











## 2 Horizon Scanning Interviews

Our horizon scanning activity started in month 5 of the work package. It seeks to inform the wider NZC program through weak signal recognitions and pattern-finding. We conduct desk-based research on near-term and future trends both in response to signals from cities and wider trends shaping the context of the Mission, with a focus both on risks and opportunities. We use horizon scanning tools and connect research findings to the ongoing emerging climate transition trajectories in the cities. Delivering quarterly short horizon scanning briefings.

### 2.1 Approach

Horizon scanning is a systematic process used to identify emerging trends, opportunities, and threats that could impact future developments. This technique involves gathering information from a wide range of sources to detect signals of change early on. In our project, horizon scanning has been instrumental in identifying the different phenomena that serve as the starting points for our scenarios. (Amanatidou, Butter, Carabias, Könnölä, & Leis, 2012).

For our horizon scanning exercise we defined the purpose of the horizon scanning exercise. This was defined as achieving insights into trends, challenges, risks and opportunities for cities endeavoring to move to climate neutrality. We focused particularly on disruption and topics that went beyond incremental development.

We determined that the scope of the exercise was a 20 month, time bound set of expert interviews responding to themes that emerged from our individual horizon scanning praxis of signal seeking from academic papers, news sources, the City Support Groups and events. The time horizon was focused on 18-36 months, with themes or sectors to be explored grouped by risk domains (e.g., technology, environment, economy).

We created a core set of interview questions based on the '7 questions' foresight method, with the intention that interviews would be semi structured and with scope for deepening questions that were topic specific. Over the 20 month period we intend to conduct around 25-30 interviews, roughly 4 per quarter. Our interviewees were selected based on both expertise and lived experience or positionality, with a recognition that they would be eurocentric but with an aim to include perspectives from beyond Europe too.

Interviews take place via google meets and a recorded transcript is generated. These transcripts are stored in a shared folder and a light touch analysis highlighting key sections and insights is undertaken promptly by the interview lead. Thematic analysis highlights key themes, and looks for indicated trends, drivers, risks and opportunities. There is a focus on identifying weak signals (early signs of change) and strong signals (well-established trends).

The data collected in each quarterly batch of interviews is screened and filtered to filter out irrelevant or redundant data. Further analysis and interpretation categorize the information into themes or clusters based on common topics or patterns. This helps in organizing the data and identifying key areas of interest. These are then synthesized into the horizon scanning briefing for each quarter. These briefings contain content that analyses the identified signals to determine their relevance, impact, and likelihood to impact upon the net zero cities mission.

This analysis considers the following aspects:

- **Emergence:** How new is the trend? Is it just starting to appear or is it well-established?
- **Impact:** What is the potential impact of the trend on your organization or area of interest?
- **Uncertainty:** How certain are you about the trend's development? Are there conflicting signals or high levels of uncertainty?

## 2.2 Questions

We created a core set of interview questions based on the '7 questions' foresight method. These are below. Interviewers also ask deepening and topic specific questions, prepared ahead of each interview.

- Can you tell us a little about your area of focus? We're interested particularly in how it overlaps with the NZC mission ambition of supporting cities to climate neutrality by 2030.
- What is the most interesting thing at the moment in your area of focus? What excites you?
- What are the current trends, drivers and risks that impact on ....
- Optimistic but realistic. If things went well how do you expect ..... will develop over the next 5-10 years? What would be the signs of success? Can you tell us an ideal scenario? (utopian)
- What is the worst-case scenario you can imagine, what are the factors or challenges that would enable this?
- The internal situation. From your knowledge of the organization, culture, knowledge systems and resources (including people) that impact on .... How would these have to be changed to impact on the NZC mission or reach the optimistic state?
- What are the key barriers and threats to .... ? What events or environmental conditions could impact to deteriorate.... Impact on NZC mission?
- Looking back 10-20 years, what has shaped ....
- Looking forward. What decisions or investments need to be made in the short term to enable a successful long term state for ...

## 2.3 Interviewees

Over the lifetime of the work package, we will interview 25-30 experts. These will be approximately 3-4 per quarter. Below are the biographies of the interviewees interviewed to date.

### **Sobia Kapadia**

Sobia Kapadia is the Senior Project Manager on the UKRI GCRF Gender, Justice and Security Hub, Middlesex University. Sobia graduated as an Architect in 2004 and joined the UN in 2010. She has worked in South Asia and the Middle East with a focus on gender, social justice and human rights. Her work has mainly been in Urban Resilience and Community Development to improve the living conditions of the most vulnerable in disasters affected and conflict regions. She has delivered and managed projects for UN and INGOs. On the Hub, Sobia is managing projects across the Migration and Displacement and Transformation and Empowerment streams.

### **Pooja Agrawal**

Pooja is an architect and planner who worked as a public servant at Homes England and the Greater London Authority (GLA). It was at the GLA in the Regeneration and Economic Development team where she developed the idea of and co-founded Public Practice in 2017. Prior to this, she worked at private architecture and urban design practices, including Publica, We Made That and G-Tects (New York),

taught at Central Saint Martins, and was a Trustee for the Museum of Architecture. In 2018, 2019, 2021, and 2022 she was nominated for the Planner's Women of Influence. Public Practice is a social enterprise founded by Pooja Agrawal and Finn Williams to improve the quality of everyday places by building the public sector's capacity for proactive planning. Public Practice asks how can built environment experts can better serve society? It embeds talented architects and urbanists within local authorities to tackle complex issues, like the lack of affordable housing.

### **Professor Tim Minshall**

Professor Tim Minshall is the Head of the Institute for Manufacturing (IfM) and of the IfM's Centre for Technology Management. He is the inaugural Dr John C. Taylor Professor of Innovation, a member of the board of directors for St John's Innovation Centre Ltd and IfM-ECS Ltd, a Visiting Research Fellow at the Institute of Technology, Enterprise and Competitiveness (ITEC) at Doshisha University, and a member of the IET's Innovation and Emerging Technologies Policy Panel. He is a member of advisory / steering committees for groups including ideaSpace, Cambridge i-Teams and 100% Open. He is a member of the board of directors for IfM Engage Ltd, St John's Innovation Centre Ltd, and the Møller Institute Ltd. Tim is a Fellow of Churchill College Cambridge and is Chair of Trustees for the William Templeton Foundation for Young People's Mental Health (YPMH).

### **Anders Wijkman**

Anders Wijkman (born 30 September 1944 in Stockholm) is a Swedish opinion leader and author. Since 2012 he is co-president – together with Professor Ernst von Weizsäcker – of the global think tank Club of Rome. In 2017 he was appointed chairman of the Governing Board of Climate-KIC – a major public-private partnership at EU level for the promotion of innovation of a low-carbon society. Since 2015 Anders is a member of the International Resource Panel (IRP) – a UN appointed expert body "to build and share the knowledge needed to improve the use of our resources worldwide". The Panel's goal is to steer us away from overconsumption, waste and ecological harm to a more prosperous and sustainable future. Anders is also chair of the Association of Recycling Industries in Sweden, member of the board of SIDA (the Swedish International Development Authority), member of the Royal Swedish Academy of Sciences and the Royal Swedish Academy of Agriculture and Forestry and one of the members of the World Future Council.

### **Marta Olazabal**

Marta Olazabal is an interdisciplinary scientist exploring pathways of progress on climate action in cities worldwide. She is also an Ikerbasque Research Associate and Head of the Adaptation Research Group at the Basque Centre for Climate Change (BC3). At BC3, she facilitates conversations around everything urban and I am a member of the Management Committee. She has a background in Environmental Engineering, a PhD in Land Economy and almost 20 years of experience in urban sustainability and climate governance. My interests revolve around environmental governance, local climate planning and transdisciplinary sciences including knowledge production. Her current work focuses on the assessment of climate adaptation progress at the local scale. I have an extensive publication record in top international peer-reviewed journals, actively advise national and international bodies and mentor MSc and PhD students. Since 2020, I have been a member of the Steering Committee of the International Platform on Adaptation Metrics (IPAM). I am now the Principal Investigator of the European Research Council project IMAGINE Adaptation (<https://imagineadapt.bc3research.org/>).

### **José Chong**

José Chong is an urban development and international cooperation specialist with over 20 years of working experience. Track record on managing global programmes for urban planning strategies, urban regeneration and public space policies in international organizations. Leader, Global Public Space Programme at Planning, Finance and Economy Section of the United Nations Human Settlement Programme. Technical coordinator on urban planning and design initiatives in Latin American and Arab States. Advisor for several national and local government on urban policies and strategies for sustainability. Graduated in International Cooperation, with specializations in Urban Development, Post-disaster Architecture, Renewable Energies and Sustainable Architecture and Urbanism.



**Dr Pablo Sendra**

Dr Pablo Sendra is an architect and urban designer. He is an Associate Professor at The Bartlett School of Planning, UCL. He combines his academic career with professional work through his own urban design practice, LUGADERO LTD, which focuses on facilitating co-design processes with communities. At UCL, he is the Director of the MSc Urban Design and City Planning Programme and the Coordinator of the Civic Design CPD and the Cultural Infrastructure short course. He has carried out action-research projects in collaboration with activists and communities. He is co-author of *Designing Disorder* (with Richard Sennett, 2020), which has been translated into 7 languages, co-author of *Community-Led Regeneration* (with Daniel Fitzpatrick, 2020) and co-editor of *Civic Practices* (with Maria Joao Pita and CivicWise, 2017). He is part of the City Collective for the journal *City*.

**Zaida Muxi**

Dr. Muxí is Associate Professor at the Department of Urbanism and Spatial Planning of the Universitat Politècnica de Catalunya (UPC), where she teaches urbanism and gender. She is part of the research group called QURBIS - Quality of Urban Life: Innovation, Sustainability and Social Engagement. Her research at UPC has focused on three main areas: gender studies in planning and architecture; dwellings and neighborhoods; and the impact of globalization on the urban fabric (society and buildings). She is an architect and researcher with over 30 years of experience with a profound knowledge of gender equality principles and their application in an urban context (for example, gender quality indicators).

## 2.4 Emerging themes

Within Manufacturing, 'Regenerative Manufacturing' was identified as a growing trend, with a move to a new imaginary of what a factory can be or do. **Professor Tim Minshall** highlighted the work of Steve Evans in talking about the factory you want on the end of your street as its emissions are cheap energy, water and purified air. The impact of intervening within manufacturing and production is relevant for cities and their emissions, especially as on a global scale in particular reducing emissions in the concrete industry as Concrete production is responsible for 8% of global emissions, larger even than aviation (2%) so an intervention at source can have impact with significant orders of magnitude.

Sustainable and resilient shipping is a current concern, with recent red sea geopolitical tensions amplifying the precarity of shipping routes and norms. These already impact the timeliness of delivering supplies globally but elsewhere in the shipping industry there is an increasing recognition that shifting the consumer norm away from 'as soon as possible' may become crucial, a recent gathering of shipping experts highlighted that reducing the speed of shipping by 10% would have more impact on reducing global emissions than a move towards sustainable fueling. This also reduces whale collisions and positively impacts on maintaining biodiversity.

Public sector staffing and skilling was highlighted by **Pooja Agrawal** with a recognition that the last 10-20 years has seen a trend of skills loss in the public sector, the cause and experience of this varies across Europe ranging from austerity measures to an aging population and changing population needs. Public Practice as an organization specializes in attracting professionals from the private sector into public service roles and stresses the need for new roles and job descriptions that meet the transition needs of cities and the new cultures of work and capabilities that are required.

**Sobia Kapadia** highlighted that it is not just climate change, but climate change chaos or crisis is part of the conversation as well, we talk about livelihood and governance when we talk about the climate crisis induced movement of people. A specialist in migration and displacement, she emphasized the needs for micro levels of governance that are responsive to emergent and shifting needs of migrant communities. Such governance arrangements may be in relation to housing, temporary work and

integration. The majority of the associated challenges are human induced, reflecting an incapacity or in capability of governance structure, with the less privileged in society marginalized and lacking options.

**Marta Olazabal** emphasized the critical need for cohesive strategies in both mitigation and adaptation to climate change at the city level, pointing out a common pitfall of addressing these strategies in silos within the same municipal departments. Contrasting with the more established evaluation and funding mechanisms available in the field of mitigation, Marta identified a significant challenge in the field of adaptation—primarily, the lack of evaluation methods, which affects the cities' ability to assess the effectiveness of interventions and how these really enhance resilience or lead toward maladaptation. This gap not only hinders understanding and measuring progress but also impacts the accessibility of financing options, particularly affecting cities that are already vulnerable and less equipped to confront these barriers. Moreover, Marta advocated for a change of narrative in how adaptation strategies are evaluated, calling for an approach that extends beyond technical measures to embrace a more inclusive, socially oriented framework. This includes integrating notions of justice, equity and amplifying diverse perspectives from bottom-up, particularly those of more vulnerable cities, while at the same time addressing potential maladaptive outcomes. Redefining success in adaptation should be better connected with local realities and include notions of health, well-being and consumer behaviors (e.g. food choices) alongside the traditional metrics.

**Zaida Muxi** emphasized the importance of incorporating a gender perspective in urban planning, highlighting the need to recognize and integrate care roles traditionally assigned to women. She pointed out that current urban mobility plans often overlook these roles, which involve complex, multifaceted trajectories. Muxi identified a significant challenge in overcoming the reductionist economic view of city planning, advocating instead for the feminist economy that values unpaid care work. This shift is crucial for creating mixed-use, walkable, and safe neighborhoods, contributing to sustainable cities. Additionally, Muxi called for addressing suburban sprawl and promoting neighborhoods that integrate diverse social classes and age groups. She also stressed the importance of involving men in care work and building narratives that normalize and value collective care responsibilities. By recognizing and valuing care work, cities can enhance resilience and move towards climate neutrality, aligning with the goals of the Net Zero Cities project.

### 3 Foresight Deep Dives

We structure our research activities as deep dives; these seek to conduct an anticipatory process by exploring the risks and opportunities in trends in the external environment of the Mission such as global trends and events (including potential crises). By collating the state of existing knowledge on a topic and describing the implied constraints and opportunities for cities we allow capacity for agile responses and innovation through future programme & service (re)-design.

#### 3.1 Approach

A deep dive is a qualitative research technique that involves a detailed and thorough investigation into a particular subject. It goes beyond surface-level information to explore the underlying causes, implications, and intricacies of the topic. The goal is to gain a deeper, more nuanced understanding that can inform decision-making, strategy, or further research.

Within T4.8 Deep Dives are intensive research sprints that take place over 3 months led by a relevant partner organization. The number of deep dives per partner organization is dependent on the number of PMs allocated. Over the lifetime of the work package, we will undertake 8 deep dives.

We frame deep dives and research through a lens of systemic transformation. Topics for deep dives are selected on the basis that they are something that will directly affect cities, impacting directly on their mandate to create a good quality of life and protect the health of citizens to thrive. Topics also need to be aligned to the net zero cities mission and be expected to impact cities prior to 2030. They are envisaged to be issues that a city at this point may not have on their radar and are likely not incorporated into municipalities action plans or strategies yet.

Selected topics for deep dives to date include; Electrification risks in the context of material scarcity, AI and Carbon Neutrality, Mitigation and adaptation, and responding to the health impacts of climate change.

Each deep dive starts with an initial scope, usually established through workshopping in our regular meeting to surface the existing knowledge and insights that we have collectively. This is followed by a literature review that sets out to establish systematically an overview of the state of knowledge on the topic now. This may be accompanied by targeted interviews.

Analysis of the topic is undertaken with an aim to articulate the trends; drivers risks and opportunities that will impact upon cities. This research often involves collaborative and interdisciplinary methods to address the complex challenge of these selected topics, emphasizing sustainability, resilience, and social equity. Each deep dive aims to uncover hidden dynamics and create innovative solutions that can be scaled and adapted to various contexts.

Each deep dive concludes with a summary of the key data and concepts from the research, analyzing the current patterns and misconceptions and comparing the current relative advancements with absolute ones needed for the transition. The research is distilled into a few deep key points for transition. These insights inform the description of constraints and opportunities that will impact cities in a world where these topics' impacts are felt widely. By combining these diverse sources of information, a deep dive allows us to develop a rich, detailed understanding of the factors driving climate transitions, which can inform the creation of robust and realistic scenarios.

A deep dive is a valuable research technique for exploring complex and multifaceted topics in depth. It provides comprehensive insights that can support strategic decision-making and planning. In the context of our climate neutrality project, deep dives help us to uncover critical phenomena and pathways, ensuring that our scenarios are grounded in detailed and credible research.

## 3.2 Topics

Selected topics for deep dives to date include:

- Electrification risks in the context of material scarcity - DML
- AI and Carbon Neutrality - Polimi
- Mitigation and adaptation - Demos
- Health impacts of climate change. - Viable Cities

### 3.2.1 Full electrification risks

The Deep dive on Full Electrification Risks in Achieving Net Zero Cities is a 12 page document, below is a summary of the key points.

### 3.2.1.1 Introduction and Objectives

The transition to carbon neutrality in cities presents both significant opportunities and substantial risks. This document explores these risks and aims to clarify key concepts, misconceptions, and pathways for achieving sustainable energy transitions. The focus is on enhancing understanding and legibility to support decision-making in European cities.

European cities face an urgent need to shift towards clean energy. This work examines critical areas such as energy consumption patterns, increasing energy demands, and the systemic implications of new technologies. It also highlights the environmental, social, and economic risks associated with the energy transition and offers pathways to mitigate these risks while achieving sustainability goals.

### 3.2.1.2 Context

#### *Energy Consumption in European Cities*

Cities rely heavily on energy for heating, cooling, transportation, industry, and electricity. Much of this energy currently comes from fossil fuels. The mobility sector, in particular, has the highest potential for emissions reduction through transformation to cleaner energy sources.

Despite growth in renewable energy, global energy demand has outpaced these gains. European cities face unique challenges, such as securing reliable and affordable energy in the face of geopolitical tensions and increasing demand driven by higher comfort standards and technological growth.

#### *Increasing Energy Demand vs. Urgency to Reduce Emissions*

Energy demand in Europe continues to rise due to more extreme temperatures and increased building stock. Buildings contribute to 40% of the EU's energy use, primarily for heating and cooling. The demand for cooling has tripled in the last thirty years, driven by rising global temperatures. Meanwhile, the urgency to reduce greenhouse gas emissions remains critical, with Europe needing to lower CO<sub>2</sub> emissions by 40% by 2030 to stay within a 1.5°C warming limit.

#### *Predominating Systems and Products in the Green Transition*

**Electric Vehicles (EVs):** EVs are crucial for reducing road transport emissions. However, the production of batteries and motors requires critical minerals and rare earth elements, posing environmental and social challenges.

**Solar Panels:** Solar technology is central to global electricity transformation but relies on materials with significant environmental impacts and supply chain vulnerabilities.

**Wind Turbines:** While cost-effective for climate mitigation, wind turbines also depend on critical minerals and generate waste at the end of their lifecycle.

**Air Conditioning and Heat Pumps:** These technologies significantly increase electricity demand and pose risks of greenhouse gas emissions through refrigerants.

### 3.2.1.3 Capturing Systemic Impacts of the Green Transition

Understanding the entanglements and systemic impacts of new technologies is essential. For example, the production of electric vehicles and other clean energy technologies requires substantial mineral resources, leading to potential supply chain vulnerabilities and environmental degradation.

#### *Risks*

**Sourcing and Production Risks:** Clean energy technologies often require more resources than conventional alternatives. The demand for minerals like cobalt, lithium, and rare earths is expected to surge, necessitating sustainable mining and refining practices. However, the long lead times for developing new mining projects and climate risks to existing supply chains pose significant challenges.

**Environmental Impact Risks:** Transitioning to clean energy involves substantial environmental risks, including pollution and waste from mining and processing critical minerals. Current recycling rates for these materials are low, and improvements in recycling technology are crucial to mitigate these impacts.

**Social Impact Risks:** The high geographical concentration of critical mineral supplies, particularly in politically unstable regions, can lead to social unrest and geopolitical risks. Additionally, a lack of skilled workforce for implementing the energy transition poses further challenges.

**Economic Risks:** Rising costs of critical materials and the potential for insufficient resources to meet the transition goals could hinder progress. Economic stability and investment in sustainable practices are essential to navigate these risks.

### 3.2.1.4 Key Takeaways

- Global energy demand growth outpaces renewable energy installations.
- The electrification of lifestyles must address the root causes of extractive behaviors.
- Europe faces challenges in maintaining a long-term circular economy for electrification.
- Greenwashing and inadequate solutions are prevalent in the green transition.
- Cities must adopt science-based evaluations and holistic approaches to select new solutions.

### 3.2.1.5 Pathways for Cities

Main Goals:

1. Global Environmental Justice
2. Global Social Justice

*What Needs to Be Achieved:*

**Transparency and Knowledge:** Promote data transparency and standardize data collection to enable progress tracking and supply chain fairness.

**Full Circularity:** Reduce the need for virgin materials and enhance circularity in building stock and material use.

**Lowering Energy Use Demand:** Redefine comfort standards and prioritize nature-based and passive design solutions.

Community Engagement: Enhance local involvement in practices and support workforce development for green technologies.

sustainable

*How to Achieve It:*

Data Capabilities: Use advanced data capturing and AI technologies to evaluate systemic impacts.

Standards and Regulations: Develop and enforce sustainability standards across supply chains.

Incentives and Public Spending: Implement incentives and direct public funding towards sustainable practices.

Learning and Inspiration: Foster cross-geographic and intergenerational learning to redefine sustainability standards.

By addressing these areas, European cities can navigate the risks of electrification and achieve their net-zero goals in a sustainable and just manner.

### 3.2.1.6 Foresight workshop

In April 2024, partners from Work Package 4.8 and guests from their organizations gathered for an foresight workshop on electrification risks. This collaborative session aimed to delve deep into the complexities surrounding the transition to electrified urban environments. Over the course of the workshop, participants engaged in a series of interactive activities designed to uncover and analyse the trends, drivers, risks, and opportunities related to electrification.

#### Exploring Electrification Risks

The workshop kicked off with a group activity that revisited the findings from the electrification risks deep dive. Using Miro, a digital collaboration tool, participants populated virtual post it notes with their insights, categorizing them by colour to indicate trends, drivers, risks, and opportunities.

#### Trends in Yellow:

The discussion highlighted several key trends. Notably, global energy demand has surged, outpacing the growth of renewable energy installations. Buildings emerged as significant energy consumers, accounting for 40% of the EU's energy use. The group noted the astonishing rise in energy demand for indoor cooling, which has tripled over the past thirty years. Additionally, the increasing need for critical minerals such as cobalt, lithium, and rare earths, driven by the Paris Agreement's goals, was a major point of concern.

#### Drivers in Blue:

Participants identified various drivers influencing these trends. They emphasized the crucial yet economically challenging advancements in recycling technology. The geopolitical landscape also played a significant role, with European cities grappling with the reliability and affordability of their energy supplies, heavily influenced by international relations. The geographical concentration of the solar



photovoltaics value chain in China was another pivotal driver. Furthermore, the EU's stringent carbon budget necessitates a drastic reduction in CO2 emissions by 2030.

#### Opportunities in Green:

Opportunities were intertwined with risks. The climate sensitivity of critical minerals like copper and lithium highlighted the need for stable supply chains. Despite the availability of raw materials, the environmental and social implications of sourcing them posed significant challenges. The relentless rise in energy consumption for cooling underscored the urgent need for innovative solutions.

#### Risks in Pink:

Risks were ever-present. The lack of recycling capacity was a significant issue, contributing to waste generation. There was a call to strengthen data collection and reporting to enable effective benchmarking and progress tracking. Geopolitical instability, rising energy costs, and societal resistance to forced renovations were also highlighted as potential barriers.

#### Additional Insights in Orange:

Additional insights painted a complex picture of the energy transition. Participants expressed concerns about the immense material demands of the transition, geopolitical tensions, and the potential societal unrest due to rising energy costs and lifestyle changes.

#### Mapping the Future: Futures Wheel Exercises

The workshop then shifted to futures wheel exercises, where participants split into groups to explore the consequences of selected challenges, opportunities, trends, and risks.

#### Group 1 Futures Wheel One:

Group 1 delved into the socio-economic impacts of the energy transition. They discussed the potential collapse of economic systems and the importance of just transition politics. The need for radical lifestyle changes, such as adopting a sharing economy and prioritizing biodiversity, was emphasized. Participants noted a concerning lack of political will and means to limit energy consumption.

#### Group 1 Futures Wheel Two:

This exercise highlighted the far-reaching consequences of poor working conditions. Participants discussed issues such as supporting undemocratic states, environmental degradation, and increased dependency on imports. The discussions underscored the interconnectedness of economic, social, and environmental factors in the context of electrification.

#### Group 2 Futures Wheel One:

Group 2 focused on the environmental impacts of mining and pollution. They examined the damage caused by extracting critical materials, the energy costs of mining, and the need for sustainable

practices. The group also touched on international relations, the push for carbon neutrality in construction, and the importance of local participation in decision-making.

#### Group 2 Futures Wheel Two:

This exercise centred on the challenges of rising energy demand and inequality. Participants discussed the necessity of technological innovations for cooling and heating, the shift towards renovation over demolition, and the broader implications of climate breakdown on urban environments. The need for restructuring ownership policies and promoting sustainable urban ecosystems was also highlighted.

#### Crafting Scenarios: 2x2 Matrix Exercises

In the final activity, participants used a 2x2 matrix to combine two trends or events, generating scenarios based on different combinations of these occurrences.

#### Group 2 Matrix One:

The group explored the implications of mineral scarcity and business as usual (BAU) scenarios. They discussed how scarce mineral availability would drive up prices, necessitate changes in energy sources, and increase recycling. Conversely, continuing BAU without developing alternatives could lead to environmental degradation and societal conflicts.

#### Group 2 Matrix Two:

This exercise focused on the balance between mining and recycling. The group discussed the potential for technological advancements to improve mining sustainability and the impact of increased recycling capacity. Concerns about waste accumulation, landfill fires, and social stability were prominent. The discussion highlighted the importance of balancing technological progress with social and environmental considerations.

#### Conclusion

The foresight workshop on electrification risks provided a rich tapestry of insights into the challenges and opportunities facing European cities in their journey towards climate neutrality. Through collaborative activities, participants developed a nuanced understanding of the complex dynamics at play. The outcomes of this workshop will inform the development of robust scenarios, guiding cities in navigating the green transition and achieving their climate goals sustainably and equitably.

### 3.2.2 AI and Climate neutrality

Led by Polimi, this deep dive is currently in process and will be completed in June.

This exploration delves into leveraging Artificial Intelligence (AI) to achieve climate neutrality, focusing on four key components: **AI for Citizen Intelligence**, **AI for Smart Circularity**, **AI for Environmental Adaptability and Resilience**, and **AI for Governance Innovation**. These components are essential for developing Net Zero cities, offering a blueprint for effective and efficient AI utilization.



AI-driven Citizen Intelligence and Governance Innovation work in tandem to empower communities and streamline policy development with data-driven strategies, promoting sustainable governance. Meanwhile, AI for Environmental Adaptability and Resilience, paired with Smart Circularity, prepares cities to face climate challenges through resource optimization and resilience-enhancing strategies. Together, these AI components create a holistic framework for sustainable urban development, highlighting the importance of integrated technological and governance solutions in achieving climate neutrality.

### 3.2.2.1 Foresight workshop

This deep dive will conclude with a foresight workshop in June.

### 3.2.3 Adaption and mitigation

Led by Demos Helsinki, this deep dive has only just started and is focused on two fundamental strategies used to manage and respond to the impacts of climate change.

Adaptation refers to the process of adjusting to actual or expected climate change and its effects. The goal of adaptation is to reduce the vulnerability of communities, ecosystems, and economies to climate-related impacts and to enhance their resilience. Adaptation involves a range of actions at various levels, from local to global, and can be implemented in various sectors, including agriculture, water management, infrastructure, health, and urban planning. Adaptation strategies can be proactive (anticipatory) or reactive (responding to impacts after they occur). Effective adaptation requires an understanding of local vulnerabilities and the integration of climate considerations into planning and policy-making processes.

Mitigation involves efforts to reduce or prevent the emission of greenhouse gases (GHGs) and enhance carbon sinks. The primary goal of mitigation is to limit the magnitude of future climate change, thereby reducing the risk of severe impacts. Mitigation strategies are typically implemented at national, regional, and global levels and encompass a wide range of activities, including:

While adaptation and mitigation are distinct approaches, they are interrelated and can be complementary. Effective climate action often requires an integrated approach that combines both adaptation and mitigation measures.

Both adaptation and mitigation face significant challenges, including financial constraints, technological limitations, policy and regulatory hurdles, and the need for international cooperation. However, they also offer opportunities for innovation, economic growth, and the development of sustainable communities. Adaptation aims to reduce vulnerability and enhance resilience to climate impacts, while mitigation seeks to limit the extent of future climate change by reducing GHG emissions. An integrated approach that combines both strategies is essential for achieving long-term climate goals and ensuring sustainable development.

## 4 Scenario generation

Scenario generation builds upon the foresight deep dives and horizon scanning interviews, alongside work from across NetZeroCities to create compelling narratives about systemic change.

## 4.1 Intent

The purpose of this task is to develop 6 positive scenarios that enable the consortium, cities, and the Mission to anticipate barriers, bottlenecks, and opportunities in the journey towards achieving climate neutrality. By identifying these critical factors and proposing tactics to navigate future risks, we aim to support cities in strategically planning and executing their transition to sustainable energy systems and carbon neutrality.

These scenarios will serve as an enabler for cities, providing them with knowledge, and frameworks to overcome challenges and seize opportunities. By identifying and addressing barriers, we empower cities to effectively navigate the complexities of the green transition, ensuring they are well-prepared to meet their climate goals.

Ultimately, these scenarios will be editorial assets that are impactful storytelling our purpose is to accelerate the transition to climate neutrality by 2030. Rooted in research, led by a clear vision and cognisant of the existing risk landscape, these scenarios produce a visual syntheses of possible futures, to support Mission development, SGA review and iteration, and external communications.

## 4.2 Approach

We have opted for a vision-oriented scenario generation approach, with the collective goal of climate-neutrality. The vision is rooted in three things; climate, health and justice.

Our aim is to produce six positive scenarios, these are catalysed through crises or breakthroughs. These catalysts are the trigger for action, enabling Overton windows for change. We arrived at the selected catalysts through our horizon scanning activities.

We work from a lived experience of risk perspective. Considering the impacts and risks on bodies and environment, emphasizing why we should care about change, and crafting arguments about what needs to be shifted.

We utilize work from across NetZeroCities to articulate bottlenecks or challenges that currently exist in cities. Then leverage insights generated from our deep dives and horizon scanning interviews to articulate the constraints or shifts that are possible.

Working collectively, we bridge these insights into action points and tactics that inform a decision tree that establishes scenario pathways that include political, economic, behavioural and technological actions and tactics.

Our scenario storytelling focuses on changes in everyday lives in the future. Viewed through the lenses of climate, health and justice. We produce storytelling assets that have a citizen centric viewpoint on change, focusing on articulating impacts and benefits on everyday lives and experience.

We selected this vision-oriented approach because it is lighter than a futures table, easier to communicate and more narrative oriented. A weakness is that it might be more limited and less explorative, but it works well together with horizon scanning, which has helped us to identify the different phenomena and deep dives which inform the pathways. It is also worth noting that, as we are only halfway into the work package, it is a realistic approach to build on the work to date.

## 4.3 Initial scenario catalysts

Our scenarios are initiated through responding to catalysts in the form of breakthroughs or crises. This approach is grounded in the belief that significant transitions often require a triggering event or a tipping point, which can accelerate the shift towards a desired future state, such as climate neutrality. These catalysts are the trigger for action, enabling Overton windows for change.

The selection of breakthroughs or crises as the focal points for our scenarios is a critical step in our methodology. We arrived at a selection of possible catalysts for change through our horizon scanning interviews and from insights from our work package partners. These initial ideas were brought to our regular meeting where we discussed each potential catalyst and scored them against a criterion for selection.

### 4.3.1 Examples of Selected Catalysts

- Technological Breakthrough - AI : A major advancement in AI technology, making it economically viable and possible to create mass multi actor contracts to deliver climate neutrality.
- Behavioural Shift - Degrowth: A widespread societal shift towards sustainable consumption patterns, driven by increased awareness and education about climate change impacts.
- Policy Intervention - Built Environment: The implementation of a comprehensive carbon ceiling built environment policy, incentivizing contractors and developers to adapt rather than rebuild.
- Natural Crisis -Mitigation and Adaption: A significant climate-related disaster, such as a series of unprecedented wildfires, that galvanizes public and political will for urgent climate action.
- Economic Disruption - Finance Innovation: A major economic shift, such as the rapid decline of fossil fuel industries, leading to increased investment in green technologies and infrastructure.
- Political Crisis: The emergence of a rural urban divide and the loss of political mandate triggers social unrest and a breakdown of public services.

## Conclusion

In summary, Task 4.8 of the NetZeroCities project has made significant progress in its first 12 months, laying a solid foundation for achieving its objectives in year two. Through a systematic anticipatory process, T4.8 has effectively integrated emerging signals from cities, expert insights, and horizon scanning to identify trends, opportunities, and risks. This approach seeks to produce assets that enabled the consortium, cities, and the Mission to develop agile responses and innovative solutions for future program and service design.

The key activities undertaken include horizon scanning interviews, foresight deep dives, and scenario generation. These efforts have produced valuable insights into critical areas such as energy consumption patterns, the systemic impacts of new technologies, and socio-economic challenges. By synthesizing this information into quarterly briefings and visual syntheses of possible future scenarios, T4.8 has provided strategic frameworks to support Mission development, SGA review, and external communications.

As the project progresses into its second year, the focus will remain on enhancing the robustness and relevance of the scenarios produced. This will involve continued engagement with external experts, 5 more deep dives into emerging trends, and iterative refinement of the scenarios based on new data and insights. The ultimate goal is to equip European cities with the knowledge and tools needed to navigate the complexities of the green transition, ensuring a sustainable and equitable path to climate neutrality.

T4.8's work underscores the importance of a vision-oriented approach that prioritizes climate, health, and justice. By leveraging research, fostering collaboration, and emphasizing the lived experiences of urban populations, the project aims to create impactful and actionable strategies. This commitment to foresight and innovation will be crucial as cities strive to meet their climate goals and build resilient, sustainable futures.