https://www.budaors.hu/?module=news&action=show&nid=191872>

<https://www.budaors.hu/?module=news&action=show&nid=192773>

1.4. BASELINE SETTING AND ACTION PLANNING

A STARTING POINT AS A KEY TO PLANNING THE NEXT STEPS

As seen in previous chapters, every LLCS should incorporate key goals and a comprehensive vision. To achieve these goals, as a thorough baseline review is crucial to the development of the LLCS. Establishing such a review allows for the creation of a clear snapshot of 'where we are'—a depiction of the city's current climate neutrality status. This process aids in describing the city's starting position as it progresses toward the goal of achieving climate neutrality by 2050. A comprehensive baseline should rely on existing data, encompass relevant objectives, and incorporate appropriate action plans and monitoring strategies.

Planning activities assume a pivotal role in LLCS, closely aligned with the policies and measures necessary to attain the established objectives. It is, however, crucial to emphasize that planning constitutes just one step in the overarching process and should not be treated as an objective. Instead, it functions as a tool to efficiently implement the LLCS and realize the defined objectives.

A well-structured baseline enables the city to:

- 🌿 Outline the future appearance of the city in terms of the considered sectors.
- 🌿 Analyze current energy and climate actions, creating a systematic plan based on existing experiences but with an ambitious vision in mind.
- 🌿 Communicate and share the plan with stakeholders.
- 🌿 Translate this vision into practical actions, setting deadlines and budgets for each.
- 🌿 Serve as a reference during the implementation and monitoring process.

IDENTIFYING A STARTING POINT AND OTHER TIPS FOR ACTION PLANNING

A city's baseline is dependent on a variety of factors: Its economic structure, population dynamics, density, the characteristics of the building stock, use and level of development of the various modes of transportation, citizens' attitudes, climate, etc. It is useful to understand the influence of these parameters, how they change over time, and identify upon which the local authority can act – in the short, medium and long term (Borsboom-van Beurden et al., 2021).



The baseline review can be conducted internally within the local authority as part of a self-assessment process. Enhancing this self-assessment with an external peer review can add value and lend legitimacy to the evaluation. External experts from other local authorities or organizations with expertise in similar fields can conduct peer reviews. This method is cost-effective and is often a politically acceptable alternative to hiring consultants.

To create a comprehensive baseline for the LLCS, it is essential to consider and map current legislation, existing policies, plans, and instruments, and involve all departments and stakeholders. Completing a baseline review requires sufficient resources to collate and analyze the necessary data sets. This assessment is crucial as it enables the development of an LLCS that addresses the emerging issues and specific needs of the local authority's current situation (Borsboom-van Beurden et al., 2021).

The aspects to be covered in the baseline review can be either quantitative (evolution of energy consumption) or qualitative (energy management, implementation of measures, awareness). The baseline review makes it possible to prioritize actions and subsequently monitor the effects based on relevant indicators.



STEPS FOR CONDUCTING A BASELINE REVIEW (BORSBOOM-VAN BEURDEN et al., 2021)

- 1 Form a (preferably cross-sectoral) team, establish roles, timelines and a schedule.
- 2 Identify and engage key external stakeholders.
- 3 Identify key indicators to be included in the assessment. The following should be taken into account:
 - ✎ What are the energy consumption and CO₂ emissions of the various sectors and entities located in the local government territory, and what are the trends?
 - ✎ Who produces energy and how much? What are the most important sources of energy?
 - ✎ What are the impacts associated with energy consumption in the city (air pollution, traffic congestion)?
 - ✎ What efforts have already been made in energy management, and what results have they produced?
 - ✎ What barriers need to be removed?
 - ✎ What is the level of awareness among officials, citizens and other stakeholders regarding energy conservation and climate protection?
- 4 Gather output data by collecting and processing quantitative data, indicators and qualitative information through document review and interviews/workshops with stakeholders.
- 5 Write a self-assessment report. Be honest and truthful, because a report which does not reflect reality serves no purpose.



The effectiveness of defining measures tailored to each context relies heavily on the accuracy and thoroughness of the assessment of the current framework.

One of the key challenges in developing and implementing LLCS is the complexity of the city itself and the (decision-making) processes that need to be launched to change the current scheme. Potential solutions for the city need to be understood and barriers – such as the regulatory environment, decision-making processes and existing governance mechanisms – need to be overcome. This requires building and communicating a strategic and long-term vision for the city, envisioning funding scenarios and tools, and planning for multi-stakeholder collaboration while considering the local/regional/national environment. The action planning process often includes responding to the ‘why, what, when’ questions. The most important question, however, is how this is to be achieved.

In order to be able to successfully plan activities, it is worth asking the following questions and trying to find answers to them (Stacey, 2016):

- ✔ Why is the formulated strategy beneficial to the city?
- ✔ What is the economic rationale for the initiative or innovation?
- ✔ What solutions should be implemented?
- ✔ What actions should be taken?
- ✔ Which projects and plan elements are key?
- ✔ In what ways should solutions be implemented?
- ✔ What policies and business models should be introduced to implement the plan?
- ✔ Is the local government's capacity sufficient, or is a new organizational structure needed?



Who are the key stakeholders?

Having answered the above questions and understood the overall approach, the city will be able to prepare a coherent and comprehensive plan (Stacey et al., 2016).

Box 1: Key considerations

When planning the actions remember:

1. Explore Best Practices:

- Gain insights from successful examples that have achieved similar goals in comparable contexts. Identifying these practices can guide local authorities in determining effective actions and measures.

2. Prioritize and Identify Key Measures:

- Recognize that undertaking the entire list of potential actions may exceed current capabilities in terms of costs and project management. Therefore, a thoughtful selection of actions within a specific time frame is crucial. Conduct a preliminary analysis considering costs and benefits, even in qualitative terms.

3. Conduct Risk Analysis:

- Assess potential risks associated with the selected measures.

4. Develop a Schedule with clear Responsibilities, Budget, and Funding Sources:

- Establish a timeline outlining responsibilities, budget allocation, and funding sources for each activity.

5. Draft Plan of Measures:

- Create a comprehensive plan outlining the identified measures.

6. Confirm Measures and Budget for Actions:

- Allocate necessary resources in the annual budget. Ensure that all planned measures are well communicated to citizens and local decision-makers.

7. Review the Strategy:

- Initiate a cycle of continuous improvement by regularly monitoring and adjusting the plan accordingly (Stacey et al., 2016).

1.5. FINANCING THE STRATEGY

FINANCING THE STRATEGY

Developing a financing strategy is essential to achieving climate neutrality, as it ensures the availability and efficient allocation of the funding necessary for implementing the measures, making it vital for developing successful LLCS. Given that the measures for achieving climate neutrality, which will be planned in the LLCS, often require significant investment, a financing strategy can help identify the sources of funding required, including government subsidies, private investment, and international aid, and estimate the required amount of funding.

A financing strategy can also help identify the most cost-effective measures for achieving climate neutrality. By prioritizing measures based on their impact, feasibility and cost, a financing strategy can determine which measures will provide the greatest return on investment. This process can help to ensure that the available funding is utilized most strategically and efficiently. This chapter will briefly outline a few indispensable measures crucial for attaining climate neutrality while simultaneously providing a financial return.

Overall, developing a financing strategy is crucial to ensure that the necessary funding is available for developing and implementing measures for achieving climate neutrality and that those measures are implemented strategically and cost-effectively.

While the EU and its member states are currently the most significant contributors to public climate finance globally, the European Green Deal emphasized the need to mobilize private financial resources and capital influx towards green investments (European Council, n.d.). While the EU and its member states are currently the largest contributors to public climate finance globally, the European Green Deal emphasizes the necessity to mobilize private finance and capital inflows for green investments



(European Council, n.d.). In this context, the following 3 points are particularly important to keep in mind when developing a financing strategy:

1 THE EUROPEAN STRUCTURAL AND INVESTMENT FUNDS, which are available at Member State level, constitute the primary source for public authorities' capital investments.

2 THE EU FUNDING PROGRAMS also provide technical assistance, capacity building, and knowledge exchange for the preparation of investment projects, which can help improve the quality and impact of climate and energy-related projects.

3 ALTERNATIVE FINANCING AND PROCUREMENT SCHEMES present a viable solution for the private investors' mobilization and citizens' engagement in public projects.

STEPS IN CRAFTING A CLIMATE NEUTRALITY FINANCING STRATEGY: ESSENTIAL MEASURES FOR EMISSION MITIGATION

In the realm of climate change mitigation, the development of a robust financing strategy commences with a comprehensive understanding of the key measures crucial for attaining climate neutrality. These foundational steps are vital to effectively allocate resources and funding for a sustainable transformation. This section sheds light on the pivotal measures that form the framework of a strategic financing approach.

1 ENERGY EFFICIENCY: A Cornerstone of Emission Mitigation

Within the spectrum of emission reduction strategies, energy efficiency emerges as a cornerstone. By optimizing energy consumption across diverse sectors such as buildings, transportation, and industries, the potential for substantial emissions reduction is palpable. The energy-efficient measures can include upgrading insulation, installing efficient lighting and appliances, and optimizing transportation systems. For

example, by switching to more energy-efficient lighting products, a household can save around €30 per year (European Commission, n.d.a).

2 RENEWABLE ENERGY: Powering Sustainability

Another critical facet of climate neutrality rests upon renewable energy sources deployment. Investing in renewable energy sources such as wind, solar, hydropower, and geothermal can reduce dependence on fossil fuels, mitigate greenhouse gas emissions, and improve energy security. The 82% decrease in the cost of solar power over the period 2010–2020 further bolsters the EU's transition towards renewable energy. This cost reduction has positioned solar power as the most competitive source of electricity in numerous parts of the EU as such promoted the achievement of the EU's sustainability goals and its commitment to the European Green Deal (European Commission, n.d.b). The cost of renewable energy technologies has decreased significantly in recent years, making them increasingly competitive with traditional energy sources.

3 SUSTAINABLE LAND USE: A Catalyst for Change

The intricate interplay between land use and emissions is at the forefront when it comes to LLCS measures. Sustainable land use practices, including reforestation, afforestation, and better land management, offer a multifaceted approach to sequestering carbon and mitigating emissions. Furthermore, land use plays a substantial role in climate change mitigation by actively fostering sustainable management of forests and oceans as well as other terrestrial, coastal and marine ecosystems (United Nations Climate Change, n.d.).

By addressing each of these pivotal measures, we lay the groundwork for a financing strategy that takes into account not only emission reduction goals but also the strategic allocation of resources and funds, paving the way for a resilient and sustainable future.



While these measures serve as the first steps towards climate neutrality, achieving this goal will require the implementation of a diverse array of climate change mitigation and adaptation strategies, all of which are comprehensively detailed in Chapter 2 of this document.

EXPLORING FINANCING OPPORTUNITIES: THE SECOND PILLAR IN CRAFTING AN LLCS FINANCING STRATEGY

Having established an initial understanding of key emission mitigation measures (further developed in Chapter 3), the journey toward a comprehensive financing strategy transitions to a pivotal aspect: the exploration of financing opportunities. This section delves into the realm of funding opportunities within the European Union (EU), highlighting their strategic importance and the multifaceted advantages they offer.

Box 1: Important funding streams (Climate Adapt, n.d.)

- ✔ **LIFE Programme:** The EU's LIFE Programme focuses on environment and climate action, with a sub-program dedicated to climate change mitigation and adaptation. This funding avenue contributes to a shift towards sustainable, renewable energy-based, climate-neutral, and resilient economies.
- ✔ **Horizon Europe:** As a key funding program for research and innovation, Horizon Europe plays a pivotal role in addressing climate change. Public authorities can leverage Horizon Europe to access funding for innovative projects aimed at climate change adaptation and mitigation.
- ✔ **EU Cohesion Policy – European Regional Development Fund:** The European Regional Development Fund (ERDF) supports economic, social, and territorial cohesion within the European Union. In the 2021–2027 period, the ERDF enables investments in a greener, smarter, and more connected Europe. This funding stream allows public authorities to address climate change resilience through infrastructure projects, contributing to sustainable development.
- ✔ **Just Transition Fund:** The Just Transition Fund, a part of the Just Transition Mechanism, is designed to assist regions heavily affected by the transition to climate neutrality. It aligns with the goals of the Cohesion Policy and supports green and sustainable economic development. Public authorities can benefit from tailored support to promote climate action and mitigate the impacts of transitioning towards a carbon-neutral economy.

Annex 1 provides an overview of funding opportunities for cities and municipalities in the European Union. This information is intended to assist city officials and municipal administrators in identifying and accessing funding programs best suited to their needs, and is divided into key two project phases: The technical preparation and the financing of the capital investment. The funding programs listed in the table cover a broad range of areas, including environmental sustainability, social inclusion, economic development, and infrastructure.

In addition to the available EU funding opportunities, there are alternative financial tools and approaches to facilitate the financing of climate change mitigation and adaptation measures. Financial institutions are one of them. A significant example is the European Investment Bank (EIB) which offers a range of instruments and products to support sustainable initiatives. Notable offerings include the Municipal Framework Loans, which offer flexibility and support for various types of projects. These loans are tailored to meet the diverse needs of public entities, sovereign states, national agencies, local authorities, and public sector companies.

EIB's Municipal Framework Loans consist of two main possibilities:

- 🌿 **Investment Loans:** EIB provides dedicated loans for single large investment projects. These loans are instrumental in attracting other investors, as EIB's support serves as a quality stamp. The loans can cover up to 50% of the total project cost, and they are particularly valuable for projects with investment costs exceeding EUR 25 million.
- 🌿 **Multi-Component (Framework) Loans:** Framework loans are designed to finance multiple projects across different sectors, such as infrastructure, energy efficiency, renewables, transport, and urban renovation. These loans facilitate multi-annual investment programs, offering unmatched flexibility for cities and regions.



Additionally, EIB offers the **Public Sector Loan Facility** to address socio-economic challenges in territories heavily impacted by the transition to climate neutrality. This facility provides preferential lending conditions for projects that may not generate sufficient revenue to be financially viable. It combines grants from the EU budget with loans from the EIB, reducing the financial burden for beneficiaries and enhancing the attractiveness of investments. This facility specifically targets public entities and aligns with the Just Transition Mechanisms goals.

Finally, since the European Green Deal emphasizes mobilizing private financial resources for green investments in addition to public funding, there are some innovative approaches that public authorities can use to fund and deliver infrastructure projects. Those are called Alternative Financing and Procurement schemes and often involve collaboration between the public and private sectors to meet infrastructure needs more efficiently. The following are the most significant examples:

1 CITIZEN COOPERATIVES:

Joint ownership by citizens in renewable energy (RES) or energy efficiency (EE) projects. Members buy shares and profit from local projects, often gaining the opportunity to buy electricity at a fair price.

2 CROWDFUNDING/INVESTING MODELS:

Internet-based platforms pool resources for sustainable energy projects, offering donations, rewards, loans, or equity participation.

3 ENERGY PERFORMANCE CONTRACTING (EPC):

External Energy Service Companies (ESCOs) fund energy upgrades using cost savings. Income from savings or renewable energy repays project costs, ensuring ESCOs receive payment upon achieving expected energy savings.

4 GREEN AND SUSTAINABLE MUNICIPAL BONDS:

Investors lend money to entities for projects at fixed/variable rates. Green bonds fund eco-friendly investments, complying with standards like the EU Green Bond Standard or Climate Bond Principles.

5 ON-BILL FINANCING:

Energy efficiency improvements are financed through utility bills. Energy suppliers collect loan repayments via bills, making sustainable energy investments accessible.

6 SOFT LOANS, GUARANTEES:

Soft loans: Low-interest, longer-term loans with added advantages (grace period, lower costs);

Loan guarantees: Covering first losses of non-payment, incentivizing energy renovation. ESCO portfolio guarantees reduce payment risks, lowering overall financing costs.

Box 2: Useful resources

Commission, unites thousands of local governments committed to ensuring a brighter future for their constituents. By joining the initiative, they voluntarily commit to implementing EU climate and energy objectives.

Within the Covenant of Mayors' online platform, an array of valuable resources is available to support cities in their endeavors. Among these resources, you can find a comprehensive list of funding opportunities, each accompanied by detailed information and relevant links, all designed to assist cities in their sustainable development efforts.

More information available at: https://eu-mayors.ec.europa.eu/en/resources/funding_guide



"GREEN SCHOOL" IN THE FORMULA OF PUBLIC-PRIVATE PARTNERSHIP IN PIASTOW



Figure 1: The city of Piastow

Piastow, Poland is one of the youngest cities in Mazovia, located in the Mazovian Lowlands, 14 km from the center of Warsaw. Piastow is a typical sub-capital area, a city dependent on the life rhythm of the Warsaw agglomeration.

SHORT PORTRAIT

Piastow is the smallest municipality in the Masovian voivodeship in terms of area (5.76 km²) and at the same time the most densely populated (3,934 people/km²). The city is part of a compact complex of the capital agglomeration.



CITY'S EMISSION REDUCTION TARGETS

- 🌿 reduction in final energy consumption by 16.982,13 MWh
- 🌿 reduction of CO₂ emissions by 6.105,99 Mg
- 🌿 increase in the share of energy from RES by 1.511,43 MWh
- 🌿 reduction of PM₁₀ dust emissions by 1,32 Mg
- 🌿 reduction of PM_{2.5} dust emissions by 1,18 Mg
- 🌿 reduction of benzo(a)pyrene emissions by 1,56 Mg

EMISSIONS

110.043,89 Mg/year

LEAD INSTITUTION

City of Piastow (public partner), Warbud S.A. (private partner)

DURATION/TIME PERIOD

Investment in 2019–2020, public-private contract period until 2041

FINANCING

Own contribution in public-private partnership

OBJECTIVE/VISION

The redevelopment and extension of the Adam Mickiewicz High School premises were a particularly important investment for Piastow. The city authorities strive to make its surroundings ever more resident-friendly and to be both a good place to live and to provide an appropriate range of top-quality public services. Education is one of the priorities of the local authority. The redeveloped school building became a part of the sustainable building concept, benefiting owners, users, and residents through reduced operating costs, improved indoor air quality and reduced energy consumption. This site is intended to be environmentally friendly and energy efficient.

ACTIVITIES

The initiative was implemented as a public-private partnership (PPP), i.e., based on a long-term agreement dividing tasks and risks between the public entity and the private partner. As part of the joint implementation of the project, the private partner undertook to finance and execute construction works in the form of the reconstruction and extension of the high school and the construction of a sports hall along with landscaping and infrastructure. Once the civil works have been completed, the private partner is responsible for providing technical infrastructure maintenance and energy management services.

FUNDED BY

The private partner has financed and executed construction works and expansion of the high school and the construction of a sports hall with landscaping and infrastructure. The private partner is also responsible for providing technical infrastructure maintenance and energy management services. According to the project's financial assumptions, the public entity will pay remuneration to the private partner in the form of a so-called availability fee. The final remuneration structure will be determined in the course of the competitive dialogue. The investment has not been subsidized by any additional sources.

GROSS VALUE OF CAPITAL EXPENDITURES OR SERVICES

EUR 1.963.180

CHALLENGES

The preparation an appropriate contract between the entities regulating the obligations of the parties has proven to be a major challenge. Here, attention must be paid to appropriate provisions relating to, for example, price increases for materials and to how the facility is to be managed by the private party until the end of the contract. A serious problem for every local authority is the need to repay the value of the investment (construction and assembly work) and the repayment of the loan taken out for this investment by the private partner, which is passed on to the local authority.

LESSONS LEARNED

The solution applied in Piastow allowed the implementation of an investment that would not otherwise have been possible to implement in such a short time due to the numerous expenses of the local government. PPP is an interesting and effective tool that is worth using when planning the development of cities and municipalities.

SUCCESS FACTORS

The modernized building and the new facilities make full use of renewable energy sources and meet high energy efficiency ratings. A PV system was installed to generate electricity and heat pumps to generate heat, as well as modern ventilation with an air filtration system.

CASE STUDY CONTACT/FURTHER INFORMATION

Piastow City Council, 11 Listopada 2 street, 05-820 Piastow, e-mail: sekretariat@piastow.pl, phone: 22 770 52 07

<https://www.ppp.gov.pl/przebudowa-i-rozbudowa-liceum-ogolnoksztalcacego-im-adama-mickiewicza-oraz-budowa-hali-sportowej-w-piastowie/>

KRIŽEVCI SOLAR ROOFS AND THE ESTABLISHMENT OF KLIK



Figure 2: City of Križevci

The City of Križevci is situated on the slopes of the Kalnik Mountain. The landscape is characterized by rolling hills and fertile agricultural land. It takes pride in its green spaces, with several parks and recreational areas scattered throughout the city.

SHORT PORTRAIT

Like other rural areas of Croatia, Križevci experiences depopulation and an ageing population. It benefits from its proximity to larger urban centers like Zagreb, which provides additional opportunities for employment and access to services.



SIZE

19.052 inhabitants (2021), 263,72 km² and 72,24 inhabitants/ km²

TARGETS

At least 40 % emission reduction by 2030

EMISSIONS

37 845,62 tCO₂ (SECAP, for year 2010)

LEAD INSTITUTION/ACTOR

City of Križevci

INTERNAL AND EXTERNAL PARTNERS

ZEZ, KLIK

DURATION/TIME PERIOD

2018–2022

FINANCING

Crowdfunding

OBJECTIVE/VISION

The first citizen investment project as part of a municipal initiative, which is the only one of its kind in Croatia, was launched in 2018 by the City of Križevci and the Green Energy Cooperative. The investment went towards the installation of a solar PV system on the roof of a public facility. The project was named 'Križevački sunčani krovovi' (Križevci Solar Roofs). Citizens were given the opportunity to finance the installation of the EUR 30.530 worth power plant on the roof of the Development Centre and Technological Park in Križevci by granting loans for a period of 10 years, during which time their investment will be returned at an interest rate of 4.5 per cent. The minimum investment was EUR 133, while the maximum was EUR 1 330. Following the announcement of the campaign, the required amount was raised in just ten days, and the response from citizens was truly exceptional. The installed power station has a capacity of 30 kW and is estimated to save EUR 4 778 in electricity costs.

The main driver and initiator of the project was the Green Energy Cooperative (ZEZ), with the support of the 'Start Something of Your Own' program and the partner organization REA Sjever, which prepared the feasibility study for the 30 kW photovoltaic power plant through the COMPOSE project, funded under the Interreg MED program. The campaign was conducted with the support of Greenpeace, Terra Hub, and the City of Križevci. The project received support from the European Federation of Energy Cooperatives (REScoop.eu) and the European Association of Cities, Energy Cities.

In 2019, Križevci carried out another collective investment, this time for the installation of a photovoltaic power station on the roof of the 'Franjo Marković' City Library in Križevci. The value of this power plant was EUR 22 830, and the required amount was raised in a record two days. It was also fully financed by citizens through microloans.

As a result of the Križevci Solar Roofs, ZEZ helped create KLIK, a new local energy cooperative and Croatia's first citizen energy cooperative. KLIK is the main driver and supporter of changes in the city that lead towards the vision of making the city the best place to live. It was established to contribute to developing an energy-independent city and the transition toward a climate-neutral city.

LESSONS LEARNED

Citizen Engagement: Providing opportunities for citizens to contribute and participate in renewable energy projects fosters a sense of ownership and promotes sustainable practices within the community.

Microloans and Collective Investment: The utilization of microloans and collective investment models can be an effective strategy for raising funds for renewable energy projects.

Collaboration and Partnerships: The collaboration between the City of Križevci, the Green Energy Cooperative, and other partners, such as the Compile project, demonstrates the value of partnerships in implementing sustainable energy initiatives.

SUCCESS FACTORS

Involvement of citizens. microloans

CASE STUDY CONTACT/FURTHER INFORMATION

North-West Croatia regional Energy and Climate Agency (REGEA), info@regea.org

<https://www.zez.coop/krizevacki-suncani-krovovi/>

<https://www.zadruga-klik.hr/o-nama/>

1.6. MONITORING & EVALUATION

INTRODUCTION

In the ongoing journey towards achieving local climate neutrality, it is crucial for municipal leaders and experts to periodically assess their progress. This review helps them understand the extent to which they have attained local emission reduction targets. By doing so, they can pinpoint areas that need improvement and make informed decisions to further advance their efforts towards climate neutrality.

These assessments involve a monitoring and evaluation process that requires extensive data collection, processing, and evaluation. This process must be reproducible, allowing for the comparison of results across different monitoring phases. The monitoring outcomes serve as a basis for leaders and experts to assess the progress made in implementing LLCS measures during the specific period under consideration.

The information obtained during the monitoring and evaluation process is an important reference point for **modifying previous measures or setting further measures, additional goals and indicators** in the LLCS.

Assessing the implementation status of climate actions and their effects allows city leaders to determine whether an action is performing well and to identify corrective measures in case specific actions are not delivering their expected results.






Monitoring energy consumption, CO₂ emissions, vulnerability to the impacts of climate change, and adaptation actions allows municipal actors to understand whether they are on track to reaching the target.

Monitoring is furthermore an important exercise to **help understand the barriers to LLCS implementation** and determine the cause of failure to implement specific measures.

This chapter introduces key aspects that arise during the monitoring and evaluation process and provides insights to consider when designing Local Long-Term Climate Strategies. These aspects, as detailed below, are derived from the recommended review steps outlined by the Covenant of Mayors organization (CoM, 2022):

- 1** Creating a monitoring database and emission inventory.
- 2** Identifying obstacles and potential solutions in each sector and measure.
- 3** Assigning responsibilities, connecting measures, and identifying responsible parties.

In addition, the chapter explores considerations in the following areas:

-  Mainstreaming: Integrating climate measures into local strategic documents.
-  Life Span Approach: Adopting a long-term and holistic perspective.
-  Involvement of local decision-makers.
-  Questionnaires: Incorporating citizen and stakeholder engagement.
-  Communication.

CREATING A MONITORING DATABASE AND EMISSION INVENTORY

When developing an LLCS and during its monitoring periods, it is necessary to create/supplement a city-level database that is suitable to summarize the annual energy consumption and emission data item by item, as well as the emission reduction measures. This can take the form of a complex Excel spreadsheet, but using a separate energy monitoring software (e.g., SmartSave Energy Monitoring) is even better. This way, the most important changes in energy consumption and GHG emissions can be visualized with more transparent and understandable diagrams (see Case study Bydgoszcz below).

Updating the database is always preceded by a detailed data collection period when all usable and most recent data is collected from available sources (local and national statistics, data of energy providers, consumers, municipal bodies, traffic counting data



of public road operators, etc.). The monitoring database should be more detailed in the case of municipal data (e.g., energy consumption and emissions of municipal building stock or car fleet). This data is easier to obtain, and the municipality has a direct influence on its development. In other sectors, such as the residential, service, industrial and transport sectors, those performing the monitoring and evaluation process can, in most cases, only rely on comprehensive consumption and emission data.

The emission inventory – broken down into energy sources and sectors (e.g., natural gas, electricity, firewood etc.; and residential sector, services, transport, etc.) – must be updated at least every 2–4 years. It requires a more extensive monitoring process over a longer period of time.

The progress in measures must be evaluated more frequently, at least every 2 years.

Box 1: Key considerations to keep in mind

- ✓ Check if important/key data sources are easily accessible and searchable.
- ✓ Check whether we have a suitable monitoring and evaluation methodology.
- ✓ Check if there are numerical indicators for different time scales to evaluate progress.
- ✓ Check whether we have a person responsible for each task/action/investment related to the LLCS.

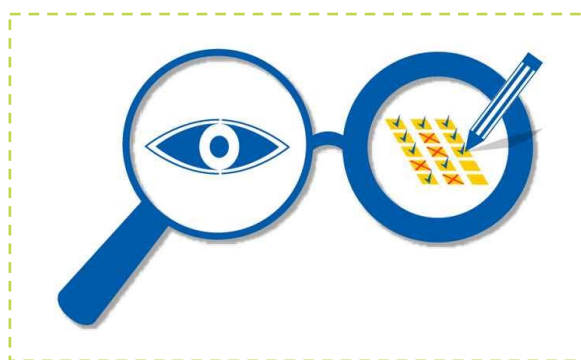


Figure 1: Monitoring and evaluation

Box 2: Evaluation of progress along the LLCS goals**Important points in the evaluation process:**

- ✔ Check the goals of the evaluation process. Overall goals; specific measures; availability of resources and knowledge, etc.
- ✔ Evaluate the reason(s) for the progress in mitigation. The implementation of measures has progressed or the actual emissions have decreased because of other reasons (e.g., climate effects – milder winter, Covid-19, change in national electricity emission factor, etc.)
- ✔ Extra effects must be considered, and the relevance of these effects analyzed
- ✔ The municipality should also evaluate its actual efforts, not only the numerical results.

IDENTIFYING OBSTACLES AND POTENTIAL SOLUTIONS IN EACH SECTOR AND MEASURE

During a monitoring process, the extent to which the LLCS measures were implemented compared to the preliminary plans must be examined. Is there a time lag in the case of individual measures and investments? Are there any clearly **identifiable obstacles** (financial, human resources, expertise, etc.) that make the action impossible or slow it down?

Examples of obstacles and solutions that a policymaker might encounter during the monitoring and evaluation process:

- ✔ If there is a lack of financial resources for a measure: Available subsidies (state, EU) and alternative income opportunities (ESCO, CSR, etc.) must be taken into account. In the case of a municipal measure, re-planning the annual budget or modifying the framework for the following years is an option. In the case of a measure in the residential or service sector, communication between sectors, information assistance, and encouragement must be replanned or strengthened.
- ✔ If there is a lack of human resources for a measure: An overview of local government personnel is necessary. Filling missing positions or combining



several responsibilities, further training programs, and hiring an external expert can be alternative solutions.

After the identification of the obstacles, specific solutions must be outlined, and depending on the possibilities: specific measures, time frame, and human and financial resources must be modified in the LLCS.

ASSIGNING RESPONSIBILITIES, CONNECTING MEASURES, AND IDENTIFYING RESPONSIBLE PARTIES

1 MAINSTREAMING: INTEGRATING CLIMATE MEASURES INTO LOCAL STRATEGIC DOCUMENTS

Since the final and overall goals of the **LLCS** are to achieve complete climate neutrality on a local level and to adapt to the inevitable changes, these **goals must be integrated into every city-level strategic document** (e.g., Integrated City Development Strategy, Local Health Care Plan, etc.); and taken into account during every **city development decision**. This process is **mainstreaming**, the implementation of which must also be reviewed during every monitoring process.

It is necessary to monitor whether **climate aspects** are included **in the annual budget plans** with appropriate weight.

The **mitigation of emissions coming from new investments** (e.g., local industrial developments, new residential districts, new services) **must be reviewed** and cannot be left out of the calculations and emission reduction scenarios.

Based on other major local development goals, changes that negatively impact the achievement of LLCS goals must be reported to the decision-makers during the monitoring and evaluation processes, and these cross-sectoral decisions must be reconsidered/replanned.

2 LIFE SPAN APPROACH: ADOPTING A LONG-TERM AND HOLISTIC PERSPECTIVE

During monitoring, it is important to **analyze the lifespan of different emitting sources** (buildings, public transport vehicles, power plants, etc.), and how much time is potentially left of it at the time of monitoring. Municipal experts must think about climate-neutral substitutions or investments in the case of the given emitters over a suitable period (2050 at the latest).

Approximate lifespan of different emitters:

- 🌿 Buildings: ~ 100 years
- 🌿 Vehicles: ~ 10–15 years
- 🌿 Power plants: ~25–30 years

3 INVOLVEMENT OF LOCAL DECISION-MAKERS

Evaluation of progress is essential not only at the expert level but also at the management level. **Local decision-makers have a key role in making and reviewing long-term (climate) policy decisions** during every monitoring and evaluation phase.

Professional consultations with local government, business and industry leaders are indispensable in climate matters. Monitoring periods are a good opportunity for these meetings.

Among the changing environmental, economic and social conditions, the opportunities and willingness of local decision-makers to contribute to implementing individual climate measures may also change.



4 QUESTIONNAIRES: INCORPORATING CITIZEN AND STAKEHOLDER ENGAGEMENT

A monitoring period also provides an opportunity to **collect the opinions, attitudes, expectations and suggestions of citizens and stakeholders in terms of climate goals and measures through questionnaires** in a way that is **comparable to previously collected data**.

It can help the cooperation with citizens along the implementation of residential sector-related climate measures.

5 COMMUNICATION

Communicating the monitoring results on different platforms (local newspaper, TV, radio, social media) is essential to **reach as many people as possible** with the message: **Climate-related measures are a common cause and require the cooperation of all local actors**. It is worth communicating the most important successes as well as areas for improvement.

A monitoring and evaluation process is also a good opportunity to identify and document best practices and success stories to be shared with other stakeholders.

Box 3: Resources, useful tools and more information

Covenant of Mayors – [Quick reference guide for Monitoring SECAP Implementation](#)

The **Covenant quick reference guides** provide ad-hoc information on specific Covenant processes and approaches such as Monitoring SECAP implementation.

It describes main steps of a monitoring process, tips for success and requirements.

ROBOTIZATION OF ADMINISTRATIVE PROCESSES IN MUNICIPAL ENERGY MONITORING AND MANAGEMENT IN BYDGOSZCZ

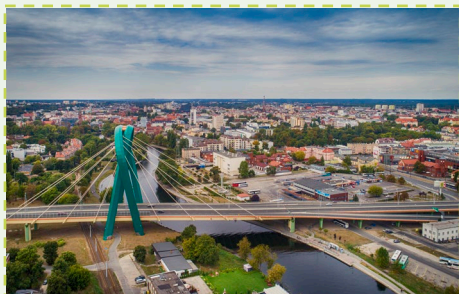


Figure 2: City of Bydgoszcz, Łuczniczka Hall

This case study presents an example of energy transformation as implemented in the city of Bydgoszcz, Poland through implementing the idea of smart city, robotic process automation, digital transformation of documents management. Bydgoszcz is the largest city in the Kuyavian-Pomeranian Voivodeship, located on the Brda River, the Bydgoszcz Canal and the Vistula River. It ranks 8th in Poland in terms of population (1,875.6 inhabitants per km²).

SHORT PORTRAIT

Bydgoszcz, Poland is a large centre of industry, trade, and logistics and a hub for road, rail and inland waterways. Bydgoszcz is one of the country's main centres for IT and business services, with an Industrial and Technological Park and the Pomeranian Special Economic Zone. Bydgoszcz is also an important academic, scientific and cultural centre.



EMISSIONS REDUCTION TARGETS

- 🌿 Estimated emission reductions: 522,5 Mg CO₂
- 🌿 Estimated reduction in energy consumption: 1672,5 MWh

LEAD INSTITUTION/ACTOR

Bydgoszcz City Hall, Energy Management Team, IT Department

EXTERNAL PARTNERS

ForProgress Sp. z o.o.

DURATION/TIME PERIOD

from 2020

FINANCING

approx. €30.000

OBJECTIVE/VISION

In 2021, a robotization project was implemented to manage the documents for the supply of electricity from the seller and distributor for city units. The software itself performs the distribution and archiving of documents as well as the acquisition of data from these documents. The volume of documents retrieved by the software on an annual basis is approximately 20,000 multipage PDF documents.

ACTIVITIES

The operation process for this solution consists of four steps: Source document acquisition, data acquisition and analysis, document distribution and archiving. The software automatically downloads the source documents from the eBOK (customer service centres) pages. Then it transcribes the data into the energy management database and distributes documents to the relevant emails of the city's units. During the process, deviations from fixed data are monitored, such as energy and energy distribution rates and charges, commercial charge or contracted power.

ACHIEVEMENTS

Thermal energy accounts for about 65% of the incurred costs of operating facilities in the city. Thanks to the measures taken by the team, there has been a reduction in ordered power by 1.569 MW compared to 2018 contributing to a reduction in heating costs by PLN 227,421.08 per year. The estimated savings as a result of thermal energy management is 5%, which translates into PLN 767,610 (based on 2018).

FUNDED BY

City's budget

ACHIEVEMENTS

Previously, this whole wide-ranging process was so tedious and complicated that it was not possible to manually download documents on an ongoing basis and build a database. In the "Innovative Local Government" 2021 competition, the project to create an automatization software was awarded in the large cities category. The competition was organized by the Local Government Service of the Polish Press Agency. "Robots are a tool that has been used in IT for some time, what is new is the application of this solution to a business process. The human factor meant that all the necessary data could not be retrieved in a single working day. Thanks to the robot, we have eliminated this problem — it works 24 hours a day, and collecting this data for it is no difficulty at all" says Janusz Popielewski, Director of the IT Department at Bydgoszcz City Hall.

LESSONS LEARNED

The software not only distributes invoices, but also collects data from these invoices and simultaneously detects any anomalies regarding energy consumption. Information is collected on an ongoing basis, including whether a given invoice has been collected or paid. The database allows to better manage the parameters of contracts with energy suppliers and adjust them to the volume of consumption. Among other things, this knowledge allows to take action, e.g., install devices such as compensators, which will eliminate exceedances and thus the need to pay additional fees.

SUCCESS FACTORS

1. The culture of innovation is nurtured throughout Bydgoszcz city hall, with a particular emphasis placed on the energy management team.
2. An awareness of the energy management team about robot software; designated person dealing with emergencies and business errors occurring during the robot's processing of the documents related to electricity consumption.
3. The correctly defined business expectations regarding the software robot's operating principles and correctly selected business process in terms of its characteristics.
4. Close cooperation and efficient communication between the energy management team and the contractor.

CASE STUDY CONTACT/FURTHER INFORMATION

Bydgoszcz City Hall, Energy Management Team, St. Wojska Polskiego 65, 85-825 Bydgoszcz

phone: +48 52 58 59 490; e-mail: h.lewandowska@um.bydgoszcz.pl

<https://www.mdpi.com/1996-1073/14/16/5191/htm>

https://www.youtube.com/watch?v= PSpnvuAi_I

<https://robonomika.pl/rozmowy-o-hiperautomatyzacji-robotyzacja-procesow-biznesowych-w-samorzadzie>

http://www.pnec.org.pl/images/stories/2022/20220421/Robotyzacja_w_Bydgoszczy_IT_w_admin.pdf

<http://www.projectduet.eu/en/systemy-zarzadzania-energia/wdrozenie-systemu-zarzadzania>

LONG-TERM COMMITMENT IS KEY: CO₂ REDUCTION IN SZENTES



Figure 3: The city of Szentes

Planning a climate strategy is not enough. In order to implement it, you have to adapt to constantly changing conditions, be it financial or human resources, new technologies and changes on the market. To determine active progress, the municipality of Szentes carries out a monitoring and evaluation procedure of the town's local energy and climate plan on a biannual basis according to a strict methodology.

The city administration of Szentes does all this in the framework of long-term professional cooperation that ensures the foundations of implementation and progress for at least a decade in advance.

SHORT PORTRAIT

Szentes is located in the Hungarian Great Plain near the rivers of Tisza and Kurca. The town has remarkable renewable energy potential (solar and geothermal), which helps to generate and supply clean energy locally.

The city has set ambitious goals in the field of climate mitigation and adaptation. Its low CO₂ emissions per capita are already worthy of recognition.



SIZE

26 218 inhabitants, 353,25 km² (administrative area)

CITY'S EMISSION REDUCTION TARGETS

40% CO₂ emission reduction by 2030, long-term local climate neutrality by 2050

EMISSIONS

Emissions: 3,6 tCO₂/capita (2019)

LEAD INSTITUTION/ACTOR

Municipality of Szentes

INTERNAL AND EXTERNAL PARTNERS

Energiaklub Climate Policy Institute

DURATION/TIME PERIOD

2020–2031

FUNDED BY

Municipal sources

OBJECTIVE/VISION

The Municipality of Szentes has joined the Covenant of Mayors (CoM) international organization and has drawn up Sustainable Energy and Climate Action Plan in 2021, in which they set itself the goal of a 40% reduction in local CO₂ emissions by 2030 compared to the base year 2019. It is also taking steps towards adaptation to prepare for the inevitable effects of climate change.

In accordance with the recommendations of the CoM, the city management reviews the progress of the mitigation and adaptation goals and measures defined in the action plan every 2 years. The monitoring analyses for Szentes are prepared by Energiaklub Climate Policy Institute (the organization that also developed the original SECAP document) as part **of a long-term collaboration until 2031.**

We know of very few settlements across Europe that have been willing to commit to the continuous revision, renewal and development of local climate plans a decade in advance. This commitment can be a guide for other settlements. There was and is a complete consensus in the city administration of Szentes regarding the importance of achieving the local climate goals, as well as regarding the acceptance and continuous development of the plans through monitoring processes.

Long-term planning is an important goal in climate mitigation and adaptation, a fact which the city administration recognized early on. Beyond the development of the SECAP, Szentes also joined the Ready for Net Zero project, in which local climate neutrality is in the crosshairs. Achieving the local climate neutrality goal of 2050 is based on the 40% local CO₂ reduction goal by 2030 and achieving the 40% goal is based on periodic monitoring and evaluation procedures.

The district heating system of Szentes is 100% based on geothermal energy, which is a rarity in Europe. In recent years, the utilization of solar energy has also developed rapidly. The city is very forward-looking in its use of renewable energies. These are strengths that can be built upon in the pursuit of climate neutrality. At the same time, they face serious difficulties in terms of energy efficiency in the construction and transportation sectors.

Strengths, weaknesses, obstacles and solution options were highlighted in the latest 2023 monitoring report of the SECAP of Szentes, which was developed jointly by external experts and the municipality's specialists. It was a so-called light monitoring process, which included the revision of different actions and the state of progress, the summary of emerging obstacles and their possible overcoming, whether in terms of financial, human or other resources.

The factors hindering the progress of SECAP and LLCS measures were also evaluated at Szentes. Many of the measures were delayed due to a lack of financial resources. Some of them are becoming more and more unlikely to be fulfilled until 2030, so the experts looked for other measures and areas of intervention that could replace those that have been eliminated and ensure that the 40% emission reduction target can be achieved.

In 2025, Szentes will carry out a full monitoring process, that includes the points mentioned above, moreover the development of a brand-new CO₂ emission inventory based on the most recent data.

In all cases, the monitoring process is preceded by a detailed data collection process, in which the involvement of local experts is essential. In order to make the data transparent, it must be systematised, and the cooperation and information flow between the individual units of the municipality must be strengthened. This demand was also highlighted during the monitoring in Szentes.

Another light monitoring in 2027 and a full monitoring process in 2029 will support the up-to-date development of the SECAP in Szentes, followed by an overview assessment in 2031 regarding the achievement of the 2030 climate goal.

LESSONS LEARNED

- ✔ Long-term cooperation requires committed and long-term planning municipal experts and managers.
- ✔ Transparency, continuous review and development, and close cooperation are essential when it comes to achieving climate goals and implementing measures.
- ✔ Climate change, mitigation solutions, and available or missing resources create a constantly and dynamically changing environment, to which we must adapt in strategic planning.
- ✔ The more frequently we review the progress of the measures, the better.

SUCCESS FACTORS

- ✔ The municipality of Szentes committed to continuous SECAP monitoring until 2030 (contract with Energiaklub).
- ✔ There is a common goal and a suitable supporting background for long-term cooperation.
- ✔ Continuous plans and ideas adapting to changing conditions and circumstances in the direction of emission reduction and adaptation.
- ✔ Dedicated persons in the municipal staff.
- ✔ Advanced climate mitigation factors: High proportion of renewable energy; 100% geothermal energy in district heating supply.

CASE STUDY CONTACT/FURTHER INFORMATION

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1.7. JUST TRANSITION

INTRODUCTION

Including everyone as key to the success of the change and planning process

The transition toward climate neutrality is more than a race to reduce greenhouse gas emissions. It will offer opportunities but also pose challenges for regions due to the socio-economic costs associated with the transition process. Additionally, it will present several challenges in the context of various economic sectors. How we approach this transition also holds profound social implications, including on matters such as social justice, human rights, gender equality, health, education, and jobs. The two main challenges are expanding the transition from fossil energy to other sectors and involving the private sector, social partners, and civil society in the transition. Some regions will encounter more challenges than others, and not all will possess the same capacity to manage the costs associated with adapting to the climate transition (European Commission, 2022c). To address this issue effectively, significant emphasis on climate actions is placed on the concept of a "just transition."

The concept of a just transition can be defined as greening the economy in a way that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities, and leaving no one behind (European Commission, 2022c). It traces its origins back to the 1980s, when it was first developed within a movement led by the United States trade unions that was aimed at safeguarding the interests of workers affected by new water and air pollution regulations. More recently, this concept has gained significant traction in the context of achieving climate goals while also ensuring the full inclusion of all segments of society – communities, workers, and social groups – in the journey toward a net-zero future (Climate Promise UNDP, 2022c). Despite its widespread use for promoting social justice and equity in climate action, there is no universally agreed-upon definition, and perceptions of it vary across countries and regions.



In December 2019, the European Commission adopted a communication on the European Green Deal, which set out a roadmap for a new growth policy for the EU. As part of the European Green Deal and to achieve the objective of EU climate neutrality effectively and fairly, the European Commission proposed the creation of a Just Transition Mechanism (European Parliament, 2023). **Its main objective is to ensure that no one and no region is left behind in the transition to a climate-neutral economy.** The primary goal of the mechanism is to provide support to the most negatively affected regions and people and to help alleviate the socio-economic costs of the transition (European Commission, 2022c).

Box 1: REPowerEU as one of the European Union's measures within the line of just transition approach within the line of just transition approach

Launched in May 2022, the REPowerEU plan is a response to the difficulties and disruptions in the global energy market caused by Russia's invasion of Ukraine. Transforming Europe's energy system is urgent for two reasons: ending the EU's dependence on Russian fossil fuels, which are used as an economic and political weapon and cost European taxpayers almost €100 billion a year, and overcoming the climate crisis. Among the measures presented in the plan are energy conservation, diversification of energy supply, and accelerated introduction of renewable energy. In line with the Global Gateway concept, the plan proposes to give priority to the EU's commitment to a global green and fair energy transition by increasing energy savings and energy efficiency, thereby reducing price pressures, stimulating the development of renewables and hydrogen, and stepping up energy diplomacy (European Commission, 2022a,b).

HOW TO LEAVE NO ONE BEHIND IN ACHIEVING CLIMATE GOALS?

Transformation pathways have distributional consequences – job losses are more likely in sectors, regions, and communities where there is a heavy reliance on fossil fuels or carbon-intensive practices and where economic diversification is limited. Focusing on the energy transition without proper consideration of these varied socio-economic impacts risks strengthening existing vulnerabilities and overlooking systemic inequality (Climate Promise UNDP, 2022).

The IPCC in the Sixth Global Assessment Report defined 11 elements of a just transition, the consideration of which can help set the focus and components of the activities planned in the LLCS (IPCC, 2022):

- 1 INVESTMENTS** in establishing low-emission and labor-intensive technologies and sectors;
- 2 RESEARCH AND EARLY ASSESSMENT** of the social and employment impacts of climate policies;
- 3 SOCIAL DIALOGUE AND DEMOCRATIC CONSULTATION** of social partners and stakeholders;
- 4 CREATION** of decent jobs; active labor markets policies; and rights at work;
- 5 FAIRNESS** in energy access and use;
- 6 ECONOMIC DIVERSIFICATION** based on low carbon investments;
- 7 REALISTIC TRAINING/RETRAINING PROGRAMS** that lead to decent work;
- 8 GENDER-SPECIFIC POLITICS** that promote equitable outcomes;
- 9 FOSTERING** of international cooperation and coordinated multilateral actions;
- 10 REDRESSING** of past harms and perceived injustices;
- 11 CONSIDERATION** of intergenerational justice concerns, such as the impacts of policy decisions on future generations.

By incorporating the just transition approach into the development of LLCS, it becomes possible to progress towards reaping the benefits of a fair transformation. However, achieving this entails addressing the repercussions of economic change across all sectors and involving all stakeholders. It goes beyond the mere acknowledgment and participation of stakeholders and vulnerable groups: it involves strengthening their roles. It also necessitates a critical examination of existing systems that undermine



climate justice and social equity. Up to this point, efforts to achieve a just transition have primarily centered around specific sectors, predominantly the energy sector, and specific stakeholders, particularly workers in industries dominated by men. Achieving a just transition demands taking into consideration the impact of decarbonization on consumers, employers, and communities and guiding a successful economic transition within each sector and industry (Lee and Baumgartner, 2022).

The Just Transition Mechanism stands out, as an illustration of the just transition policy in action. This mechanism specifically tackles the social and economic consequences of the transition, with a particular emphasis on regions, industries, and workers that will encounter the most significant hurdles. Implementing the actions mentioned above can yield favorable outcomes for the future of local communities.

The European Commission has also established provisions for co-financing activities aimed at facilitating a just transformation, structured around three primary pillars, each focusing on different aspects of a just transition (European Commission, 2022c):

Box 2: Just Transition Mechanism pillars

NEW JUST TRANSITION FUND	INVESTEU JUST TRANSITION SCHEME	NEW PUBLIC SECTOR LOAN FACILITY
<p>This first pillar of the Just Transition Mechanism aims at alleviating the economic, environmental, and social costs of the transition for those most negatively affected by this process. It is focused on economic reconversion measures, reskilling of affected workers and jobseekers, and job-seeking assistance.</p>	<p>The second pillar is focused on just transition objectives that support economically viable investments by private and public sector entities. It will provide a budgetary guarantee under the InvestEU program and an Advisory Hub as a central entry point for advisory support requests.</p>	<p>The third pillar aims at supporting projects that do not generate a sufficient stream of revenues to cover investment costs. Loans will be combined with grants to provide public sector entities with resources to meet the development needs in the transition towards a climate-neutral economy.</p>

ROLE OF LOCAL AUTHORITIES AND DIALOGUE WITH THE SOCIETY

The Just Transition Fund is implemented under shared management rules, which means close cooperation with national, regional and local authorities. In order to access Just Transition Fund support, Member States have to submit territorial **just transition plans**. These plans outline the specific intervention areas based on the economic and social impacts of the transition. In particular, these plans have to take into account expected job losses and the transformation of the production processes of the industrial facilities with the highest greenhouse gas intensities (European Parliament, 2023; Anczewska, 2020).

The way such action plans are created should be an example of how long-term planning should be approached inclusively. A key to the success of developing a valuable plan is to enable all local communities to take an active part in its development. Through open dialogue, local governments will be able to learn more about the needs, opportunities, and aspirations of their citizens, with particular attention paid to the most vulnerable groups. A detailed analysis of the information obtained can help to better plan measures to meet these needs and direct support where it is most needed and will be used optimally for the future development of the regions.

- 🌿 The process of development should be transparent, and all stakeholders should have access to information on its timetable and progress, as well as the opportunity to present their views and participate in the working groups.
- 🌿 Every analysis and research on the challenges and needs in the transition towards climate neutrality should be publicly available.
- 🌿 A series of meetings with residents, local authorities, community organizations, and local business representatives, preferably conducted in the form of citizens' panels should be organized.



Box 3: How to aim for just transition implementation during LLCS development? (Lee & Baumgartner, 2022)

1. Attract and engage the public

Following the principles of just transition through collective and participatory decision-making processes is key to ensuring broad public support and enabling greater climate ambition.

2. Support a green revolution in the job market

Steps toward achieving the goals of the Paris Agreement and investing in a circular economy can provide millions of new jobs. Applying a just transition approach will help ensure that these jobs are dignified – with guaranteed living wages, adequate workplace safety protections, and health benefits – and that they contribute to the eradication of poverty and social inclusion.

3. Lay the foundation for a resilient net-zero energy economy

Transparent planning processes with the active participation of a broad range of stakeholders can help minimize fear, opposition, and inter-community and inter-generational conflict. Integrating just transition when developing LLCS also helps highlight the social capital required to achieve net-zero.

4. Support concrete local solutions

There is a need to develop a local vision that incorporates equitable transformation. Poorly defined approaches that are too broad or generic can make the concept inapplicable. To unlock the benefits of just transition, the socio-economic impacts must be understood through assessments and extensive stakeholder consultations.

5. Strengthen joint efforts

To ensure that this transition happens smoothly but also reduces inequality, poverty and social exclusion, it is necessary to focus on economy-wide measures that incorporate a whole-of-society approach.

To successfully engage all sectors of society, especially the most vulnerable and disadvantaged, on the planned changes, it is necessary to know their perspective, take into account their points of view, and support their visibility. Effective implementation of just transition policies can be helped by following the guidelines below.

Just transition can help in several ways as countries deal with the effects of climate change and green their economies (UNDP Climate Promise, 2022):

- ✔ First, by attracting an audience. If governments can demonstrate the socio-economic benefits that a green transition provides, they can build a broad base of public support for higher climate ambitions.
- ✔ Second, by laying the social groundwork for a resilient net-zero economy. Through transparent planning and the active participation of a wide range of stakeholders, governments can minimize fear, opposition, and conflict among communities.
- ✔ Third, by implementing local solutions. By going through the consultative processes involved in achieving a just transition, it is easier to communicate the impacts of bold climate action understandably and then identify the best solutions for their context.
- ✔ Fourth, by increasing the urgency of collective efforts to combat climate change. Transitions are often disruptive and a deliberate effort is needed to smooth them out. A just transition strategy, embedded in long-term climate plans, will help leaders focus on the urgent task of rapid decarbonization while pursuing equitable and inclusive outcomes.



THE ENERGY TRANSITION IN RHEIN-HUNSRÜCK-KREIS



Figure 1: A visit from the (former) environmental minister of Rhineland-Palatinate, Ulrike Höfken, as well as (former) MdB Hans-Josef Fell at the local energy provider "RheinHunsrück Energie"

The Rhein-Hunsrück-Kreis in Germany reacted to demographic challenges with a central focus on renewable energy and thus made the district the prime example in Europe of a successful energy transition on the local level.

SHORT PORTRAIT

The Rhein-Hunsrück-Kreis¹ consists of 137 municipalities situated in central Rhineland-Palatinate. The district lies west of the Rhine River around the natural heritage site of Mittelrheintal. It predominantly consists of rural areas with a low population density and economic and structural challenges. Demographic change is a major factor in the district, as population size decreased in recent years, and the average age has risen.



SIZE

103,767 inhabitants (2021), 990.70 km² and 100 inhabitants/km²

TARGETS

Regional value creation of up to €250 million in annual energy import costs regionally by 2050

EMISSIONS

Net-zero emissions in the sectors of heat, electricity, and waste

LEAD INSTITUTION/ACTOR

Rhein-Hunsrück-Kreis, mainly District Administrator Volker Boch and Climate Protection Manager Frank-Michael Uhle

INTERNAL AND EXTERNAL PARTNERS

Institut für angewandtes Stoffstrommanagement (IfaS)

DURATION/TIME PERIOD

1999–today

FUNDED BY

Rhein-Hunsrück-Kreis

¹ The German organizational level "Kreis" is comparable to a district, i.e. a small area comprising several municipalities.

OBJECTIVE/VISION

The efforts of the Rhein-Hunsrück-Kreis concerning energy already started in the late 1990s. As a reaction to rising prices of fossil energy sources, the focus was set on energy efficiency to reduce costs. In the following years, the district additionally started investing in the creation of renewable energy sources. The efforts culminated in the 2011 Integrated Climate Mitigation Concept, which formalized measures to create value regionally instead of spending high amounts for imported energy sources (approx. €290 million/year). The district's vision is to create the whole value of €290 million/year by 2050 regionally.

ACTIVITIES & FINANCING

The concept lines out how, instead of paying for imported energy, the district can invest these funds in measures such as energy efficiency and expansion of renewables, thus creating value regionally. In addition to an energy and emissions balance, it includes an analysis of the potential of 92 single measures. Nine workshops with 300 participants were held to support these analyses by including the local population. A Climate Protection Manager was hired to implement the measures and concentrate the district's efforts.

The concept's core mechanism is that investments in the energy transition bring regional added value (for example, in 2015, investments in renewable energy sources totalled €1.36 billion, with €102 million being regional investments and €43.5 million regional added value). Among other factors, the regional added value results from rental income and taxes for renewable energy plants, feed-in tariffs for local plant operators as well as from new orders for crafts and construction companies. This value is then reinvested into the local infrastructure, projects, renovations, and many other measures.

ACHIEVEMENTS

The Rhein-Hunsrück-Kreis has been immensely successful in its energy transition efforts and has gained international attention. In 2011, the district received the European Solar Prize for its success in expanding the installation of solar plants. The Rhein-Hunsrück-Kreis and its municipalities are among the least indebted communities in Rhineland-Palatine. In 2020, the district reached a balance sheet of zero emissions in the sectors of heat, electricity, and waste. The expansion of renewable energies has been so successful that the district now produces 337% of its energy use, thus providing further income through energy exports. These developments have increased the quality of life in Rhein-Hunsrück-Kreis, thereby also making the district more attractive and reversing the demographic decline.



Figure 2: A visit of a Japanese delegation at the local energy provider "RheinHunsrück Energie"

LESSONS LEARNED & SUCCESS FACTORS

The case study of the energy transition in Rhein-Hunsrück-Kreis shows that a successful energy transition is possible locally. Important factors are the inclusion of the local population in the process as well as a long-term vision implemented by ambitious actors. In the case of the Rhein-Hunsrück-Kreis, the district administrators ('Landräte') and Climate Protection Managers played an important role in that matter.



Figure 3: The municipality of Schnorbach created an award-winning programme to help citizens reduce private energy consumption - and contribute to local climate protection!

CASE STUDY CONTACT/FURTHER INFORMATION

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DEVELOPMENT STRATEGIES FOR DISADVANTAGED NEIGHBORHOODS DEVELOPED IN PARTICIPATORY MANNER IN MINSK MAZOWIECKI



Figure 4: Human Smart City event in Minsk Mazowiecki

Minsk Mazowiecki, Poland is located in the eastern part of the Masovian Voivodeship, 20 km from Warsaw. Geographically, it is part of the South Podlasie Lowland region, whereas historically and culturally it is considered Mazovian.

SHORT PORTRAIT

Minsk Mazowiecki is a local and supra-local centre for business (developed trade, services, and industry), education (university, six high schools, seniors university), military (air base, gendarmerie, and military supplement headquarters) as well as culture. However, above all, it is a place of residence and leisure for many people working in Warsaw. The challenges facing the city are first and foremost to develop and take care of the influx of residents.



City's emission reduction targets (40% in line with SECAP):

- 🌿 reduction in final energy consumption by 70 084 MWh/year
- 🌿 reduction of CO₂ emissions by 69 136 Mg CO₂/year
- 🌿 increase in the share of energy from RES by 24 178 MWh/year

EMISSIONS

169 864 Mg CO₂ (based on emission inventory for 2019)

LEAD INSTITUTION

City of Minsk Mazowiecki

DURATION/TIME PERIOD

February 2019 – December 2021

FINANCING

EUR 225 220

ADDRESSED ELEMENTS OF A LLCS

inclusion, just transition, citizen, participation, planning

OBJECTIVE/VISION

The project 'Minsk Mazowiecki — City of Smart Neighbourhoods' is a comprehensive activity aimed at setting a new standard in transforming urban spaces into centers with stable local structures that guarantee a high quality of life for their residents. The developed standard is related not only to the satisfaction of needs of a purely practical nature but also to strategic thinking about the development of culture in the city, social integration, and encouragement, i.e., elements important for building local identities, necessary for creating and maintaining high-quality social capital and involving the community in the development of the city.

ACTIVITIES

The project created a pilot model common space, the construction of which is a guideline for the implementation of the developed solutions in other districts. Main activities of the project were:

- 🌿 assessment of residents' needs: The activities began with identifying the most important needs of residents in terms of their daily functioning in the space of the city and municipality. The study used techniques and tools for both quantitative and qualitative research. The first stage of the work was to conduct a quantitative survey among adult residents. In second stage, qualitative research was conducted, which consisted of focus group interviews (FGI) with representatives of NGOs, seniors, and youth.
- 🌿 urban audit: To assess the potential of the area, it was necessary to identify the current state of availability of public and non-public services at the level of each district;
- 🌿 creation of a strategy in a participatory manner: assessment, with the help of residents participating in consultation workshops, nine concepts for common spaces were created. In parallel, training sessions for City Hall employees, a Hackathon, a city-wide Charette workshop, and educational workshops for residents were implemented.
- 🌿 creation of a concept for the development of recreational areas: In each of the city's districts, those concepts were developed together with the residents (three design documentations and one realized in the so-called Serbinow estate).

The implemented measures have contributed to CO₂ emissions reduction by increasing the amount of green area in the city available for residents (social effect). Green planting plays a major role in the areas designed as part of the project, successfully absorbing both CO₂ and other particulate matter in the air. This is also possible thanks to the changes made to the road lanes allowing traffic to slow down and reducing it by giving priority to non-motorized users (pedestrians first, then cars) and by bringing the recreational areas closer to the centre (no need to leave the city).

FUNDED BY

Realizing the need to provide equal opportunities among different groups of residents of cities and towns in general, the national Ministry of Development has announced a grant competition aimed at local government units under the title: 'HUMAN SMART CITIES. Smart cities co-created by residents', which covered the costs of project.

CHALLENGES

As a result of the research, the challenge facing the city authorities as well as the residents themselves was identified. It is to work out how to skilfully involve residents in the active development of the city — both in terms of social and spatial changes, but also those related to strengthening local ties and identity.

LESSONS LEARNED

It is worth remembering that the use of surveys with the participation of city residents enables the implementation of a participatory development path — taking into account the real needs, problems, and expectations indicated by them. The implementation of the Human Smart Cities program in Minsk Mazowiecki affects many aspects of the city. The assessment of residents' needs carried out during its implementation clearly indicated that one of the main expectations is to improve the quality of public spaces also in the environmental aspect. Conclusions from the surveys and diagnoses point in the direction of the need for the city to carry out activities aimed at reducing greenhouse gas emissions and mitigating their effects.

SUCCESS FACTORS

The construction of the public recreation area in the selected neighbourhood was completed, and the residents received the space exactly as they wished. Thanks to the fact that they were part of the planning process, they influenced what was changed and improved, and thus are considerably more willing to use and respect this refurbished space. All performed activities have given the city a kind of legitimacy to initiate actions aimed at reducing the role of individual transportation in daily travel and revalorizing greenery in public places.



Figure 5: Human Smart City event in Minsk Mazowiecki

CASE STUDY CONTACT/FURTHER INFORMATION

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CHAPTER

2

CRAFTING CLIMATE NEUTRALITY MEASURES

CHAPTER 2: CRAFTING CLIMATE NEUTRALITY

MEASURES

Climate change poses a critical and urgent challenge that demands immediate attention and coordinated efforts across various sectors. The EU is actively addressing those issues through ambitious mitigation measures, including a commitment to reduce greenhouse gas emissions by at least 55% by 2030 and a goal to achieve climate neutrality by 2050. Additionally, the EU is implementing climate change adaptation measures to safeguard against the impacts of a changing climate. As climate change continues to have far-reaching effects on ecosystems, economies, and communities, the EU's proactive approach to mitigation and adaptation underscores its commitment to mitigating the impacts of climate change and ensuring a more sustainable and resilient future for its citizens and the planet (IPCC, n.d.).

Climate change mitigation primarily focuses on reducing greenhouse gas emissions, the primary drivers of global warming. This involves implementing policies, technologies, and practices to decrease our carbon footprint and transition towards cleaner and more sustainable energy sources. By curbing emissions, we can slow down the pace of global warming and work towards stabilizing the climate (European Parliament, n.d.).

On the other hand, climate change adaptation involves building resilience and adapting to the existing and projected impacts of climate change, of which some are already unavoidable. Adaptation measures help communities, ecosystems, and infrastructures cope with the changes and reduce vulnerability. This includes improving water management, enhancing disaster preparedness, and promoting climate-resilient agriculture.

To effectively tackle this global challenge, it is crucial to actively involve diverse stakeholders who can foster collaboration, shared vision, and ambitious roadmaps. Moreover, engaging local and regional governance, energy providers, academia,

businesses, NGOs, and the public is of utmost importance for informed decision-making and broader acceptance of climate initiatives. Setting realistic deadlines ensures efficient action, while integrating climate strategies into spatial plans fosters sustainable urban development and resilient infrastructure.

2.1. HORIZONTAL MEASURES



Figure 1: Education and communication are crucial in driving behavioral and lifestyle change.

Horizontal measures are challenging to define and categorize, since they are cross-sectoral measures that can simultaneously affect mitigation and adaptation aspects and help or strengthen the implementation of many other measures. They are related to energy-conscious/climate-conscious lifestyles, decisions, and actions, either from the point of view

of decision-makers or consumers.

Decision-makers' and public authorities' task is to create opportunities and possibilities for citizens to reach a lifestyle with lower energy consumption and emissions as well as to strengthen the desire of consumers to achieve it as a desirable lifestyle.

Examples for offering opportunities: creating more favorable conditions for cycling and public transport, promoting local products, supporting the utilization of renewable energy sources, prioritizing green public procurement, etc.

Strengthening desire in consumers: education, attitude formation, communication.



The concept of sufficiency (a modest but adequate scale of living) often appears regarding behavior/lifestyle changes. Three types of energy sufficiency have been identified:

- ✔ **Dimensional sufficiency:** using the right equipment according to the use (e.g., choosing a vehicle according to the type of travel);
- ✔ **Sufficiency of use:** being conscious of how to use equipment (e.g., turning off the ventilation or drink dispensers in offices when no one is there);
- ✔ **Collaborative sufficiency:** sharing equipment (e.g., car sharing).

The most important goal of horizontal measures in an LLCS is to change the behavior of all types of local consumers towards a climate-friendly way.

CHANGES IN CITIZENS' BEHAVIOR

Behavior change is a central element of addressing the climate crisis. Most of the interventions needed to reach global or local emission reduction targets require at least some behavioral change and adapting to the growing impacts of climate change similarly requires significant lifestyle and societal change. Impactful mitigation actions include **avoiding driving and reducing red meat, dairy, material, and energy consumption**, while adaptation measures include emergency and long-term behavioral responses such as **preparing for extreme weather events**.

Addressing the climate crisis requires **focusing on high-impact behaviors** (*mobility, food, consumption, resilience*) **and high-emitting groups**; interdisciplinary approaches to designing interventions that address the diverse and interacting behavioral barriers and drivers.

Behavior change interventions can:

- ✔ Target individual decision-making (downstream) or
- ✔ Target the context in which decisions are made (upstream);
- ✔ Provide/improve options (e.g., cycling tracks) or

- 🌿 Remove options (e.g., car entry ban);
- 🌿 Make use of automatic (trends) or
- 🌿 More intentional/deliberative processes (e.g., citizen assemblies).

In general, combining multiple approaches (!) is always necessary.

The two main pillars for people's behavior/lifestyle change are **education and communication** on all local platforms (check: ENERGISE project (Horizon 2020)).

Did you know?

The livestock industry contributes substantially to greenhouse gas emissions. Approximately 14.5% of all human-caused greenhouse gas emissions come from livestock farming, with methane and nitrous oxide being the leading gases emitted, along with carbon dioxide. The gases from livestock farming have a significant global warming potential, with methane being about 25 times more potent and nitrous oxide about 300 times more potent than carbon dioxide (Wilde, 2022).

EDUCATION

One of the most important conditions for long-lasting climate-conscious behavior is the development of internal motivation, which can be established most effectively in kindergartens, elementary schools, and high schools.

In kindergartens, sessions may address the topic of saving energy and resources in everyday life or focus on learning about renewable energy sources.

Within school frameworks, teachers teaching natural sciences or ethics can incorporate environmental and energy awareness into their curriculum.

High schools often organize themed weeks or days, e.g., Earth Day, on which young people can enrich and supplement their knowledge acquired in class; school organizers often invite external experts and speakers.



In addition to the already mentioned opportunities and their encouragement, the local government can actively get involved in the environmental education and attitude formation of children and young people. Presentations and discussions organized by local government employees that demonstrate the city management's dedication to the mitigation of climate change, to the protection of the environment as well as show already achieved results can serve as an excellent opportunity to do this. Importantly, attention must be drawn to the fact that young people can greatly contribute to the success of climate mitigation.

Changes in general circumstances can change people's behavior, such as the energy crisis in Europe in 2022, when the energy price increase caused a relevant effect in reducing consumption in every sector, especially in the residential and service sectors. These changes in behavior can also be promoted by appropriate incentive tools, policy changes, and communication both on the local and country level.

Fun fact

The 2IMPRESZS project, initiated in 2017, has actively promoted the green energy transition by engaging young students in Belgium, Germany, the Netherlands, the UK, and Denmark. The project's primary objective is to enable students to take the lead in reducing their schools' energy consumption and fostering a culture of sustainability and energy efficiency.

One remarkable achievement of the 2IMPRESZS Energy Challenges is that small-scale behavioral changes by the students have resulted in approximately 7000 tons of carbon emissions reduction in school buildings alone. These reductions were achieved through various initiatives, such as optimizing lighting, promoting biking for vacations, and encouraging energy-saving practices at school and home (Langlois, 2023).

COMMUNICATION

In the case of information and attitude formation, in addition to the traditional channels – local or regional daily/weekly newspapers, **local TV/radio** – the Internet (**social media** platforms) and thematic papers dealing with energy are also available. It

is recommended that the municipality launch a series of **thematic articles, podcasts, or short videos** on renewable energy or energy efficiency on a weekly/monthly basis. Even articles about local government developments can go beyond the simple presentation of facts. It may be worthwhile to fill these articles with deeper professional content to place the developments in a regional, national, European, and global context since, based on the principle ‘a little goes a long way’, residents can feel they are essential participants and shapers of a global change.

The most important areas the communication should focus on because of the high climate impacts they have on the local level:

🌿 Reduction of energy consumption without investments (sufficiency)

- 🌿 Reduction of indoor heating temperature (winter), raising indoor cooling temperature (summer)
- 🌿 Conscious ventilation in residential and office buildings
- 🌿 ‘Buy less, buy local’, etc.

🌿 Promotion of energy efficiency and renewable energy sources

- 🌿 Importance of local energy communities and eco-circles
- 🌿 Tenders, opportunities, and methods for deep renovation of low-efficient buildings.
- 🌿 Support of options for locals living in energy poverty, etc.

🌿 Promotion of climate-friendly measures and activities related to transport

- 🌿 Modal shift in transport (promotion of cycling / public transport)
- 🌿 Eco-driving
- 🌿 Car-sharing, etc.

In addition to education and communication, the city administration must add **further horizontal measures** to the LLCS, regarding the municipal and city operation. These measures include **climate-conscious local regulations, green procurement, mainstreaming**, etc.



Did you know?

Campaigns focusing on awareness and behavior change have played a vital role in enabling citizens to save energy during the energy crisis. Well-designed campaigns have the potential to motivate people to reduce their energy use, resulting in significant energy savings in residential sectors (Motherway et al., 2022).

LOCAL REGULATIONS

It is vital to reconsider local regulations **with climate neutrality in mind**.

Climate conscious regulations:

- 🌿 Lifting local ordinances that may hinder the installation of household PV systems in specific locations or city districts
- 🌿 Tightening parking and entry regulations in certain city districts
- 🌿 Regulations protecting green areas
- 🌿 Internal procurement regulations, etc.

Did you know?

In order to combat air pollution and to promote sustainable mobility, numerous European cities have taken significant steps to prohibit fossil fuel vehicles, particularly diesel cars, from entering their inner cities. By 2024, cities such as Paris and Madrid will completely ban passenger vehicles running on diesel fuel, and a few years later, cities like London, Rome, and Barcelona will also restrict access to all combustion engine cars. Overall, approximately 24 European cities, representing a population of 62 million people, are planning to ban diesel vehicles over the next decade, with 13 aiming to eliminate all combustion engine cars to meet stringent emissions limits (Behrmann, 2019).

GREEN PROCUREMENT – LOCAL PRODUCTS, CLIMATE ASPECTS, AND LIFE-CYCLE APPROACH

Green public procurement breaks with the approach that the cheapest offer should be accepted. Green aspects play a prominent role in the selection criteria. In addition to

the one-time purchase price, the life cycle cost perspective helps assess medium- and long-term expenses. Green aspects may appear in several parts of the call for tenders. They can be included in the eligibility requirements, the technical description, or the contractual conditions, and they can also be included in the evaluation criteria. Thus, instead of the cheapest, the best from both an economic and environmental point of view, i.e., the so-called 'most advantageous overall' offer, will be accepted.

The life cycle length of emitting sources and products is an important aspect. More expensive products may be worth it in terms of costs and emissions in the long run.

Environmental protection and sustainability aspects must be enforced whenever possible during public procurement procedures (e.g., municipal car fleet, electrical appliances, food in public canteens, etc.).

MAINSTREAMING – INCORPORATE CLIMATE CONSIDERATIONS IN PLANNING AN ANNUAL MUNICIPAL BUDGET OR LOCAL MUNICIPAL INVESTMENTS

Aspects of climate change must appear in all municipal sectoral and development plans and local legislation. It is necessary to think about how the goals and measures appearing in the given strategy or action plan may be affected by the effects of climate change, and the plans must be modified as necessary.

Furthermore, when allocating the available budget, priority should be given to investments and measures that more strongly represent/support climate aspects (e.g., measure and compare investments in car transport and other modes of transport).

URBAN PLANNING

Urban planning is a very important part of the city's management. To prevent and fight climate change, it is essential to forecast how the land will be utilized. Such a procedure



significantly **reduces the costs** associated with changes in urban land use. At the same time, proper planning makes it possible to **increase the living comfort** of residents (Steuteville, 2021).

Did you know?

- ✔ Spatial planning makes it possible to avoid oversizing the public transport system, which is the reason for excessive emissions of harmful substances into the environment.
- ✔ The appropriate placement of landfills is essential when it comes to residents' health and comfort. Proper urban planning facilitates the introduction of a stable and high level of recycling.

To adapt to climate change, it is necessary to properly design and provide for the operation of protective infrastructure, namely breakwaters and levees. Adequate drainage, green spaces between buildings, and the airiness of urban buildings play a key role in the city's water management, the frequency of heat islands, or the overall temperature prevailing in urban spaces.

2.2. BUILDING SECTOR

The EU Directive on the Energy Performance of Buildings sets the vision for a highly energy-efficient and decarbonized building sector. Achieving this involves specific activities that reduce energy demand for heating/cooling and electricity. It entails a cost-effective transformation of existing buildings to nearly Zero Energy Building (nZEB) standards through activities such as building envelope renovation, installation of a new high-efficiency heating and/or cooling, replacement or introduction of a high-efficiency ventilation system, replacement of indoor lighting, installation of solar photovoltaic (PV) systems, introduction of automation and building management systems, etc. (European Commission, n.d.).

Also, the mentioned Directive and the member states, through their national legislation, encourage the comprehensive renovation of the buildings, which, in addition to the energy renovation, will also implement additional measures that will improve the basic

requirements for the building and increase the climate resistance of the building, such as:

- ✔ Increased mechanical resistance and stability (especially concerning seismic activity)
- ✔ Increased safety in case of fire
- ✔ Ensuring healthy indoor climate conditions/indoor air quality
- ✔ Elements of green infrastructure and nature-based solutions
- ✔ Accessibility for people with disabilities and reduced mobility
- ✔ Smart and sustainable mobility

Box 1: Some of the benefits of the measures for the building sector

- ✔ **Energy cost savings:** Operating cost savings can reach up to 80–95% reduction and even become positive for energy-plus buildings.
- ✔ **Improved comfort:** Well-insulated homes feature a more balanced room temperature profile, less need for heating and cooling (thus less dry air and potential germs), a lack of heat bridges, and reduced draught.
- ✔ **Improved energy performance:** Adding to a comparative advantage, renovated homes are sold and rented out quicker and for higher prices.
- ✔ **Increased value of the building:** Property value increases by 2–10% (dependent on the location and other building characteristics).
- ✔ **Reduced maintenance and repair costs:** Automation, modern equipment, and state-of-the-art solutions can reduce the need and cost for maintenance and repair.
- ✔ **GHG savings:** A roll-out of deep energy renovation would significantly reduce carbon footprint (estimated in 2014 at 90% by 2050 compared to 1990 in the EU).
- ✔ **Improved air quality:** Reduced primary energy and resource demand have a direct

IMPLEMENTATION OF SIMPLE ENERGY EFFICIENCY MEASURES AND CONSUMPTION MANAGEMENT

Low-capital-intensive activities can be implemented without significant disruptions to the normal functioning of buildings. Energy savings achieved in this way can be



significant. This measure is continuous and involves maintaining all building systems and components.

In the first phase, it is necessary to conduct a detailed analysis of the buildings and identify where specific activities listed in the measure description can be applied. It is recommended that the analysis is conducted progressively during the revision of building energy certificates. The maintenance of a continuously updated database is necessary, and this measure is directly linked to introducing an automatic monitoring system and individual measurement of energy and water consumption in public sector buildings.

Specific activities:

- ✦ **Conducting energy audits** to identify areas of energy waste and inefficiency in buildings;
- ✦ **Upgrading lighting systems** to energy-efficient LEDs;
- ✦ **Improving insulation with low-cost solutions such as** applying reflective foils to windows to reduce heat gain during summer, using weatherproof stickers or seals for older windows to minimize drafts, and adding insulating curtains or blinds;
- ✦ **Optimizing heating and cooling systems through regular** maintenance and tuning of heating, ventilation, and air conditioning (HVAC) systems;
- ✦ **Implementing energy management systems** for better monitoring and control of energy consumption.

IMPLEMENTATION OF ENERGY EFFICIENCY MEASURES ON BUILDING ENVELOPE

Respecting the 'Energy Efficiency First' principle, it is necessary to lower the energy demands for heating and cooling of buildings by enhancing thermal insulation through the addition, renewal, or replacement of building components within the heated or cooled areas.

Measures include replacing windows, doors, and transparent façade elements with new ones with better energy and thermal performances implementing thermal insulation of floors, walls, ceilings, flat, sloping, curved roofs, roof covering, and waterproofing.

Did you know?

Energy demands can be lowered substantially by applying the abovementioned measures – from 30% to 70% or more, depending on the state of a building. Also, this lowers the baseline for the second step – design and dimensioning of heating and cooling systems, making investments in technical systems also lower and cost-efficient.

INSTALLATION OF RENEWABLE ENERGY SOURCES FOR HEATING (AND COOLING)

Renewable energy sources, such as heat pumps and solar collectors, offer compelling advantages for building heating systems. Understanding the benefits of renewable heating technologies empowers potential users to make informed choices for building heating needs. By embracing heat pumps and solar collectors, sustainable, cost-effective, and environmentally conscious heating (and cooling) solutions can be achieved. This knowledge paves the way for a greener future, ensuring a positive environmental impact.

Did you know?

Heat pumps are highly energy-efficient appliances. Most good quality heat pump systems achieve average COP (Coefficient of Performance) figures of four or more, meaning they can provide four kilowatts of heating or cooling power using an average of less than one kilowatt of electricity (RISE Engineering, n.d.).



INSTALLATION OF SOLAR PANELS

Solar power plants for electricity generation have significant potential for reducing greenhouse gas emissions with a short payback period. Integrating such systems into existing buildings reduces operating costs, contributes to climate protection, and potentially opens new markets for private investors.

Integrating solar power plants into existing buildings reduces reliance on traditional energy sources and serves as a visible commitment towards climate protection and the transition to clean, renewable energy. Additionally, it creates opportunities for private investors to participate in the renewable energy sector and contribute to the local economy.

Did you know?

Solar power is particularly beneficial in rural electrification efforts. Remote areas often lack access to traditional power supply systems, making grid expansion challenging and expensive. Solar energy provides a decentralized and economical solution for these regions, where individual homes can install solar panels and batteries for customized energy solutions. Additionally, solar-powered microgrids can be implemented to supply reliable energy to entire communities (Cathcart, 2023).

GREEN INFRASTRUCTURE

Green Infrastructure involves nature-based solutions like green roofs and walls, enhancing building and urban resilience for climate change adaptation. These solutions offer multiple benefits, including energy savings, reduced carbon footprint, and improved energy efficiency due to natural insulation from vegetation on rooftops and walls. The vegetation acts as a natural barrier against extreme temperatures, maintaining comfortable indoor environments by using plants and soil layers as thermal buffers, which is crucial amidst frequent temperature fluctuations due to climate change. This is particularly relevant in urban areas prone to heat island effects. Greenery also reduces the risk of flooding by absorbing rainwater, enhancing the

building's resilience to extreme weather events. In urban planning, green infrastructure improves air quality, reduces noise, and creates recreational spaces, thus fostering a harmonious coexistence between built and natural environments. Notably, post-industrial regions like the Katowice Conurbation benefit from green infrastructure to address challenges and enhance urban resilience against climate change impacts (Climate Adapt, 2021).

To keep in mind

While implementing green infrastructure, one should be wary of the possibility of maladaptation. Maladaptation refers to actions or strategies intended to reduce climate change's impacts but create more risk and vulnerability. It occurs when adaptation efforts fail to achieve their intended goals and worsen the situation, leading to unintended negative consequences. For example, planting trees for carbon sequestration in an area prone to wildfires could release more carbon into the atmosphere when they burn, exacerbating the carbon emissions issue. Recognizing this pitfall is vital for effective adaptation (Schipper, 2020).

ADAPTIVE RENOVATION

Adaptive renovation involves retrofitting existing buildings to enhance their energy efficiency and climate resilience, thereby reducing their vulnerability to the impacts of climate change.

The integration of adaptive renovation measures goes beyond physical upgrades. It includes incorporating resilient design principles considering the local climate, potential hazards, and changing environmental conditions. For example, buildings can be retrofitted in areas prone to flooding with flood-resistant barriers, elevated foundations, and drainage systems to prevent water infiltration. In regions at risk of hurricanes or strong winds, buildings can undergo retrofitting to strengthen their structural integrity and resistance to such weather events. By enhancing the durability and functionality of buildings, adaptive renovation contributes to the overall resilience of urban areas and communities (Pajek & Košir, 2021; Manzan et al., 2023).



Did you know?

Adaptive reuse projects come in various forms. These include renovation, where existing buildings are updated and modernized; integration, which involves combining old and new elements seamlessly; facadism, preserving the facade while creating a new interior; preservation, maintaining historical and cultural significance; and infrastructural, repurposing structures for new functions like transportation or utilities. These approaches offer flexibility in how buildings are repurposed to meet contemporary needs.

2.3. WASTE MANAGEMENT

Waste management is a sector closely related to health and the environment. It is influenced by national legislation, regional restrictions, and local planning guidelines that relate to waste and wastewater transport, recycling, treatment, disposal, and energy use. Many possible actions can be taken to reduce greenhouse gas emissions from waste, plenty of which have additional benefits; for example, landfill gas recovery for energy can be cost-effective in many countries. Decisions on alternative waste management strategies are often made locally; however, there are also factors based on national regulation and policy. The chosen waste management treatment also determines the options for reducing greenhouse gas emissions. For many countries still relying on landfilling, increased use of landfilled methane (CH₄) can be a cost-effective mitigation strategy. Therefore, a well-planned and responsible approach to this sector, together with an analysis of the possibilities for local implementation, is important in achieving climate neutrality (Bruggers et al., 2021).

Box 1: Benefits of waste management

- ✔ **Reducing air pollution and environmental pressure:** Landfills can be related to ground and air pollution. Groundwater contamination is not beneficial to humans and the environment, and without proper treatment can be dangerous. Also, the odor associated with the proximity of a landfill is extremely unpleasant. This phenomenon can be eliminated by reducing the amount of garbage produced by the public or increasing the level of recycling.
- ✔ **Slowing down global warming:** Landfills generate enormous amounts of greenhouse gases like methane, which speeds up the global warming process. Reducing the amount of waste in society greatly influences how big landfills are.
- ✔ **Proper waste management** (including the annihilation of illegal waste processing) can **improve hygiene and health:** less waste means less risk of contamination of water or agricultural fields and, thus, less risk of poisoning.

SMALL-SCALE WASTE MANAGEMENT

Waste management is a paramount challenge in today's urban life, as cities grapple with increasing populations and escalating waste volumes. The 8R ideology, comprising eight essential principles, holds the key to improving waste management practices (McDonald, 2021). Those principles are:

- ✔ **Reduce** – The first step to proper waste management is waste reduction. By buying less, we generate less rubbish. It is worth considering whether the thing we want to buy is necessary.
- ✔ **Refuse** – Reusing an item rather than accepting the offer of getting a new one is a good option for reducing waste. For example, refusing a plastic straw for a drink or consuming it from a reusable cup altogether is much greener and reduces the waste created.
- ✔ **Reuse** – A characteristic feature of plastic waste is its durability. Using the same bag again is better than getting a new one.
- ✔ **Repurpose** – It is advisable to find a new life for something that may not be useful to you anymore in its intended purpose. This requires some creativity, but it is worth it when the planet's welfare is at stake.



- 🌿 **Repair** – Instead of buying a new version of a broken product you own, try fixing it. We can cut the quantity of produced goods by reducing the amount of things we have to buy.
- 🌿 **Recycle right** – Make it easier for garbage collection services to sort the garbage. This will speed up the entire process, resulting in more efficient waste reduction.
- 🌿 **Remove** – As with recycling properly, we can help the services by cleaning up waste left by other citizens. It is a good habit that costs us little effort and makes a real difference to our well-being as well as the planet's.
- 🌿 **Rally** – Share your knowledge of these principles with others so that more people learn how to take care of our planet.

For this strategy to work, the vast majority of society must take part. Teamwork makes dream work!

Did you know?

During the manufacturing process, greenhouse gases are generated and released into the atmosphere. Therefore, by reducing the amount of products we buy and use, and thus lowering the number of goods that need to be produced, we can effectively combat this problem. Moreover, by buying fewer products we reduce the amount of waste that ends up in landfills (EPA, 2021). The manufacturing process may generate a lot of greenhouse gases into the atmosphere; therefore, it would be beneficial to cut down the production amount and – as a result – reduce the amount of waste in landfills (EPA, 2021).

WASTE INCINERATION PLANTS

Incineration plants are also known as WTE plants, which stands for Waste-to-Energy plants. These work as follows: After proper sorting and preparation, municipal waste is put into a chamber where it is incinerated. The resulting heat is then processed to heat the water supply located inside the plant. Now, the WTE plant's purpose determines if heat is converted into high-temperature steam for electricity or is used to heat nearby household water.

Burning waste is not as simple as it may seem. The process takes time and it is necessary to conduct it safely so as not to emit dust or harmful pollutants into the atmosphere. All of the obligatory processes are described below (NEA, 2023):

- ✔ Waste reception and storage – All the waste must be delivered and checked if it is proper to use;
- ✔ Waste loading – After waste is checked, it is put into a burning chamber;
- ✔ Combustion – Garbage burns, releasing most of its energy in the incineration process;
- ✔ Heat recovery – Created heat is then used to produce high-temperature heat or to heat water that is then used by households nearby;
- ✔ Harmful substances detection – System constantly controls whether byproducts are safe;
- ✔ Air pollution control – Detecting and capturing harmful gas components;
- ✔ Ash handling – One of many byproducts is ash. It can be stored and used to create other useful things like road sub-base filling;
- ✔ Residue disposal – All byproducts that are left over are then removed and stored like other waste or, if possible, it is further processed.

Did you know?

The burning process generates high temperatures, reaching up to 1100°C. This could be used to create high-temperature and pressure steam to power turbines, resulting in electricity production. "Leftovers" from this process, like ashes and slag, might be used to fill the road base mix. As most metals have a higher melting point than 1100°C, incineration plants allow the recycling of materials that have not burned to dust (Fractory, n.d.).

OTHER WASTE-TO-ENERGY TECHNOLOGIES

The incineration plant is not the only facility that specializes in waste processing. Depending on the composition of waste, it is recommended to use different technologies. The most important and most frequently used are:



- 🌿 **Anaerobic digestion** – Using bacteria, organic waste decomposes with no oxygen. The process generates biogas, a mixture of methane and carbon dioxide. Of course, digestion happens naturally in the environment, but in the digestion tank, it occurs considerably more controlled, faster, and is more harmless to the planet (EPA, 2023).
- 🌿 **Gasification** – A huge advantage of the gasification process is that many different materials can be used. Through thermal decomposition, a gas called syngas is created. This substance is used to produce heat, electricity, and various chemical products (Fouts, 2020).
- 🌿 **Pyrolysis** – To make this process work, it is necessary to burn waste without oxygen included. The product of pyrolysis is syngas, bio-oil, and charcoal (Zafar, 2021).

Did you know?

Syngas is very useful for electricity and heat generation but is also used to create different substances during chemical synthesis. **Bio-oil** can be used to produce even more energy-efficient fuels. Using fluid like waste is always a good way to eliminate it.

REUSE AND REPROCESS WASTEWATER

By using physical, microbial, and chemical processes, wastewater can be cleared and reused. Contaminated water produced by various technological processes typically cannot be discharged directly into the environment. Instead, it must be directed to a treatment plant where it is cleaned and then reintroduced into the water cycle. First, a pipe network must transport wastewater to a water treatment facility. The next step is to remove big pieces of junk. Then wastewater is poured into a big tank where heavier substances settle down at the bottom. After the separation of sludge, it is time to use microbial organisms. Those remove dissolved and suspended organic matter by

transferring it into solids, so it falls on the bottom of the tank like before. In extreme cases, chemicals are used to make the water even purer. After going through those steps, water is ready to be applied for non-drinking purposes like irrigation, industrial use, or groundwater recharge. The whole process varies depending on the supplied water quality and could be less or more intense.

Did you know?

The main water pumping station in Poland's capital, Warsaw, is supervised by clams. These animals are very sensitive to pollution. When and close their shells in contaminated water. Therefore, when most of the clams in the water pumping station close up, the flow of water is automatically shut down to protect residents from being poisoned by contaminated water. Another place in the world where such technology is being implemented is the city of Minneapolis in the US (BoredPanda, 2020).

ADAPTING LANDFILLS

If storing waste is inevitable, landfills must be prepared to reduce its harmfulness. The idea is to prevent underground water contamination by armoring surfaces beneath landfills. Using concrete and other leakproof materials, waste collected in dumps may have less chance to leak into the ground and through it into the water. Moreover, waste collected in landfills may release greenhouse gases into the atmosphere. To minimize this, dump fields could be covered with casing that will stop gases from escaping into the environment. Finally microbial organisms can be used to oxidize methane from waste that is stored in landfill.



Did you know?

To make the substrate impermeable, layers of materials like clay, plastic, and polypropylene are used. On top, there's gravel to let liquid pass through, which is collected and pumped into a separate tank. Soil on top prevents solids from entering the tank. The setup seals tightly to contain methane gas, which is captured for other uses (Anderson Engineering, n.d).

2.4. MOBILITY SECTOR

The Sustainable Development Goals and the New Urban Agenda cover various dimensions, including urban mobility. These documents have been guiding the EU's bilateral and multilateral cooperation and other initiatives to support the implementation of sustainable practices and solutions.

Under the umbrella of the European Green Deal, the EU has adopted and put in place a **series of policy packages to achieve a more sustainable mobility system**. This system must rethink how people and goods are transported, which requires the **prioritization of public transport in urban design (e.g., railway tracks) as well as an emphasis on active mobility (e.g., walkways and bicycle lanes)**.

To help the EU reduce greenhouse gas emissions (by at least 55% by 2030 and by 90% by 2050) and support cities in this endeavor, **the New EU Urban Mobility Framework** issued by the European Commission proposes measures to develop urban transport systems that are safe, accessible, inclusive, affordable, smart, resilient, and emission-free. Such a transition requires a clear focus on active, collective, and shared mobility underpinned by low- and zero-emission solutions. An **effective multimodal transport network** has the EU's Trans-European Transport Network (TEN-T) as a framework. This policy aims to build an effective, EU-wide, multimodal transport network. TEN-T policy sets requirements for this infrastructure, including safety, quality for highly performing

transport, and alignment with environmental objectives (European Commission, 2021b).

Transit experience in urban areas is crucial to a city's reputation. Efficient, sustainable infrastructure and mobility services are required to meet quality standards for communities. Positive references come from cooperation based on cohesion, empathy, professionalism, and integrity. Local administrations can follow a list of instruments and examples to implement sustainable mobility concepts.

ATTRACTIVE PUBLIC TRANSPORT SERVICES

An effective and comprehensive approach to public transport involves using multiple modes of transport and digitalization. Public transport must be at the center of sustainable urban mobility planning, be available and attractive to all and offer barrier-free access. Public transport planning should also address the implementation of connections with areas outside the city center, such as the suburbs and rural areas. The EU Clean Vehicles Directive has been revised in 2019 to establish national targets for procuring clean buses, trucks, cars, and vans for public transport, waste collection, mail, and parcel services. Digitalization and automation of tram, bus, urban rail, and metro services can increase the frequency of services and cut operating costs. Moreover, more data on the actual traffic flows of people are needed to dynamically adapt city-wide public transport capacity, routes, and timetables rather than continuing historically established fixed transport offers. Digital multimodal solutions play a vital role in making public transport more attractive.

MOBILITY AS A SERVICE (MAAS)

Public transport authorities can utilize Mobility as a Service (MaaS) apps to create a comprehensive transportation system. The system would provide passengers with real-time public transport schedules and multimodal options. An all-inclusive package that includes a single ticket would make it easier for passengers to seamlessly connect to longer-distance rail travel and increase mobility options for commuters, people living



in remote and peri-urban areas, and those with reduced mobility (Crozet & Coldefy 2021).

Did you know?

Several key factors need to be considered to ensure a positive passenger experience. These include the cleanliness and comfort of buses and trains, the punctuality and reliability of services, the availability of seating and wheelchair space, personal safety and security on board, the provision of real-time information, the friendliness and helpfulness of staff, and the accessibility of services. To meet the passengers' expectations, customer-focused initiatives must be implemented. These initiatives include analysing feedback from various sources, monitoring of social media sentiments, and using Net Customer Sentiment Scores to determine satisfaction levels.

HEALTHIER AND SAFER MOBILITY: A RENEWED FOCUS ON WALKING, CYCLING, AND MICRO-MOBILITY

Active mobility ways such as walking and cycling are low-cost and zero-emission forms of mobility, which can also bring health co-benefits associated with more active lifestyles. Walking and cycling should be properly addressed in urban mobility policies at all levels of governance and funding, transport planning, awareness-raising, allocation of space, safety regulations, and adequate infrastructure, with a special focus on people with reduced mobility. **Authorities can actively promote cycling, walking, and public transport by investing in infrastructure, including bicycle lanes and walkways.** Moreover, the local authorities can also adopt an investment plan to expand public transport services.

Did you know?

Cities around the world are taking steps to promote sustainable transportation. For instance, the city of Graz in Austria has invested in infrastructure for cycling and walking, particularly in the suburbs. Authorities in Graz have also adopted a plan to expand public transport services (IBV-Fallast, 2015). Similarly, Copenhagen in Denmark is moving towards sustainable transportation by providing electric, hydrogen, or biofuel-powered government vehicles and encouraging residents to walk, cycle, or take public transport. Amsterdam in the Netherlands has also implemented measures such as pedestrianizing parts of the city centre and investing in charging infrastructure for electric cars (City of Amsterdam, n.d.). In France, the government is incentivizing people to switch to e-bikes by offering a subsidy of up to €4 000, with low-income families in low-emission urban zones being eligible for full subsidy (Köllinger, 2022).

ZERO-EMISSION CITY FREIGHT LOGISTICS AND LAST-MILE DELIVERY

It is crucial to accelerate the deployment of eco-friendly solutions such as cargo bikes to achieve sustainable urban mobility. This can be done by employing new distribution models, dynamic routing, and better multimodal integration of urban rail and inland waterways. Such measures would ensure optimal utilization of vehicles and infrastructure, reducing the need for unnecessary empty runs. Prioritizing the freight dimension in sustainable urban mobility planning is important to expedite their implementation. More efforts are required to better incorporate the existing sustainable urban logistics plans (SULPs) into the SUMP framework and to further enhance their development and execution (Köllinger, 2022).

Did you know?

Barcelona implemented a low-emission zone, banning most polluting vehicles on working days between 7:00 a.m and 8:00 p.m. This measure led to a 19% reduction in NOx levels (compared to 2017) within one month. The local authority also offers incentives for low-emission transport (Ajuntament de Barcelona, 2020).



DIGITALIZATION, INNOVATION AND NEW MOBILITY SERVICES

Technologies such as artificial intelligence, digital twins, blockchains, the Internet of Things, and European solutions for satellite navigation and earth observation promise to make urban mobility smarter, more resilient, and more sustainable. Many European cities are already global frontrunners in transport innovation, sustainable urban mobility planning, and implementing ambitious climate and road safety targets. Cities are often the best 'living laboratories' where new solutions to common challenges are designed, tested, and implemented, contributing to more effective and sustainable urban mobility, and further increasing the quality of life in European cities for the people who live there. Cities are also experimenting with the use of Local Digital Twins, combining data from different domains (including mobility) and using visualization, modelling, and simulation to support their decision-making in an integrated manner (European Commission, 2021a).

Did you know?

Over time, Pilsen has developed its own Digital Twin by participating in various EU projects. A local digital twin aims to connect old systems, facilitate better decision making, and allow experimentation by introducing innovation to public and private administrations. Digital Twin provides simulation models that showcase how domains interact, such as traffic, air quality, and noise pollution. For instance, it can simulate how traffic patterns would change if a bridge were to close and how this would affect air quality in specific areas (DUET, n.d.).

TOWARDS CLIMATE-NEUTRAL CITIES: RESILIENT, ENVIRONMENTALLY FRIENDLY AND CLEAN ENERGY-EFFICIENT URBAN TRANSPORT

Given the availability of suitable technological and policy options, cities must prioritize adopting zero-emission mobility solutions. The ultimate goal is to ensure that urban mobility and transport become climate neutral as early as possible. This can be achieved by leveraging synergies of renewable energy generation, storage, and energy communities. City authorities should use their powers within public procurement,

concession or license award procedures, and grant award procedures to accelerate the greening of public transport and fleets. This includes shared mobility and rental vehicles, delivery vehicles, taxis and PHV services. To achieve this transition, the European Union views the Climate-Neutral and Smart Cities mission as a practical example. The mission seeks to deliver 100 climate-neutral and smart European cities by 2030 and lay the foundation for all cities to be climate-neutral by 2050. This challenge centers on urban mobility (European Commission, 2020).

Did you know?

The Netherlands has significantly invested in new infrastructure, particularly PV charging stations. Presently, the country boasts more than 50,000 public charging points with a target of having one million electric vehicles on the road by 2025. This investment in sustainable infrastructure has had the dual impact of reducing carbon emissions and improving air quality while also reducing traffic congestion (Roks, 2019). Additionally, 21 EU countries offer eco-bonuses for electric vehicles, with Romania's Rabla Plus eco-bonus being among the highest (AFM, n.d.). In 2022, the registration of plug-in-only cars witnessed an increase of 83.6%, crossing the psychological threshold of 10 000 units for the first time and reaching 11 611 units, accounting for a market share of 9.1%. This increase is attributed to Romania's offering of one of Europe's highest eco-bonuses for electric cars, amounting to almost €10,000, but not exceeding 50% of the car's price.

INCREASED AMOUNT OF ROADSIDE PLANTING ALONG ROADS/SIDEWALKS/CYCLE PATHS

This idea tackles multiple urban climate change challenges. Firstly, it plays a role in **reducing air pollution** (Pinto Moreira et al., 2022) by enhancing the city's capacity for CO₂ conversion through the proliferation of plants. Carbon dioxide is the primary driver of global warming, and increasing green spaces can significantly contribute to its reduction. Secondly, it **addresses the issue of flooding** (Zimmermann, et al. 2016). Concrete, asphalt, and paving bricks dominate the streetscape in many urban areas, creating solid and impervious surfaces. During heavy rainfall, the water has limited places to go, increasing the risk of flooding and posing potential distress to residents. Thirdly, it **focuses on noise reduction** (Wickramathilaka et al. 2022). Sound pollution



can significantly impact citizens' quality of life in bustling metropolises. Sound behaves as a wave, echoing and subsequently being absorbed by various objects. Moreover, it **focuses on biodiversity** (Goddard et al., 2010), a critical factor in maintaining ecological harmony in our rapidly changing world. Biodiversity encompasses the diversity of animal, insect, and plant species. Lastly, it addresses the **urban heat island effect** (Zoulia et al., 2009).

Did you know?

There are new and enhanced methods of draining water underground called rain gardens and bioswales.

Rain gardens are landscape gardens, where the water is treated and filtered of harmful substances that are washed away with rain before being passed deeper into the groundwater. The structure of the rain garden consists of several filter pads of different porosity and granularity. Commonly, rain gardens are covered in advance with plants with a high resistance to noxious pollutants (Fundacja Sendzimira, 2019; Groundwater Foundation, n.d.).

Bioswales perform a similar task to rain gardens but differ slightly in design. In appearance, they look identical and perform the same function. However, a distinctive feature of bioswales is a stormwater channel under the filtering surface. As a result, excess water from rainfall is not discharged into the soil but **transported** beyond the city boundary or to a wastewater treatment plant for better purification (Iwaszuk et. al., 2019).

PERMEABLE PAVEMENTS

In urban spaces, all paths and roads are necessary for easy movement. These paths are often constructed of impermeable materials, and paving slabs are packed densely without leaving gaps. Using permeable sidewalks helps **reduce the effects of heavy rainfall** (Upper Midwest Water Science Center, 2019) by allowing water to soak into the ground. The structures vary in permeable surface, appearance, or material used. Depending on the design, a given pavement will be more or less permeable to rainwater. In addition to **draining water** into the soil, permeable footpaths **decrease the amount of pollutants** in the air. This is because, in the gaps between the paving tiles, plants are often responsible for converting harmful carbon dioxide into oxygen for humans.

Moreover, the smaller amount of concreted surface lowers **the heat island effect** (Li et al. 2013; Sambito et al., 2021).

BUILDING SOUNDPROOF BARRIERS

One often pays attention to the omnipresent noise when living in a city. High population densities, stores, restaurants, and small factories are all causes of noise pollution. One can reach a solution through sound barriers to minimize this phenomenon. Ideally, these structures should contain natural elements. Firstly, the supporting skeleton may consist of recycled plastic, simultaneously **reducing environmental waste**. Next are the plants surrounding the barriers from the base or top of the barrier. The presence of vegetation **positively influences the quality and purity of air** which in cities, due to numerous sources of pollution, may not be in the best condition. Of course, the primary purpose of the sound barrier is to **absorb noise**, which has a positive effect on the well-being of the citizens. Sound barriers do not have to be boring. Proper design of such structures with attention to the presence of a large number of plants can positively **contribute to the mental health of citizens**. In addition, such a barrier can also include **rainwater drainage systems** (Jewell, 2016).





CHAPTER

3

**URBAN PATHWAYS TOWARDS LONG-TERM
CLIMATE NEUTRALITY**

CHAPTER 3: URBAN PATHWAYS TOWARDS LONG-TERM CLIMATE NEUTRALITY

To become climate-neutral and resilient, cities must transform themselves profoundly and comprehensively (Haupt et al., 2022). Transformation pathways help to visualize the desired transformation and can introduce intuitive name tags, such as smart city, circular city or green-blue city, on a city-wide vision (2050 Pathways Platform, 2017).

The term pathway is used in the sense of both “an entity (the route or chain that is followed) and as a process (the way in which the path is forged)” (Stripple & Bulkeley, 2019, p. 53) and it involves “moving from niche-level innovations to regime-level change” (Tozer et al., 2022, p. 2). Transformations involve such large, abrupt, and persistent changes in the structure and function of a physical or social system. They entail, for instance, changes in value systems, policy objectives, and/or governance structures (Rosenzweig et al., 2018). Transformation pathways thus encompass institutional, economic, technological, and social changes necessary to achieve the desired vision.

A transformation pathway towards climate neutrality always depends on individual local conditions. Therefore, there is no one-size-fits-all ideal pathway for cities to follow. Instead, cities have to develop individual transformation pathways adapted to local needs and strengths (Izdebska et al., 2022).

3.1. WHY START THINKING IN TRANSFORMATION PATHWAYS?

Thinking in transformation pathways offers the advantage of taking an **integrated perspective** that takes into account climate mitigation measures towards carbon neutrality while considering other city objectives at the same time. This integrated perspective is key, first, because climate change mitigation and adaptation need to be integrated into all major city development processes (e.g., urban and transport planning, green area management, education, etc.) as cross-sectoral tasks (Haupt et al., 2022). Second, it allows a city to achieve synergies between the different priorities it sets.

Formulating a transformation pathway can trigger a conversation between a wide range of stakeholders to think about what they would like to achieve in terms of city development (Bailey, 2017). The creation of (collaborative) visions or scenarios and their associated transformation pathways can thus encourage **collective problem-solving, greater ownership** of proposed actions and **a common understanding of required change** (2050 Pathways Platform, 2017; Bailey, 2017). It can also help to turn qualitative aspirations into quantified scenarios (2050 Pathways Platform, 2017).

A transformation pathway **visualizes the direction of city development** (cf. 2050 Pathways Platform, 2017). By putting a name tag on a transformation pathway, it is also possible to capitalize on the associated processes through **urban marketing** strategies (Haupt et al., 2022). The following sections introduce the most common transformational concepts that help to achieve a climate-neutral city and give some practical examples.



3.2. CIRCULAR CITY

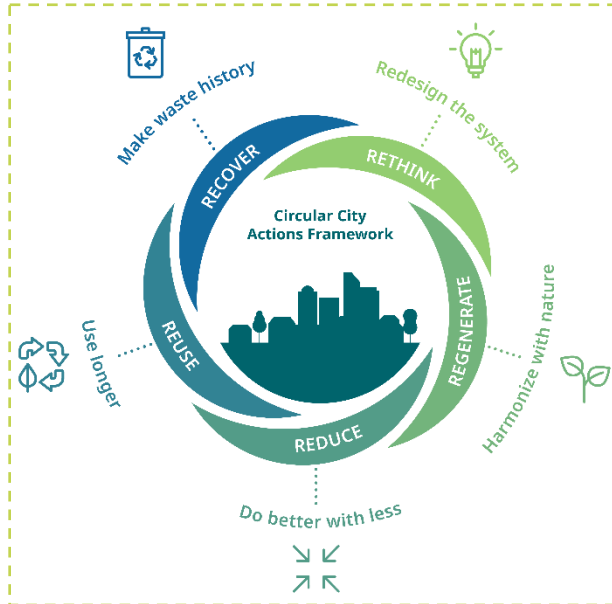


Figure 1: Circular City Actions Framework

The circular city concept is based on the transition from the linear ‘take-make-dispose’ to a circular economy through an integrated approach of all the functions a city may have. The transition should be just and in close cooperation with the civil society, the private sector, and the research and innovation ecosystem, setting the scene for a fair and prosperous society, where economic growth is decoupled from resource use and environmental harm

(World Economic Forum, 2018). The circular city can only function via a systemic shift to a regenerative economic model, fundamental to achieving climate neutrality and keeping resource consumption within the planetary boundaries (Circular Cities Declaration, n.d.).

Through this transition, cities seek to secure local resources, lower emissions, enhance biodiversity and reduce social inequities in line with the Sustainable Development Goals (United Nations, n.d.).

The Circular City Actions Framework (ICLEI et al., 2021) introduces cities to the range of strategies and actions they can implement towards circular development at the local level. These five complementary areas of intervention address the different functions of each local and/or regional authority, from public service delivery to cooperation with local stakeholders, asset management, urban planning, and regulation (Novak et al., 2021). They can be applied to production, consumption, and waste management processes and are effective if implemented in parallel.

The Framework includes five pillars:

- 🌿 **Rethink** – i.e., build the foundation for circular activities and enabling the transition to a circular economy;
- 🌿 **Regenerate** – i.e., foster infrastructure and production that allow natural ecosystems to thrive;
- 🌿 **Reduce** – i.e., enable design processes and products that minimize material, water and energy use, along with waste generation from production to end use;
- 🌿 **Reuse** – i.e., extend and intensify the use of existing resources, products, spaces and infrastructure;
- 🌿 **Recover** –i.e., maximize the recovery of resources at the end of the use phase and reintroduce them into production processes.



Box 1: Buzău's 2030 Strategy for Transition to the Circular Economy

A shining example in Romania is the '2030 Strategy for Transition to the Circular Economy in Buzău Municipality', the result of collaborative development between Buzău City Hall and the 'Ernest Lupan' Institute for Research in Circular Economy and Environment, unfolding the conversion steps to circular economy as means of turning the city towards a low-emissions self-sustainable community. The vision for a circular Buzău focuses on seven major objectives:

- ✔ **Resilience:** a pole of excellence for circular economy adopted measure;
- ✔ **Materials:** a city with zero waste and a flow of circular materials of almost 60 %;
- ✔ **Energy:** powering the city with renewable energy mainly locally produced;
- ✔ **Biodiversity:** the city's ecosystems regenerated through strategic actions;
- ✔ **Health:** flexible infrastructure, designed for maximum use and nearly zero emissions urban mobility;
- ✔ **Society and culture:** a healthy, safe, and attractive environment with recreation spaces for all;
- ✔ **Value generation:** a strong local economy stimulating the development of circular businesses.

According to the city of Buzău, the circular economy is important because it creates new jobs and processes that will use waste or unused resources of the local economy as a resource (OER, 2021). These small local businesses will generate new concepts and, in time, can develop into large businesses creating a new market for resources and products.

Investors will then have an economic interest in developing and refining them through innovative technologies. New business concepts will also have the role of reducing environmental impact, becoming clean economic processes that will no longer generate emissions or will counteract emissions of the current economic environment.

Through the 'Circular School', the city is taking steps to reintroduce rainwater into the natural cycle or to reuse rainwater in as many circuits as possible. The measures will also be reflected in urban planning regulations, so that energy efficiency, reuse or recycling processes that have been pilot projects are part of all projects for which planning permission is granted.

The Circular City Strategy was developed in cooperation with a sample of the largest economic actors in Buzău. While the circular economy is at the forefront of local policy, energy efficiency and climate actions are also decisive factors in all the local strategies and are included in all the projects developed. Moreover, they represent criteria for establishing circular economy actions, being interdependent.

Concrete actions and steps to be taken are initiated in cooperation with the Coalition for Circular Economy in Romania, civil society and external partners for the implementation of good practice measures. With the support of the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection, Buzău Municipality also developed the Smart - Green - Circular Buzău project to create a guide of measures for waste and water management, energy efficiency and education in schools.

Sources and more information:

- ✔ <https://www.oer.ro/despre-economia-circulara-in-municipiul-buzau/>
- ✔ <https://www.economiecirculara.eu/>
- ✔ <https://econet-romania.com/ro/event/incheierea-si-prezentarea-proiectului-smart-green-circular-buzau/>

3.3. DOUGHNUT ECONOMY

The ‘Doughnut’ of social and planetary boundaries could just turn out to be the compass we need for creating a safe and just 21st century.

Raworth’s model was introduced in Raworth (2017) and is separated into three main areas. The inner ring represents a society where humanity is putting little to no pressure on the planet, a utopian idea, considering the number of people on the planet today, as well as a reminder that the Earth provides resources that we can use, but must not over-exploit. Then there is the outer ring that represents how we are living today. It shows a society that has depreciated the planet’s resources, neglecting the responsibilities that each person has to the planet and the impact that certain practices have on the environment. The middle ring of the diagram, or as Raworth calls it, the ‘Safe Space’, is the perfect balance we should strive for (Raworth, 2017). This would be a world where everyone’s needs are met while keeping the planet’s health in consideration along the way.

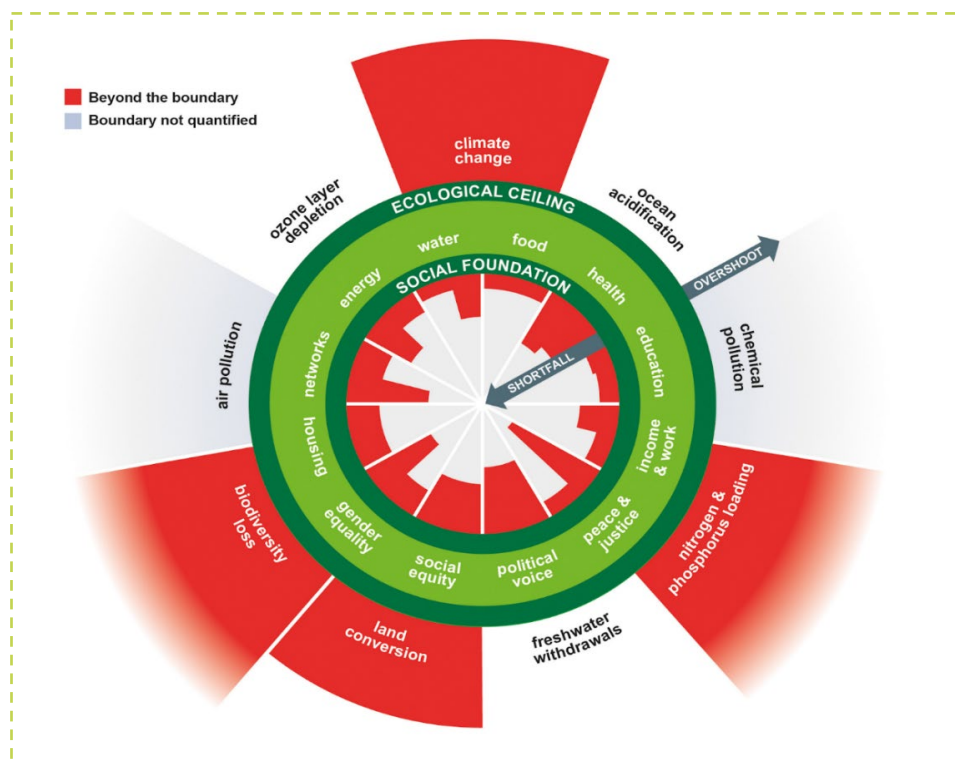


Figure 1: The scheme of the Doughnut model



In the Doughnut, there are nine ecological boundaries that surround the ecological ceiling and twelve that surround the social foundation. To develop sustainably, people cannot surpass or fail the limits of these boundaries. The environmental ceiling covers the planetary boundaries of climate change, ocean acidification, chemical pollution, nitrogen and phosphorus loading, freshwater withdrawals, land conversion, biodiversity loss, air pollution, and ozone layer depletion. In addition, the social foundation covers the following aspects: food, health, education, housing, income and work, peace and justice, political voice, social equity, gender equality, networks, energy, and water (Raworth, n.d.).

The Doughnut Principles of Practice provide an inspiring roadmap for building a sustainable future: **Embrace the 21st Century Goal** and meet the needs of all people within the planet's limits. **See the Big Picture** and transform economies by recognizing the potential roles of households, commons, markets, and states. **Nurture Human Nature** by fostering diversity, participation, and collaboration. **Think in Systems** and continuously improve by experimenting, learning, and adapting. **Be Distributive** by sharing the value created with all who co-created it. **Be Regenerative** and work in harmony with the cycles of the living world. **Aim to Thrive Rather Than Grow** and know when to let the work spread out via others instead of scaling up in size. **Be Strategic in Practice**, follow the energy, balance openness with integrity, and inspire others by sharing learning and innovation. Let's take action today and build a sustainable future for all (see box 1 for an example).

Box 1: A public policy example: Brussels' Region Shifting Economy

The pandemic has highlighted a wide range of new challenges and in order to address them, the Brussels-Capital Region has decided to adapt and deepen its commitments to an economic, social, and ecological transition. To achieve carbon neutrality of economic activities by 2050, the Go4Brussels 2030 strategy was presented in February 2021 and implemented in Brussels according to the socio-economic model of the Doughnut, with the aim of meeting the needs of all its inhabitants while remaining within planetary boundaries.

The pandemic and successive crises (environmental crisis, war in Ukraine, etc.) have, for example, highlighted the limits and vulnerability of a globalized economy with little regard for the environment. Moving Making the switch from an international and global level to a local level one is therefore a step towards achieving Go4Brussels' goals of a decarbonized, regenerative, circular, social, democratic, and digital economy by 2030.

In this context, the 'Shifting Economy', a regional strategy proposed by the Secretary of State for Economic Transition has been developed into a comprehensive action plan to align the Brussels government's economic objectives with its climate objectives. The project converges with the SDGs of the UN and is a Brussels version of these objectives.

To implement the change, this gradual shift aims to provide economic support (financing, mentoring, public procurement, R&D, etc.) to economic activities that are territorially re-anchored and have a societal purpose. The project also intends to develop quality jobs and increase the employment rate, reduce unemployment, and develop the skills of the people of Brussels.

Sources and more information: Dreze, Scarpa & Simonyan (2022).



Box 2: The Amsterdam city doughnut – a tool for transformative action

Amsterdam is in the ideal position to build on its existing ambition and use this doughnut concept as a tool for transformative action within the city. The city is home to a dynamic network of city changemakers already finding innovative ways to put doughnut thinking into practice.

This first version of the Amsterdam City Doughnut has been created based on publicly available data and reports, essentially making it a public portrait of the city. What if city changemakers were to layer onto it all of the ongoing initiatives that are helping to bring Amsterdam into the Doughnut and make it thrive? In doing so, changemakers would effectively create the first 'City Selfie': a living image of transformations underway, thus helping to make visible the seeds of a thriving Amsterdam that is already emerging.

This resulting and unique City Selfie would be a diverse, lively, ever-changing, challenging – but also energizing – portrait of a city that is already in transformation.

The City Portrait can be used by policy makers and stakeholders as a starting point for reflecting on the opportunities and challenges, synergies, and tensions, of alternative policy initiatives under consideration. By taking a holistic perspective on possible actions, they can build the insights gained into the policy design process. If the portrait is first turned into a City Selfie, the interconnections and insights will be even richer.

Source and more information: Doughnut Economics Action Lab (2020).

3.4. SMART CITY






A smart city is a place where traditional networks and services are made more efficient with the use of digital solutions benefitting inhabitants and businesses. This approach goes beyond the use of digital technologies for better resource use and less emissions. It means smarter urban transport networks, upgraded water supply and waste disposal facilities, as well as more efficient ways to light and heat buildings. It also means a more interactive and responsive city administration, safer public spaces and meeting the needs of an ageing population.



A smart city's main goal is to optimize urban functions and promote economic growth while improving the quality of life for residents through smart technology and data analytics. The value lies in how the technology is used, rather than simply how much technology is available.

The term **Smart City** signifies the ability of an urban center to adopt digital solutions and to implement cyber-physical systems, thereby realizing the vision of its various stakeholders, including the expectations and creativity of its inhabitants in the development of urban space (European Commission, 2023).

A city's smartness (Chang et. al., 2023) is determined by a set of characteristics, including:

-  Technology-based infrastructure
-  Environmental initiatives
-  Efficient and highly functional public transportation
-  Reliable and progressive city plans
-  People able to live and work in the city, taking advantage of its resources

Cities are becoming increasingly focused on how they can use technology to enhance and automatize all processes involved in urbanization. For example, from introducing Wi-Fi and wireless networks to new locations to collecting data through IoT (Internet of Things) enabled devices that can help with real-time decision-making. There are endless ways in which cities can change the way they operate. But making this kind of change is not as simple as setting up a network and adding a few IoT devices at key intersections and stops. The process of building a smart city needs to be approached wisely. It requires careful consideration of scope, implementation, and cooperation between departments.



Box 1: A 7-step guideline on how a smart city can be created (Hunt et. al, 2020)

<p>PRIORITIZING DATA</p>	<p>The decisions will only be as good as the collected data. Success depends on determining needed data, and how to get and store it. It is also important to keep in mind resilience and the need for backups, both off-site and in the cloud (Miller, 2017). The key, then, is to set up local storage and periodically sort it for long-term use on a cloud network. Data processing is just as important as data collection. It is important to limit what is transferred to the cloud, however, it is good to have local processing resources. Spread processing gives systems such as dynamic traffic management the ability to respond much faster. This reduces the need to contact headquarters for every decision.</p>
<p>STRUCTURE PROVIDED BY THE NETWORK</p>	<p>If data is the basis for building a smart city, then the network is the structure that allows its usage. Since data is only useful when it can be processed, the ability to access information from across the network at all times is crucial. The network nodes need to be close to event and activities areas, especially in terms of connectivity, distance, and architecture. The same applies to the municipal network. The key is to work with a supplier who understands the ins and outs of the network and can take these issues into account.</p>
<p>MAKING IT CONNECTIVITY EASIER</p>	<p>Besides the physical requirements of the network, there are also digital ones. The biggest priority is to create a lag-free environment that allows for fast decision making in accordance with the speed of life in 21st-century cities. It is important to consider which IoT devices need to connect and how. For example, a water level sensor has other requirements than a traffic camera.</p>
<p>INFRASTRUCTURE MADE UP OF MODULES</p>	<p>The modular infrastructure allows for updating all devices or just selected ones, while ensuring business continuity and the flexibility to upgrade or scale as needed.</p>
<p>KEEPING SECURITY IN MIND</p>	<p>Smart city infrastructure needs to consider the defense against civic attacks, as hackers can be motivated by a variety of reasons, ranging from financial gain to political convictions. Security is a constant battle, which is why it is important to think like an attacker and understand where defenses need to be strengthened.</p>
<p>PRIVACY AS THE FOUNDATION</p>	<p>Privacy is another important issue to keep in mind when increasing connectivity and data collection. Therefore, it is imperative to stay up to date with regulations such as the European Union's General Data Protection Regulation (GDPR).</p>
<p>COOPERATION ABOVE ALL</p>	<p>Departments must share data and agree on standards and formatting procedures, so everyone can make the best use of it. This also applies to any new equipment or infrastructure that should focus on multiple purposes. This requires effective communication between departments. Implementing a smart city plan is a big project that can take time. It is wise to start with a few viable projects that provide real value to the departments and citizens. By making people's lives easier, it can drive local involvement that introduces change on a larger scale.</p>

Box 2: Smart city approach in Lublin

The City of Lublin has been consistently raising the level of urban intelligence and implementing the smart city idea, in line with the Human Smart City 3.0 paradigm, where inhabitants co-create the city and have a real impact on decision-making. Projects implemented to date have included a traffic management system, the modernization of public transport towards zero-emission, the launch several solutions in the form of e-services and systems supporting the transparency of public data, such as a geoportal, a 3D model of the city (winner of the Smart City Award) and an open data portal.

Solutions characterizing the smart city of Lublin:

- ✔ Comprehensive 3D building model in an international standard (cityGML technology) – project completed.
- ✔ The creation of an unmanned network of bicycle stations, increased accessibility to tourist and recreational facilities, and making a positive environmental impact – project completed.
- ✔ Development of an EkoAPP: mobile application to assists residents with waste management (e.g, automatic reminder alerting residents of checking the collection date for each waste fraction with an automatic reminder option) – project under implementation.
- ✔ "SOS for seniors": wrist-worn life bands are devices used to summon immediate assistance in life, health, or safety emergencies (a total of 1,685 people have used the service so far) – project under implementation.

Sources and more information:

- ✔ <https://radio.lublin.pl/2020/06/model-3d-4d-lublina-z-prestizowa-nagroda-smart-city-award/>
- ✔ <https://smartcity.lublin.eu>
- ✔ <https://smartcity.lublin.eu/smart-city-lublin/innowacje-spooleczne/>
- ✔ <https://zow.lublin.eu/sosdlaseniora/>



3.5. COMPACT CITY / URBAN SPATIAL PLANNING

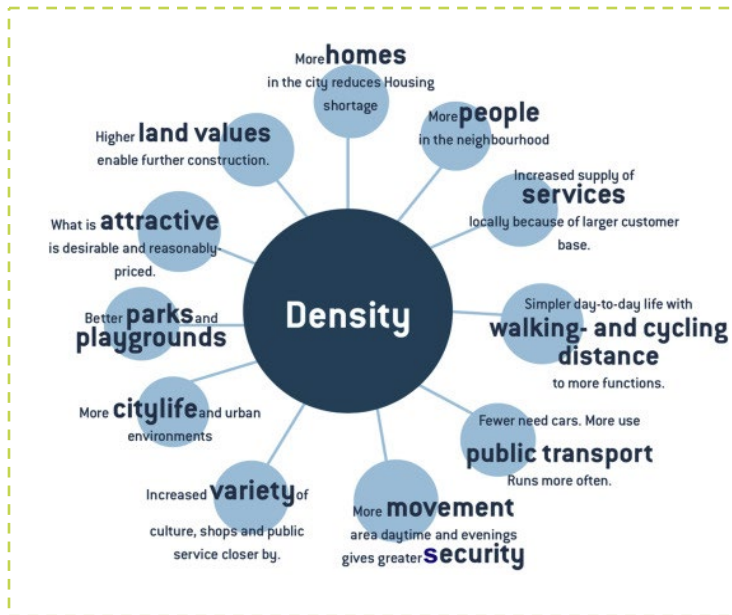


Figure 1: Compact city characteristics

The concept of compact cities already emerged in the 1990s and has been referred to as the sustainable approach to urbanism with positive effects on resource efficiency, economy, citizen health, social cohesion, and cultural dynamics (Commission of the European Communities, 1990). By creating cities with high population densities and efficient land use, this urban

planning and design approach seeks to, inter alia, minimize urban sprawl, promote walkability, provide easy access to public transportation and thus decreasing car dependency, lower per capita rates of energy use, limit the consumption of building and infrastructure materials as well as the loss of green and natural areas. Compact cities aim to reduce the environmental impact of urban areas, enhance social interactions, and improve the overall quality of life for residents (OECD, 2012; Bibri et al., 2020).

While this vision is desirable for addressing many social, environmental and economic aspects, research also shows that these outcomes are not guaranteed and may lead to undesirable side effects and conflicts, such as increased noise pollution, negative health effects, an increase in land prices and resulting socio-economic segregation and inequality (Bramley & Power, 2009; Neuman, 2005). Evidence collected by Bramley and Power (2009) also shows that the intensity and proximity of certain uses have made cities, or parts of them, toxic flashpoints detrimental to human and ecosystem health. To avoid these negative effects, researchers and planners for the concept not to be reduced to the single criterion of 'density', but should take into account the complex

entity of a city with its individual land patterns, structurally diverse ecological conditions, and, most importantly, the social characteristics (Burton, 2000; Neuman, 2005). For the successful implementation of compact city concepts, in-depth knowledge of planning practices is needed to capture the vision of sustainable urban development, as well as a deeper understanding of the multi-faceted processes of change to effectively achieve sustainable urban forms (Bibri et al., 2020).

Box 1: Compact city planning in Gothenburg



Figure 2: Gothenburg

Sweden is one of the leading countries with practical initiatives for sustainable cities, both compact cities and eco-cities. Gothenburg is currently in a phase of expansion with a growing population as a result of increased immigration. Urban planning is seen as a valuable force to achieve the objectives of sustainable development through compact urbanism as a set of practices and strategies (City of Gothenburg, 2014).

In Gothenburg, the compact city model was chosen as the most effective planning system that can go hand in hand with sustainable development.

Its implementation entails the promotion and creation of densely developed nodes/areas with a mixture of functions and demographics supported by sustainable transportation and green spaces (Bibri et al., 2020).

As such, the city of Gothenburg is often seen as a successful example of compact city planning and development. Important success factors are long planning traditions along with the existence and availability of relatively solid economic resources at the local level, the national focus on sustainability in Sweden, and the extensive power given to local authorities (Cereda, 2010; Kalbro et al., 2010).

Within the dedicated Comprehensive Plan for Gothenburg (approved 2009) and its Development Strategy Göteborg 2035 (approved 2014), Gothenburg aims for urban development and its growth within the already built-up areas. This implies that the continued planning should focus on supplementing the built-up areas in combination with concentrating on strategic nodes and building the city from the center outwards. The desired benefits, such as diversity, mixed land use, and sustainable transportation, are to be achieved through design and development strategies and practices (City of Gothenburg, 2014).



3.6. RESILIENT CITY

The Joint Research Centre of the European Commission has developed a framework (European Commission, 2017) that defines a resilient system (or society) as one that is able to face shocks and persistent structural changes in a way that maintains societal well-being without compromising that of future generations. This approach can also be applied to complex ‘human’ systems, such as cities.



Figure 1: Dimensions and indicators of cities’ resilience

According to a more common definition, a resilient city is one that is able to maintain the continuity of its services and functions throughout any acute shock or chronic stress, while protecting and enhancing people’s lives (EC’s Urban Data Platform Plus). Resilience depends on the capacity of a city’s systems, businesses, institutions, communities, and individuals to survive, adapt, and thrive, and it requires cities to consider their capacities and risks holistically, including through meaningful engagement with the most

vulnerable members of the community. The key characteristics of resilience are: Reflective, inclusive, integrated, robust and flexible (Arup and Rockefeller Foundation, 2014).

Box 1: Belo Horizonte (Brasil)

Belo Horizonte is the sixth-largest city in Brazil, with a population of around 2.7 million. Between 1991 and 2010, landslides and floods impacted more than 500 000 residents in the city and its neighboring municipalities. Though this was a particularly extreme period, such events have continued to occur. The strongest impacts were felt by low-income segments of the population, who lived living on hills, riverbanks and other vulnerable areas. To tackle this problem and make the city more resilient, the municipality has established a mix of structural and non-structural measures for the prevention and mitigation to prevent and mitigate natural hazards, such as:



Figure 3: Belo Horizonte, Brazil

- ✓ Amendment of land-use regulations for land use;
- ✓ Development of a strong network of citizens;
- ✓ Shift from an extractive to a service-based economy;
- ✓ Shared responsibility for risk prevention and mitigation across different departments.

Source and further information:

<https://www.oecd.org/cfe/regionaldevelopment/resilient-cities-belo-horizonte.pdf>.

Box 2: Vejle (Denmark)

Figure 4: Vejle, Denmark

Located between an inlet and a valley with lakes and rivers, Vejle, with a population of app. 115 000 (54 000 for the city itself), is prone to rising water levels and at risk of flooding and storm surges. In addition, Vejle faces common urban challenges such as urbanization, growing demand for infrastructure needs and demographic changes. When dealing with the water from above and below, Vejle seeks out solutions that are not only climate-friendly, but also offer multiple benefits, such as educating as

well as engaging people, creating a stronger sense of community, utilizing technological advances, improving infrastructure, and boosting the physical and mental health of the city's residents.

In February 2016, Vejle launched its Resilience Strategy, in which besides climate resilience, co-creation, smart solutions and social resilience are equally important pillars alongside climate resilience. A total of 100 ambitious initiatives were identified. The most important measure of the strategy is the mainstreaming of resilience in the Vejle 2050 plan and other planning documents.

One of the measures is the establishment of the Resilience Lab Denmark, an innovative partnership for energy, water and data. To this end, annual conferences are organized.

Source and further information: <https://resilientcitiesnetwork.org/vejle/>



Further information:

- ✦ <https://www.oecd.org/cfe/resilient-cities.htm> (source of the figure, with case studies)
- ✦ Definitions: <http://resiliencetools.net/node/14>
- ✦ City Resilience Index – interactive online assessment tool: <https://www.cityresilienceindex.org/#/>
- ✦ The European Climate-ADAPT platform: <https://climate-adapt.eea.europa.eu/>
- ✦ City resilient framework report for download: <https://www.rockefellerfoundation.org/report/city-resilience-framework/>
- ✦ 100 Resilient Cities: <https://resilientcitiesnetwork.org/>
- ✦ European Resilience Management Guideline comprising a toolbox of five well-integrated tools, supported by user manuals and video tutorials of Smart Mature Resilience project: <https://smr-project.eu/home/>
- ✦ Final products of URBACT project on Resilient Europe: <https://urbact.eu/networks/resilient-europe>
- ✦ Urban data platform of the European Commission: <https://urban.jrc.ec.europa.eu/?lng=en>
- ✦ Figueiredo, L., Honiden, T., and Schumann, A. (2018) *Indicators for Resilient Cities*, OECD Regional Development Working Papers, No. 2018/02, OECD Publishing, Paris.

3.7. SHARING CITY







Figure 1: Illustration for the annual swap and borrow days in Berlin by BUND Berlin

The Sharing City concept emerged in the 2010s as a new approach to urban development. Sánchez-Vergara et al. (2021) describe the sharing city concept as ‘an ambitious project that aims to improve the city in various fields, e.g. unsustainable overconsumption, social isolation, spatial inequalities, scarcity of resources and spaces, environmental degradation, limited

citizen involvement etc.’ The idea is that social actors transform the city by engaging in sharing practices.

In general, Sharing City projects promote several values, including social justice, well-being, and sustainability with the long-term goal of creating fairer, more democratic and sustainable cities (Sánchez-Vergara et al., 2021). In terms of sustainability, it is pointed out that cities can become more sustainable through sharing, due to associated carbon reductions, reuse of products etc. (Boyko et al., 2017).

Długosz (2014) defines the Sharing City as ‘a livable city – a place where citizens can share infrastructure, utilize idle (public) resources, gain more access to data, establish and participate in sharing enterprises, advance community interaction, and more’. The sharing city thus invites societal actors to actively collaborate on achieving the Sharing City goals, i.e. the Sharing City is co-created. Typical Sharing City goals include (Sánchez-Vergara et al., 2021):

-  the revival of the community in the city,
-  citizen empowerment,
-  solidarity and social justice,
-  sustainability and efficiency,



🌱 social innovation through new economic arrangements.

It is mainly the first three goals that differentiate the sharing city concept from other city labels and projects and account for the concept's attractiveness for city administrations and other societal actors (Sánchez-Vergara et al., 2021).

Box 1: Sharing City Berlin



Figure 2: Givebox in Berlin

Germany's capital city Berlin has a thriving sharing and collaborative economy. In 2012, the think-and-do tank OuiShare started to facilitate a lively exchange of dialogue and action, which led to a strong network of over 200 different projects and more than 1 000 individuals in 2014–15. In 2014, a group of sharing experts also launched 'SharingBerlin' to organize large networking events (Berlin Share Fairs), to map Berlin's collaborative economy ecosystem, and to engage with local politicians and the government to create an official Sharing City (Arnold, 2017). On the initiative of the Berlin Senate Department for Economics, Technology & Research, a working group was established to analyze the potential of Berlin's sharing and collaborative economy. The group published its results and recommendations in July 2016 (Arnold et al., 2016). Since then, many of the more than 200 projects and startups from 2014–15 have ceased their activities. However, new sharing organizations have been established, which share ownership in the legal form of cooperatives – instead of products and services.

Implementing democratic governance, cooperatives share the profit and decision-making with actors along the value creation chain – from developers and marketers to consumers (Arnold, 2020). Sharing City Berlin is still not an official label, but the city pursues various goals that would fit under the label (among others under the initiative Re-Use Berlin, see SenUMVK (2023)).

3.8. BLUE-GREEN CITY / SPONGE CITY



Figure 1: Ecosystem services provided by green and blue infrastructure: (a) regulation of microclimate, (b) noise reduction, (c) food production, (d) carbon storage and sequestration, (e) habitat provision, (f) run-off retention and water filtration, (g) recreational and cultural values, and (h) air purification.

The blue-green city is based on the implementation of blue-green infrastructure (BGI). According to the European Commission, BGI is defined as a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services such as water purification, air quality, space for recreation and climate mitigation and adaptation (European Commission, 2021).

Blue-green urban planning combines all our knowledge of green living with new research on how to restore an urban area's natural water cycle. In the context of urban water resource management, a Blue-Green City seeks to establish holistic planning and management of water, wastewater and stormwater across the whole city that increases the resilience to climate change and extreme weather events while ensuring the health of aquatic ecosystems (Giralt, 2022).

Targeted measures can include green roofs, parks, water retention ponds, rain gardens, or bioswales that not only provide a more cost-effective way of tackling urban flood risks but also enable the connection between blue-green infrastructures in cities through 'green corridors' (TEEB, 2015; Russo & Cirella, 2021). One concept that has



gained increased recognition in the past years is the sponge city concept, where urban water issues are approached with an integrated urban water management approach (Nguyen et al., 2019), see also Box 1.

Box 1: Sponge Town Attnang-Puchheim

The town center of Attnang-Puchheim in Austria, which consists of two central squares, is currently undergoing a major transformation and modernization. The process aims to better connect these squares by making the town center of Attnang-Puchheim more attractive for its residents, introducing more green vegetation into the public space, minimizing through-transit and all traffic in general, and creating areas for walking and relaxing. The entire project was scheduled to take over three years over four construction phases (2020 to 2022).

The reconstruction is based on the 'sponge city' principle, creating the first 'sponge city' in Upper Austria. Respective measures were carried out with pits for planting trees around the roads as well as for constructing the subsoil, which guarantees optimal conditions for tree growth. The plants (trees, shrubs, winter-hardy perennials) that were selected were species that adapt to the changing climate, e.g., by having a good heat tolerance. A specialist for the 'sponge city' system was also invited to participate in the design stage and prepared the first measures together with architects and construction companies. The first construction section was completed in 2020 and it was decided that all other construction sections would also be implemented according to this principle.

Source and more information: <https://www.lifetreecheck.eu/en/Databaze/2021/Schwammstadt-Attnang-Puchheim>

3.9. ZERO-ENERGY CITY

A zero-energy city is an urban area designed and built to generate and consume an equal amount of energy from renewable sources on an annual basis. Such cities offer several benefits, including reduced greenhouse gas emissions, improved air quality, and increased energy security. Thus, they have the potential to mitigate the impacts of climate change, promote sustainable economic growth, and improve the health and well-being of residents. While the construction and operation of zero-energy cities require significant investments, they can result in long-term economic, social, and environmental benefits for communities.

Zero-energy cities aim to achieve a net-zero energy balance by using energy-efficient technologies, renewable energy sources, and smart energy management systems. The goal is to minimize the use of non-renewable energy sources and reduce greenhouse gas emissions to mitigate the impacts of climate change. The design and construction of zero-energy buildings are crucial components of such cities, as they are responsible for a significant proportion of energy consumption. Strategies such as passive solar design, insulation, and energy-efficient lighting and appliances can help reduce the energy demand of buildings. In addition to building design, zero-energy cities also rely on renewable energy sources such as solar, wind, and geothermal to generate the energy required to power homes, businesses, and transportation systems. Such cities also incorporate smart grid technologies to manage the distribution of energy and optimize its use.

Box 1: The zero-energy city is a type of net-zero city, but not all net-zero cities are zero-energy cities!

A zero-energy city is one that produces all its energy locally, exclusively from renewable sources, thereby completely eliminating CO₂ emissions.

A net-zero city is one that may still rely on fossil fuels for to generate energy, but also incorporates an abundance of green infrastructure and cutting-edge technologies that effectively capture and store the CO₂ emissions generated, resulting in a city with a balanced emission output. More information about the difference between zero net energy and zero net carbon: Pollard, 2020.



Box 2: To become a zero-energy city, several steps can be followed (Dion & Seaman, n.d.):

<p>REDUCE ENERGY DEMAND</p>	<p>To achieve zero energy, the primary focus should be on creating a building enclosure that is airtight and super-insulated. This approach is critical as it helps to minimize the building’s overall energy consumption, making net zero energy achievable. Every square inch of the building enclosure should be optimized for maximum thermal performance. A well-insulated building envelope, combined with triple-glazed window systems, reduces the demand for heating and cooling, resulting in lower energy usage. Additionally, it allows for the use of smaller Heating, Ventilation and Air Conditioning (HVAC) systems, which not only saves energy but also reduces initial cost outlay.</p>
<p>HARVEST SITE ENERGY</p>	<p>Capturing ‘free’ energy is an undeniable advantage for building owners in any situation, but it becomes particularly crucial when striving for net zero energy. Sustainable buildings employ passive solar and cooling techniques to optimize the amount of energy collected on site. One way to achieve this is through windows which allow for natural daylight to reduce reliance on artificial lighting and electricity. Nevertheless, it’s important to strike a balance between daylight harvesting and the amount of fenestration in the building’s design. A well-insulated wall offers superior thermal performance compared to triple-glazed windows.</p>
<p>MAXIMIZE EFFICIENCY</p>	<p>As part of a net zero design strategy, building owners should utilize Demand Control Ventilation (DCV) for efficient air quality management. DCV operates by adjusting the fresh air supply in a space according to the ventilation demands identified by CO₂ sensors. During unoccupied hours, the system reduces the ventilation to the code minimum, resulting in substantial energy savings. Daylight sensors minimize the need for artificial lighting. The sensor-based system assesses natural daylight levels in different areas of the building and dims the lighting as necessary. These sensors are positioned strategically to maximize energy gains in the west, south, and east-facing regions of the building.</p>
<p>USE RENEWABLE ENERGY</p>	<p>To achieve the goal of net zero energy, building owners need to integrate the building with an on-site renewable energy system that generates energy equivalent to or greater than the building’s consumption. Among the available renewable energy sources, solar photovoltaic (PV) systems are the most cost-effective and practical option. Solar PV systems are often paired with commercial-scale electric batteries to store surplus renewable energy, reducing peak energy demand on the power grid, and ultimately resulting in significant cost savings for building owners over time.</p>

Box 3: Vauban, Germany: The Most Sustainable City District in Europe

- ✔ Plus-energy and passive solar buildings:
 - ✔ plus-energy buildings – produce more electricity than they consume;
 - ✔ passive buildings are almost entirely heated by passive-solar gains and, partly, by simple heat recuperation systems.
- ✔ A high-efficiency municipal biomass and gas cogeneration plant – provides additional electricity and district heating for buildings in the town;
- ✔ Streets have minimal parking spaces, with roads instead designed instead with pedestrians, cyclists, and public transport in mind;
- ✔ It is not completely emissions-free, as cars are allowed (a parking spot, if provided, costs around 20 000 EUR).



Figure 1: Public transport in Vauban district, Freiburg



Figure 2: Solar roofs in Vauban district, Freiburg

Source and further information:

- ✔ <https://apolitical.co/solution-articles/en/small-german-neighbourhood-became-one-worlds-greenest/>;
- ✔ <https://www.greencitytimes.com/europe-s-most-sustainable-city/>



3.10. HEALTHY CITY

Environmental and climatic conditions affect everyone's physical and mental health. With more than 50% of the world's population living in urban areas (this figure is estimated to reach 70% by 2050), the way cities are designed and developed is crucial for health and well-being. A significant proportion of the burden of disease in Europe is attributed to environmental pollution. Air and noise pollution are among the most significant environmental threats to people's health. Similarly, light pollution is not only a threat to the environment and biodiversity but also to human health. However, the city has the potential to offer more options and solutions for healthy lifestyles, active movement, sharing resources and reducing impacts on the surrounding environment. Nature helps to improve both mental and physical health and well-being, e.g., by reducing air and noise pollution. City authorities can do much to integrate health and well-being into city life, e.g., in urban planning processes or the construction of public facilities or municipal buildings (EEA, 2019; Urban Insight, 2021).

The Healthy City concept is a growing and dynamic movement around the world. It was first developed 30 years ago, has evolved over time, and its implementation has been highly innovative and diverse. It is now more relevant than ever to address the identified and emerging public challenges of the 21st century. The Healthy Cities initiative was created to put health at the top of the social and political agenda of cities by promoting health, equity and sustainability through innovation and multi-sectoral change (WHO, 2020).

The Healthy Cities approach is based on the key principles of cross-sectoral collaboration, community participation and empowerment. In the context of the 21st century, healthy cities are guided by these goals (WHO, 2020):

1 PROMOTING HEALTH AND EQUITY IN ALL LOCAL POLICIES impacting social determinants of health (SDH) and fully aligning with the Sustainable Development Goals (SDGs) (United Nations, n.d.).

- 2 CREATING ENVIRONMENTS** that support well-being, healthy choices and healthy lifestyles.
- 3 PROVIDING UHC, AND SOCIAL SERVICES** accessible and sensitive to the needs of all citizens.
- 4 INVESTING IN HEALTH PROMOTION AND HEALTH LITERACY.**
- 5 INVESTING IN A HEALTHY START IN LIFE FOR CHILDREN**, and providing support to disadvantaged groups such as migrants, the unemployed, and people living in poverty.
- 6 STRENGTHENING DISEASE PREVENTION PROGRAMS**, with special focus on obesity, smoking, unhealthy nutrition and active living.
- 7 PROMOTING HEALTHY URBAN PLANNING AND DESIGN.**
- 8 INVESTING IN GREEN POLICIES, CLEAN AIR AND WATER**, as well as child- and age-friendly city environments, and addressing climate change-related issues such as by lowering emissions and identifying climate-resilient pathways.
- 9 SUPPORTING** community empowerment, participation and resilience, and promoting social integration, peace, inclusion and community-based initiatives.
- 10 STRENGTHENING THE CITY'S PUBLIC HEALTH SERVICES AND CAPACITY** to respond to public health emergencies.

The World Health Organisation (2022) provides [a guide with 20 steps to the development of a healthy, equitable and sustainable city](#), with descriptions of a chain of interventions and events. Many of those steps secure the necessary structures and processes of local governance. These may lead to a consideration of health in all local policies as a prelude to healthy settings – healthier living and working conditions. Improving these wider social, economic and environmental determinants will improve people's health (WHO, 2022). To provide a framework for organizing and implementing healthy cities initiatives and movements, the following areas are crucial:



- ✔ Improving city governance for health and well-being.
- ✔ Reducing health inequalities.
- ✔ Promoting a health-in-all policies approach.
- ✔ Promoting community development and empowerment and create social environments that support health.
- ✔ Creating physical and built environments that are supportive to health and healthy choices.
- ✔ Improving the quality of and access to local health and social services.
- ✔ Considering and planning for all people in the city and prioritize those most in need.
- ✔ Strengthening local public health services and capacity to respond to health-related emergencies.
- ✔ Planning for urban preparedness, readiness and response in public health emergencies (WHO, 2020).



Box 1: The healthy city project in Warsaw

The Medical University of Warsaw has become a research partner the city of Warsaw in the Partnership for Healthy Cities project. With the support of Bloomberg Philanthropies and in partnership with the World Health Organization (WHO) and Vital Strategies, network member cities are taking action to prevent non-communicable diseases (NCDs) – such as cancer, heart disease and diabetes –and traffic accidents.

The „Healty Warsaw” project focuses on developing a methodology to assess and monitor the health status of Warsaw’s residents. Researchers from MUW will collect scattered health data from various medical facilities, including nine municipal hospitals and a network of clinics. This comprehensive data collection aims to provide a complete and up-to-date picture of the health situation of Warsaw residents. The model prepared by MUW will include regular data updates and is expected to be operational until the end of 2023. This initiative takes a broad perspective on population health, considering factors beyond the healthcare system, such as lifestyle choices and daily habits. The diverse set of indicators proposed will help identify the health needs of residents and emerging health problems.

The agreement between MUW and Warsaw City Hall reinforces their cooperation in crucial health care fields, including medicine, emergency medicine, nursing, and health sciences. This partnership allows the city to benefit from the university's expertise in planning activities to protect and enhance the health of its residents. Overall, the "Healthy Warsaw" project represents a comprehensive approach to understanding and improving the health and well-being of Warsaw's residents through collaborative efforts, data-driven insights, and a broad focus on various health determinants.

Sources and further information:

-  <https://www.wum.edu.pl/en/node/17750>
-  <https://www.who.int/news/item/19-08-2021-bucharest-cairo-córdoba-dublin-greater-manchester-and-warsaw-join-bloomberg-philanthropies-partnership-for-healthy-cities>



CLOSING REMARKS

Designing for Net Zero: Key Elements in Shaping Local Long-term Climate Neutrality Strategies

Developing effective local long-term climate strategies (LLCS) presents a challenging yet essential task for municipalities on their way to climate neutrality. This guidance aims to serve as a practical guide through the complex process of creating these strategies. Integral to achieving net-zero emissions, mitigating temperature rise, and averting the most severe consequences of climate change, LLCS enable cities to set enduring objectives for both climate mitigation and broader city development. By employing LLCS, cities are equipped not only to establish long-term goals but also to guide immediate decision-making. This is crucial for accomplishing net-zero emissions in the long run and fostering climate-resilient economies at the city level.

To develop an effective local long-term climate strategy, it is crucial to consider several key steps. These steps are pivotal in ensuring that municipalities not only set ambitious climate goals but also pragmatically achieve them, leading to meaningful and sustainable urban transformation.

1 DEVELOP INSTITUTIONAL AND GOVERNANCE ARRANGEMENTS:

Effective institutional and governance arrangements lay the groundwork for the design of LLCS and their successful implementation. These structures foster collaboration, ensure accountability, and support inclusive strategy design.

- 🌿 **Institutional Structures:** Leadership and responsibility are key. Clear leadership roles within municipal structures are essential for guiding the strategy development and its subsequent implementation.
- 🌿 **Governance Structures Within the Municipality:** Promote robust cross-sectoral collaboration within local governments by creating internal decision-making

structures, such as interdepartmental working groups, which are in charge of implementing specific action plans. Emphasize the significance of climate or environmental departments in spearheading and facilitating this collaboration.

- 🌿 **Provide Legal and Policy Framework Support and Work Towards Policy Coherence:** Establish an environment supportive of climate initiatives by reinforcing them through robust legal and regulatory frameworks. Ensure the strategy's outcomes are effectively used in decision-making processes to promote coherence across policies. For example, ensure that local climate adaptation and mitigation plans are integral at the city level, and align with the nationally determined contributions (NDCs) and National Energy and Climate Plans (NECPs) as a crucial resource at the national level.

2 SUPPORT YOUR STRATEGY DESIGN BY HEARING DIFFERENT VOICES:

Incorporating diverse voices and knowledge types enriches the strategy, ensuring it is well-rounded and inclusive. This element is about engaging citizens and stakeholders in participatory formats and integrating their insights into the strategy to promote ownership and increase the possibilities of successful implementation.

- 🌿 **Establish a Neutral Intermediary:** Engage a local university or dedicated agency as a neutral facilitator to build trust and coordinate efforts among various actors.
- 🌿 **Community Engagement:** Actively involve residents and stakeholders in planning and decision-making of the strategy. Explore and innovate with engagement methods such as citizens assemblies and citizen science.
- 🌿 **Multi-Stakeholder Partnerships:** Form partnerships with local businesses, NGOs, community groups, and other stakeholders. For instance, a municipal energy efficiency initiative involves local manufacturers for energy-efficient products, environmental NGOs for awareness campaigns, schools for educational programs, and resident associations for implementing energy-saving measures in homes and community buildings.



3 SET A VISION, COHERENT GOALS, AND ACHIEVABLE TARGETS:

A clear vision, along with coherent goals and achievable targets, serves as the guiding star for a city's climate strategy. This element involves articulating a clear path forward.

- 🌿 **Developing and Achieving a Long-term Vision:** Craft a clear vision with specific, achievable goals aligned with broader environmental commitments. Set short, mid and long term specific and measurable goals that will lead you to achieve the vision.
- 🌿 **Integration of Climate Goals into Operations:** Ensure climate objectives are part of all municipal planning and operations.
- 🌿 **Public Education and Awareness:** Raise awareness about the importance and benefits of climate neutrality.

4 PROMOTE TRANSFORMATIVE CHANGE:

Promoting transformative change involves rethinking and reshaping urban environments and behaviors to align with the long-term vision established for your city. This element is about making bold moves towards systemic changes.

- 🌿 **Transformation Pathways:** Create strategies that align and synergize various city objectives like economic growth, social equity, and environmental sustainability. Transformation pathways help to visualize the desired transformation and can put an easy to remember name tag, such as smart city, circular city or green-blue city, on a city-wide vision.
- 🌿 **Lifestyle and Consumption Changes:** Encourage shifts in individual and community behaviors that align with net zero goals, such as increased use of renewable energy, waste reduction, and sustainable transportation choices.

5 SET MECHANISMS TO REVISE AND MONITOR YOUR PROGRESS:

The establishment of mechanisms to revise and monitor progress is vital for the adaptive management of long-term climate strategies. It ensures strategies remain effective and relevant over time.

- ✔ **Baseline Setting and Action Planning:** Conduct a thorough assessment of current emissions to inform action planning. Develop short, medium, and long-term goals with objectives and monitoring mechanisms.
- ✔ **Monitoring & Evaluation:** Implement robust systems to track progress and adjust strategies based on performance data.
- ✔ **Transparent Reporting and Public Trust:** Maintain transparency in strategy implementation to ensure public trust and support.
- ✔ **Feedback Mechanisms:** Create channels for continuous feedback from residents to refine strategies.

By focusing on these key elements, cities can guarantee that their Local Long-Term Climate Strategies are inclusive, resilient, and to their unique urban contexts. Such a comprehensive strategy lays a solid foundation for a net-zero future, guiding municipalities in making informed, impactful decisions. This ensures that each action taken today contributes significantly towards achieving the long-term objective of net-zero emissions.



ANNEX 1: FUNDING OPPORTUNITIES PROVIDED BY THE EU (EUROPEAN COMMISSION, N.D.)

	NAME OF THE FUND	COUNTRIES	SECTORS	TYPE OF FUNDING	FUNDING RATES AND AMOUNTS	LINKS TO PROJECT EXAMPLES
EU TECHNICAL ASSISTANCE PROGRAMS	European Local Energy Assistance (ELENA)	EU member states	Buildings, Transport, Energy production, Public lighting	Grant for preparation of capital investments	90%, technical assistance up to EUR 5 mil.	https://www.eib.org/en/products/advisory-services/elena/map
	LIFE Project Development Assistance (PDA)	EU member states	Buildings, Transport, Energy production, Public lighting	Grant for preparation of capital investments	95%, technical assistance up to EUR 2 mil.	https://webgate.ec.europa.eu/life/publicWebsite/search
	European City Facility (EUCF)	EU member states, Ukraine, Iceland	Buildings, Transport, Energy production, Public lighting	Grant for preparation of investments	100%, technical assistance up to EUR 70 000	https://www.eucityfacility.eu/calls/map-of-eucf-beneficiaries-by-country-1.html
SHARED MANAGEMENT FUNDS	Cohesion Fund	BG, CZ, EE, HR, CY, LV, LT, HU, MT, PO, PT, RO, SI, SK	Buildings, Transport, Energy, Water, Waste, Environment & Biodiversity	Grant, Technical assistance, Financial instrument (equity, bonds, loans and/ or guarantees)	Up to 85%, details defined in national Operational Programmes	Country level
	EAFRD - European Agricultural Fund for Rural Development	EU member states	Energy, Water, Environment & Biodiversity, Other, Agriculture & Forestry	Grant, Financial instrument, Technical assistance	Depends on the regions	https://ec.europa.eu/enrd/projects-practice_en.html
	EMFAF - European Maritime, Fisheries and Aquaculture Fund	EU member states	Water, Agriculture & Forestry, Environment & Biodiversity, Land use planning	Grant, Financial instrument	Up to 85%, details defined in national Operational Programmes	https://oceans-and-fisheries.ec.europa.eu/funding/emfaf-programmes-2021-2027_en

SHARED MANAGEMENT FUNDS	ERDF - European Regional Development Fund	EU member states	Buildings, Transport, Energy, Water, Waste, Agriculture & Forestry, Environment & Biodiversity	Grant, Financial instrument (equity, bonds, loans and/ or guarantees), Technical assistance	Up to 85%, details defined in national Operational Programmes	Country level
	ESF+	EU member states	Buildings, Transport, Energy, Water, Waste, Land use planning, Environment & Biodiversity	Grant, Financial instrument, Technical assistance	Up to 100%, details defined in national Operational Programmes	https://ec.europa.eu/european-social-fund-plus/en/projects
	Just Transition Fund (JTF)	EU member states	Buildings, Transport, Energy, Water, Waste, Land use planning, Environment & Biodiversity	Grant, Financial instrument, Technical assistance	50–85%, details defined in national JTF plans	https://ec.europa.eu/regional_policy/funding/just-transition-fund/just-transition-platform/project-fiches_en
EUROPEAN FUNDING PROGRAMMES	Connecting Europe Facility (CEF)	EU member states	Buildings, Transport, Energy, Other, Digital	Grant, Financial instrument (equity, bonds, loans and/ or guarantees)	Different, varies from the call	https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/projects-results;programmeCode=HORIZON?programmePeriod=2021-2027&programId=43251567&order=DESC&page=1&pageSize=10
	Invest EU Fund	EU member states	Buildings, Transport, Energy, Water, Waste, Innovation, Digitalization	Grant, Financial instrument, loans, Technical assistance	Up to 100%, Details defined in national action plans	https://investeu.europa.eu/investeu-operations_en
	Horizon Europe	EU member states and	Climate, Energy and Mobility,	Grant, financial instruments	IA – 70% (except for non-profit	https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/



EUROPEAN FUNDING PROGRAMMES		associated countries	Natural Resources, Agriculture and Environment		legal entities, where a rate of 100% applies), CSA – 100%, RIA – 100 %, Depends on the type of action	opportunities/projects-results;programCode=HORIZON?programmePeriod=2021-2027&programId=43108390&order=DESC&page=1&pageSize=10
	Innovation Fund	EU member states, Norway and Iceland	Demonstration of innovative low-carbon technologies on small and large scale	Grant	60% of additional capital and operational costs of large-scale projects 60% of the capital costs of small-scale projects	https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/projects-results;programCode=HORIZON?programmePeriod=2021-2027&programId=43089234&order=DESC&page=1&pageSize=10
	LIFE	EU member states	Buildings, Transport, Energy, Water, Waste, Land use planning, Environment & Biodiversity	Grant	60–95%, depending on the type of action and specific calls, typical projects up to EUR 5 mil.	https://webgate.ec.europa.eu/life/publicWebsite/search
	European Territorial Cooperation programs (Interregs, URBACT IV)	EU member states, Norway, Switzerland, Iceland and IPA, ENI countries	Climate Change Adaptation, Nature protection & biodiversity, Circular economy, Sustainable water, Energy efficiency, Renewable energy, Sustainable urban mobility, Smart energy systems	Grant	70–85%, depending on the program and beneficiary, typical projects up to EUR 3 mil.	https://urbact.eu/good-practices

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CHAPTER 1: GOVERNANCE INSIGHTS AND STRATEGIC MILESTONES IN THE DESIGN PROCESS

FIGURES

Chapter 1 cover photo source: The Association of Municipalities Polish Network „Energie Cités”

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FIGURES

- Figure 1: View of Kempten old town, https://commons.wikimedia.org/wiki/File:Sicht_auf_Kempten_Altstadt_Neustadt.jpg
- Figure 2: Solar registry tool for the citizens of Kempten, © <https://www.kempten.de/solar-kataster-19496.html>
- Figure 3: Old Market Square in city Bydgoszcz, photo: M. Zaborowski, <https://www.bydgoszcz.pl/dla-mediow/zgodana-wykorzystywanie-zdjec/>

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FIGURES

- Figure 1: MOBILITAR research, analysis & co-design coordinated by Brasov Design Centre, photo by: ABMEE



Figure 2: Brasov Empathy Map. Photo: ABMEE

Figure 3: City of Karlovac, source: City of Karlovac.

Figure 4: The final proposal of the Lušćić spatial plan. Source: Lušćić spatial plan

1.3. PARTICIPATION AND STAKEHOLDERS' ENGAGEMENT

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FIGURES

Figure 1: A visit from the (former) environmental minister of Rhineland-Palatinate, Ulrike Höfken, as well as (former) MdB Hans-Josef Fell at the local energy provider "RheinHunsrück Energie". Source: Photo provided by Bertram Fleck.

Figure 2: A visit of a Japanese delegation at the local energy provider "RheinHunsrück Energie". Source: Photo provided by Bertram Fleck.

Figure 3: The municipality of Schnorbach created an award-winning programme to help citizens reduce private energy consumption - and contribute to local climate protection! Source: Photo provided by Bertram Fleck.

Figure 4: Human Smart City event in Minsk Mazowiecki. Source: Minsk Mazowiecki City Hall

Figure 5: Human Smart City event in Minsk Mazowiecki. Source: Minsk Mazowiecki City Hall



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