NET ZERO CITIES

Pilot Cities systemic innovation needs

Deliverable D6.3

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Abbreviations and acronyms

Acronym	Description
WP	Work Package
PCP	Pilot Cities Programme
NZC-SGA1	Specific Grant Agreement 1 under the Framework Partnership Agreement, providing additional resources to the NetZeroCities consortium including a second and third Pilot Cities Programme.

Table 1. Abbreviations and Acronyms

Summary

This report of NetZeroCities presents an assessment of the systemic obstacles preventing cities' progress in the EU's *100 Climate-Neutral and Smart cities* Mission. This analysis is based on insights revealed in the start-up phase of the Pilot Cities Programme, a programme aimed at enabling a number of selected cities to accelerate progress and highlight next domains of climate action needed to close the gap towards climate neutrality. Upon the programme's launch in April 2023 with the 25 selected Pilot Cities proposals, the NetZeroCities consortium has engaged in a range of activities to analyse selected proposals and engage directly with selected cities to surface their needs and obstacles. This report presents the various stages of this analysis, including earlier reports - such as D13.1 Cities support needs assessment and D6.4 leading systemic transformation in cities - as well as a synthesis of the needs it evidenced.

The key findings regarding the needs and areas of focus of cities through their pilots are:

- In their applications and early activities, cities have primarily focused on enhancing their overall capacity to implement transition measures (Levers of Change) rather than concentrating on specific domain-specific solutions (Emission Domains).
- There is a significant emphasis on innovation in governance arrangements, particularly in developing new forms of multi-stakeholder governance, regarded as key to enabling multi-sectoral collaboration and effective leveraging of resources, capacities, knowledge, and expertise from diverse sectors.
- Cities recognise, and look for support on, the importance of meaningful and active citizen participation that empower civic organisations and citizens at large, equipping them with the capacities and agency share ownership and play an active role in the climate-initiatives, effectively becoming co-producers of the transition.
- To enable effective resource collaboration, Cities are developing new mechanisms to mobilise and aggregate private and public financial resources to fund climate initiatives. This requires harmonising various individual project needs into coherent business cases that address multiple outcomes simultaneously.
- Among Emission Domains, pilot activities predominantly centre on domains where cities have more direct influence, such as Energy Systems, Built-Environment, and Mobility Transport. Challenges in these domains, however, are mostly related to the governance, stakeholder mobilisation and funding of the projects, than to more technical aspects.
- Activities in the other Emission Domains remain are, in comparison, largely underexplored, often linked to the previous three domains (e.g. Circular economy in the construction sector, Involvement of industrial sector limited to Construction, Energy and Transport)
- Finally, in regards to how support is delivered, Cities have emphasised their desire for more spaces for peer learning and collaboration, alongside tailored expert advice, to better understand best practices and emerging insights from peer cities.

These findings emphasise that cities view the Mission not solely as an opportunity to accelerate actions where they already have substantial knowledge, but also as a platform for innovation and

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experimentation to enable them to navigate upcoming phases of their pilots that require even greater systemic transformation. In this regard, it is important to note that the current findings are based on an initial analysis of needs, as cities have recently signed their agreements in June and are currently in the planning and early stages of their pilot projects. As a result, it is anticipated that new challenges and requirements for systemic change support will emerge as pilots evolve, but also from subsequent rounds of PCP applications under the NZC-SGA1.

Keywords

Climate-neutrality; cities; systemic transformation; levers of change; emission domains

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Introduction

It is well documented that cities face a wide range of challenges preventing their progress on the way towards climate neutrality. The 100 Climate-Neutral and Smart cities Mission launched by the EU aims precisely at supporting cities in front of these obstacles to accelerate their way towards an ambitious 2030 target. The NetZeroCities consortium (NZC), tasked with supporting selected cities in this initiative, has engaged with cities from an early stage to better understand barriers faced, gathering initial insights through several reports (D6.4 *Leading systemic transformation in cities* and D13.1 *Cities support needs assessment*). Understanding in more details what issues cities face is critical in order to build out the Mission and support effectively selected cities on their journey. These insights shape NZC's capabilities building and learning programme (NZC WP6-10 and NZC-SGA1 WP4), its delivery of agile cities support (through SGA-NZC WP2), sensemaking and monitoring activities (NZC-SGA1 WP4), as well as other Mission initiatives.

Besides the challenges that cities say they face generally, it is important to understand how specific contexts influence barriers to progress and the variety of urban climate-neutrality pathways which can emerge. The Pilot Cities Programme creates an important opportunity to embed work with cities in local intricacies in order to build capacity to unlock systemic barriers locally.

The PCP aims to test and implement innovative approaches to rapid decarbonisation over a two-years pilot programme, working across domains of emission and functional silos in support of systemic transformation. In the process of joining the programme, cities fleshed out their local challenges and where they need new experimental approaches to make progress. As the PCP started in March 2023, 25 winning Pilot Cities proposals gathering Mission and non-Mission cities kicked-off their work through the so-called PCP Bootcamp. Supported by NZC partners, they were offered the opportunity to engage in a range of activities to surface their needs and obstacles. As they reflected on their greatest challenges in the programme application and early programme phases, NetZeroCities has developed a more sophisticated understanding of obstacles to climate-neutrality in cities and opportunities for acceleration.

This report presents the result of NZC's WP6 analysis of Pilot Cities systemic obstacles and needs for support, based on an analysis of the 25 selected Pilot Cities proposals and direct interactions with these cities over the course of several months. We share the different stages of analysis, from initial application scanning to collective and individual learning sessions, and offer an in-depth presentation of key needs across Pilot Cities.

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1 Approach

The approach to understanding Pilot Cities' systemic innovation needs was carried out in three overlapping stages. Each stage consisted of activities that enabled a harnessing of insights cumulatively, creating a process of iterative information-mapping and knowledge-building.

Initial analysis: The initial analysis stage commenced with understanding high-level, strategic challenges that cities experience on the road to climate neutrality, through conclusions obtained from D13.1 *Cities support needs assessment* and D6.4 *Leading systemic transformation in cities*. This stage then progressively zoomed into an understanding of the nuanced complexities of individual Pilot City projects.

Support: Based on the insights gained from the initial analysis stage, a programme of support activities - from online collective learning sessions to one-to-one coaching between Pilot Cities teams and NetZeroCities experts - gave guidance that responded to both strategic and individual project challenges. As part of activities to provide guidance on these challenges, further subtleties about projects and support that was needed were uncovered, enabling further synthesis.

Refined analysis: At the refined analysis stage, knowledge obtained at stages one and two were brought together to develop a broader set of evidence of Pilot City challenges and barriers. In keeping with the iterative nature of the methodology, this knowledge will inform the content and approach to activities for the next cohort of the Pilot Cities Programme (as per NZC-SGA1) and Boot Camp, as well as wider NetZeroCities learning and programme evolution.

1.1 Initial Analysis

Information gained from the initial analysis stage created the basis for the learning and support programmes made available to Pilot Cities.

This analysis took into account systemic obstacles on the climate neutrality pathway as well as analysing systemic obstacles as revealed in early-stage PCP. It consisted of understanding the results of two key Deliverables, which enabled 'a first look' at Pilot Cities' needs and a more detailed 'in-depth analysis'. D13.1 *City Needs, Drivers and Barriers towards Climate Neutrality* provided the first look, while D6.4 *Leading Systemic Transformation in Cities* provided the in-depth analysis.

The insights obtained from each Deliverable is summarised below.

1.1.1 Systemic Obstacles on the Climate Neutrality Pathway

A first look: D13.1 City Needs, Drivers and Barriers towards Climate Neutrality

The report D13.1 *City Needs, Drivers and Barriers towards Climate Neutrality* (Deliverable 13.1 of the NetZeroCities programme), completed in March 2022 was a first step by the NetZeroCities consortium in developing a comprehensive understanding of Mission Cities' anticipated challenges and barriers in achieving climate neutrality by 2030. The obstacles identified in this report demonstrated the common themes across projects aiming for climate neutrality, and therefore shaped the overarching topics of guidance and support offered to the Pilot Cities.

An assessment of barriers and challenges was undertaken though hosting 10 focus group discussions and an associated survey. Each focus group discussion was curated along specific themes in line with the Mission for cities, and engaged 64 cities from 22 EU Member States and 3 Associated Countries. These cities capture typological diversities based on geography, size and level of maturity of climate action. Additionally, preliminary results from the Mission Call for Expression of Interest, which gathered data from 362 cities from all EU Member States and Associated Countries, were also integrated.

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The findings demonstrated five key themes to Cities' drivers, barriers and needs. These themes are listed below along with the most significant learnings about barriers and needs for each.

Policy and governance - barriers and needs include: working in silos with a more systemic approach and new governance model needed and lack of coordination across administration levels with greater coherence in national and local policy needed. The overall conclusion is that planning and finance systems need to change and cross-department collaboration is required to integrate management.

Implementation practices - barriers and needs include: a disconnect between strategy-making and implementation with a need to translate the former into actions and measures that are appropriate to local contexts and communities and the challenge of the length of time to design and implement policies, which may take years to become visible and measurable and which require a move from a project approach towards a portfolio one.

Culture, social innovation and participation - barriers and needs include: the challenges that cities face in engaging business owners, researchers, public institutions - such as schools and cultural organisations - associations, residents and civil society groups given the need to do so to enable cooperation at all levels of society to achieve the 2030 goal. As part of this, behavioural change is seen as a vital component to empowering citizens to take an active role in systemic transformation.

Finance and business modelling - barriers and needs include: a lack of funding to finance new schemes and the need to develop alternative financing tools and regulatory and governance barriers, such as siloed funding structures, along with a lack of knowledge and expertise on climate finance and climate investments. Cities need support in developing investment plans with actions, impacts, benefits and priorities and a structured framework to assess funding alternatives. One example mentioned in focus groups of an alternative financing tool is 'participatory budgeting'. Gothenburg's online community engagement platform, 'Citizens Lab' invites residents to propose their ideas online for how money should be spent and citizens could then vote to decide which initiatives are implemented through funding.

Strategic learning - barriers and needs include: cities would like to learn from each other, especially those with similar problems and journeys, and to learn from experts. There is a need to create peer-to-peer learning opportunities to enable sharing of best practice along with a desire for workshops, one-to-one discussions and case studies along with training from experts.

An in-depth analysis: D6.4 Leading Systemic Transformation in Cities

Following the understanding of cities' needs, drivers and barriers towards climate neutrality, as identified in the above-summarised D13.1 report, the *D6.4 Leading Systemic Transformation in Cities* report developed a framework to address these needs and barriers, including through the Pilot Cities Programme.

The report identifies that 'A change in organisational structures, practices and cultures is needed in cities and their local government, moving from a top-down single actor form of leadership towards deep collaboration; from fragmented plans and interventions towards portfolios of actions, and from isolated emission analysis towards systems understanding'. Priority capabilities for systemic transformation were then identified:

- **Creating organisational capacity for transformation**: this is encompassed by the establishment of a cross-functional Transition team, that will act as an intermediary between city government and local actors in diverse sectors that need to be part of distributed multi-actor climate neutrality efforts, alongside adopting new ways of working and communicating. Ideally, innovation would be embedded across organisational processes, leadership, knowledge management, networking and learning, coupled to a recognition that this requires new skillsets in public organisations

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- **Building an orchestrator skillset**: this is made possible by 'Leading and Storytelling', which is to create a mandate for climate action across government teams and all stakeholders; 'Connecting and Convening', which is to mobilise actors across all sectors to leverage action for local transformation; 'System Thinking', which is to create a transformative portfolio of actions; and 'Operationalising and Making', which is to use available data to create scenarios and turn a systemic understanding of the situation into tools for decision-making.
- **Developing transition leadership in city government**: this includes 'New mental models for city government', exemplified by a shift to a transformative mode of local government which prioritises collaboration and learning as well as devolved problem-solving, as opposed to an emphasis on stability. Also included is a move away from traditional governance models to a learning-focussed model, which allows for constantly evolving reactions that are necessitated by the complexity and uncertainty of the climate crisis.

Necessary to the realisation of these three priorities are three core needs for anyone willing to create systemic transformation:

- **Diffusing change in cities**: this considers the distinct audiences whose transformation capacity must be developed, including 'Individual, organisational and ecosystem audiences' who represent operational-level, leadership-level and actors in the broader ecosystem respectively. It also recommends a 'Capacity diffusion and train-the-trainer model', which targets capabilities building at subject matter experts and practitioners so they can develop practical understanding of new ways of working and train those around them.
- **Leveraging networks around cities**: this considers the ways in which learning could be shared including 'The role of platforms and national/regional communities', which emphasises the importance of active exchange with local practitioners, partners and knowledge networks, as well as national level and international exchange. Additionally, 'A Community of practice for cohesive support' advocates for initiatives such as NetZeroCities being embedded within a broader coalition of transformation supporters and coaches.
- **Change and learning triggers**: this considers how to combat change fatigue through 'learning for and from action', such as learning by doing and learning from existing local practices; 'Learning with and from others', which advises learning from peers.

These conclusions led this first analysis to conclude with the suggestion of two frameworks to address cities need of new capabilities for the transition:

- **Mission cities learning journey**: the Mission cities learning journey culminates in the Climate City Contract (CCC) and consists of seven blocks, which include Building a strong mandate; Activating an inclusive ecosystem for change; Understanding the system, Co-creating a portfolio, taking action, Learning and reflecting, Making it the new normal.
- **Pilot cities boot camp journey**: The Pilot Cities Programme under NetZeroCities is open to both mission cities and non-mission cities. The boot camp is identified as a means to support Pilot Cities to overcome critical challenges and will 'need to begin building the capacity and system innovation capabilities in local government to rethink economic, financial, organisational, political, and cultural systems in order to unlock new pathways towards climate neutrality'.

1.1.2 Systemic Obstacles as Revealed in Initial PCP Proposal Analysis

Analysing the Pilot City Project Applications

Following the announcement of the awarded Pilot City Projects, a high-level analysis of the submitted applications was undertaken. The primary objective of this analysis was to provide a deeper understanding of the collective of projects within the Pilot Cities Programme. This involved identifying common areas of interest, specific project focuses, overarching cross-cutting challenges, potential

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opportunities, and expertise gaps that might exist within the NZC consortium. This analysis was led by Metabolic, with the support of Dark Matter Labs. Its outcomes were insightful to the design of the structure and content of the inaugural Collective Learning Session that took place on **23 March 2023**.

Due to the fast-pace of the programme, the analysis was strategically targeted to specific segments of the Pilot City Applications, which were deemed most relevant to obtain the information needed for the aforementioned purposes. The sections of the pilot applications subject to review included: “Emission Domains”, “Levers of Change, Description”, “Pilot activities”, and “Barriers and Challenges”. First, Emission Domains and Levers were analysed to ascertain general trends (e.g. repetition, notable differences). Then, the remaining sections were analysed more in further detail to identify shared ‘areas of focus’ that emerged consistently across various projects.

For this analysis, an inductive approach was adopted to prioritise granularity and responsiveness to the unique interests of each city. Instead of adhering to the categories of the Emission Domains and Levers from the application form, the categories of the analysis were catered to reflect the specific focus of each pilot project and activity. The emerging labels were then organised into broader categories based on similarity and common properties. These aspects were then organised into broader categories by identifying similarities and common characteristics among them (**Table 02**).

Consequently, the resulting categories, while closely aligned with those of Emission Domains and Levers, exhibit noteworthy distinctions. While almost Levers can be identified, although under different names (except Technology, which was placed into ‘Others’), only four of the six Emission Domains were identified: Built-Environment encompassing partially Energy Systems, Circularity (Multi-sector waste), and Sustainable Mobility. This divergence can be attributed to the fact that, from a high-level assessment, the other two emission domains (Industrial emissions and Land-use) did not emerge as common areas of interest across pilots.

The results of this analysis directly shaped the content of the **Collective Learning session,** organised as part of the PCP Boot camp. The session's themes and discussions were structured around the categories that emerged from this process.

Group	Cities	Key words
Built-Environment & Energy (18 pilots)	Budapest, Cluj-Napoca, Dutch Cities, Galway, German Cities, Guimaraes, Istanbul, Italian Cities, Kozani, Leuven, Liberec, Limassol, Malmo, Polish Cities, Rivne, Slovenian Cities, Spanish Cities, Uppsala	Energy and Climate Policy / Renewable Energy / Energy Communities / Energy Production and Carbon Sinks in Public Space / Heat System Networks / Decentralised Energy Systems/ Housing Energy Network / Fuel poverty / Infrastructure Gaps
		Energy Efficiency in Buildings / Energy Use in Buildings / Energy Efficiency in Housing Stock / Carbon Neutral Built Environment / Built Environment Transition
		Retrofit for Carbon Neutrality / Affordable Housing
Citizen participation (14 pilots)	Bristol, Budapest, Cluj-Napoca, Dijon, Galway, German Cities, Guimaraes, Istanbul, Leuven, Liberec, Limassol, Slovenian Cities, Turku, Uppsala	Citizen Participation and Ownership / Citizen and Community Engagement / Just Transition / Lack of Awareness / Local Action / Citizen Pact / Place-based Participation and Implementation / Communication and Engagement / Participation / Private Sector Buy-in
New Ways of Working (13 pilots)	Bristol, Budapest, Cluj-Napoca, Dijon, Galway, German Cities, Italian Cities, Liberec, Malmo, Polish Cities, Turku, Umea, Uppsala	New Institutional Infrastructure / Innovative Governance / Bureaucratic Procedures / Multi-level Governance / Contractual Innovation / Process Management / Social and Institutional Innovation / Organisational Change
Finance (10 pilots)	Bristol, Budapest, Dijon, Dutch Cities, Galway, Italian Cities, Limassol, Spanish Cities,	Financial Innovation / Climate Finance / Innovative Financing Models / Private Investment / Significant Upfront Costs / Financial Sources / Smart Finance

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	Turku, Uppsala	Instruments / Public-Private Funding / Carbon Budget and Finance
Multi-Actor Collaboration (8 pilots)	Budapest, Istanbul, Kozani, Lahti, Leuven, Liberec, Limassol, Umea	Multi-Actor Incentives/ Multi-Actor Collaboration / Cross-Departmental Collaboration / Co-Creation and Co-Design / Inter-Organisational Collaboration
Portfolio Approach (9 pilots)	Dijon, Drammen, Guimaraes, Italian Cities, Lahti, Leuven, Limassol, Malmo, Slovenian Cities	Systemic Approach / Portfolio / Test Bed Demonstrators / Demonstrator Interventions / Demonstrator District / Systems Change / Distributed Pilots / Co-Benefits
Behavioural Change (7 pilots)	Italian Cities, Liberec, Limassol, Malmo, Nantes, Turku, Umea	Collective Self-consumption / Behavioural Change / Individual and Collective Behaviour / Low-Carbon Lifestyles
Sustainable Mobility (5 pilots)	Dutch Cities, Guimaraes, Lahti, Liberec, Slovenian Cities	Urban Transport / Mobility / Sustainable Commuting / Transport Electrification / Soft Mobility / Sustainable Transportation
Capability Building (5 pilots)	Drammen, Leuven, Malmo, Rivne, Umea	Capability or Capacity Building / Learning / Sensemaking
Circularity (3 pilots)	Malmö, Spanish Cities, Uppsala	Circularity /Circular Businesses / Food Waste / Bio-based Building Materials
Other	(9 pilots) Budapest, Istanbul, Kozani, Liberec, Limassol, Polish Cities, Rivne, Slovenian Cities, Turku	Smart Technical Solutions / Sensors and Energy Use Technology / Smart Cities Collection and Storage of Data / Data Science / Data-Informed Decision Making / Monitoring Systems
		Massification (Scaling) /Insufficient Contractors / Social Innovation / Land Use / Policy and Planning / Management of Public Facilities/ Business Models

Table 2. Areas of Focus of Pilot City Projects

Emission Domains

Among the Emission Domains (**Table 3**), the most prominents were **Consumption of non-electricity energy for thermal uses in buildings and facilities** and **Consumption of electricity generated for buildings, facilities, & infrastructure**, prevalent in most PCP applications. These two domains are closely correlated, with built-environment projects often addressing simultaneously electricity and non-electricity energy. For instance, a project to enhance energy efficiency in buildings (passive design, insulation), may also involve renewable energy systems. **All vehicles and transport** (referred to as 'Mobile Energy' in the application form) is another recurrent domain, featured in over half of the applications, while **Land Use (agriculture, forestry, and other land uses)** and **Multi-sector waste management and disposal** were each addressed by ten projects. It's worth noting that, among the ten pilots addressing Land-use and Waste management, six are comprehensive projects that simultaneously span five or more Domains; in this regard, the impact within these domains may be closely tied to actions that effectively tackle multiple domains concurrently, and not to actions exclusively dedicated to Land-use or Waste management. Finally, **Industrial process emissions** stands as the least covered domain in only five projects - a picture consistent with the relatively lesser attention paid to Industrial Processes and Product Use (IPPU) compared to other emission domains in early stage Climate City Contracts submitted by Mission Cities to NetZeroCities over the course of 2023. This may be due to cities having a lack of data on this sector or not (yet) seeing it as a central aspect of their climate neutrality pathway.

	Br	Ma	DE	IT	Cj	Gu	Na	Tk	Um	Up	NL	Di	Dr	Sl	Lb	Lm	ES	Bu	Ga	Is	Kz	PL	Lh	Lv	Ri

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Non-electricity energy																									**22**
Consumption of electricity																									**21**
Mobile energy																									**16**
Land use																									**10**
Waste management																									**10**
Industrial processes																									**5**

Table 3. Emission Domains addressed by each Pilot City application

Levers

In the case of the Levers (**Table 4**), 11 Pilot applications mentioned a focus on all 6 of them in their applications. Among the Levers, **Democracy & participation** and **Learning & capabilities** are the most prominent, present in 24 out of the 25 pilots, and closely followed by **Governance & policy** on 23 applications. In this regard, it is remarkable that cities seemingly prioritised the most transversal Levers, which were heavily covered in the PCP handbook and in early NZC support (e.g. Transition Team Playbook), and which are also the ones for which cities often struggle to find dedicated innovation funding streams. It will be relevant to monitor the PCP applications under the NZC-SGA1 contract to see whether this remains consistent, and to understand what other factors may play a role. For example, it may be that Levers such as **Technology and Infrastructure** are seen to entail significant (capital) costs that surpass the available NZC funds. Equally, it is possible that limitations in deep-knowledge of social and financial innovation may potentially hinder the formulation of compelling pilot applications in those domains, which may change as cities are already receiving more support in these domains through Climate City Contract support and various NZC Capabilities building efforts.

	Br	Bu	Cj	IT	Lh	Lv	Lm	Ma	PO	ES	Up	Di	Dr	Gu	Is	Kz	Lb	Na	Tk	NL	Ga	DE	Sl	Um	Ri	
Democracy & participation																										**24**
Learning & capabilities																										**24**
Governance & policy																										**23**
Social innovation																										**21**
Technology / Infrastructure																										**19**
Financing & funding																										**18**

Table 4. Levers addressed by each Pilot City Application

Areas of Focus

To identify Areas of Focus, the projects' descriptions were analysed and inductively coded with keywords which were then clustered into thematic groups based on similarity (**Table 1**). These reflect areas of interest into which the pilots intend to delve, and not necessarily challenges or needs for domain-expertise. The largest cluster pertains to the "Built-Environment and Energy", a broad category includes energy systems, energy-efficiency, and retrofit. This is consistent with the analysis of Emission Domains, where consumption of electricity and non-electricity energy were the most commonly addressed domains. For example, Istanbul's pilot focuses on the reconstruction and improvement of residential buildings to transition to renewable energy and enhance energy-efficiency, addressing electric- and non-electric energy, built-environment and energy systems simultaneously

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Similarly, Citizen Participation and New Ways of Working are recurrent areas of focus, consistent with the presence of Democracy & Participation, and Governance & Policy as common levers across PCP applications. For instance, The German Cities' project focuses on innovative ways to reduce emissions from consumer behaviour by engaging citizens as co-decision-makers and co-designers through the House of Change transformation model. A closely related area of focus is Multi-actor collaboration, present in eight pilots, which expands participation of citizens to focus on the involvement of other private and institutional stakeholders in climate initiatives. For example, Liberec's pilot proposes an Energy Community that involves citizens but also public transport operators, local housing cooperatives, regional authorities, citizens, SMEs, and non-profit organisations in the development of solutions in the domains of Energy Systems and Mobility.

Finally, finance is another area of focus that is consistent with the previous analysis, being a key area of focus in ten pilot applications. It groups activities related to innovative financial instruments and models and aligning different public and private financial resources. Most prominently, Bristol and Dutch Cities projects propose innovative financial platforms and instruments to harness private and public resources within blended investment funds to support a range of climate-initiatives.

Among emerging categories, "Portfolio Approach & Demonstrators" was present in nine pilot applications. This group involves aligning projects or activities under one coherent logic in a way that they are complementary to one another, creating synergies, and addressing multiple outcomes simultaneously. For example, Limassol's pilot proposes a "real-world living lab", running multiple small-scale sustainability projects simultaneously across the city. Another notable emerging category is "Behavioural Change", present as a key area of focus in seven pilots. These activities aim to enable a significant modal shift in the general population towards more sustainable lifestyles in areas like consumption and mobility. Lahti, for example, aims to enable a significant modal shift through behavioural change towards sustainable mobility and reduce the car dependency of residents.

Fewer projects addressed "Sustainable Mobility", "Learning & Capability-Building", "Circularity" as central to their pilots. In the case of "Sustainable Mobility", while only expressly addressed by five applications, activities in this scope were well developed, including promotion of soft mobility, and electrification of public and private transport. Conversely, "Circularity" was found often intertwined with other domains such as waste or built-environment. For example, in the Spanish Cities pilot, circularity is related to the use of bio-materials and the upcycling of other construction materials. Finally, "Capability-Building " was found present in five projects, in initiatives like Umea's proposal to develop a training programme for their employees to establish a shared understanding and work methodology of systemic innovation.

Lastly, while clustered as 'Others', technology and data-related activities found in nine pilots, most notably the Polish, Slovenian Cities and Rivne, underscoring the importance of data-driven strategies.

Summary of findings

Most of the proposed pilot projects aim to address climate change and work towards achieving a sustainable, climate-neutral city by 2030 by covering a wide range of areas simultaneously, such as energy, mobility, waste, land use, and building efficiency, and by involving various stakeholders, including industry, local government, academia, and citizens. Some projects focus on developing new tools and capabilities to support the city's energy strategy, while others aim to engage citizens and promote behavioural change through digital platforms and incentives. Several pilots also aim to institutionalise decarbonization efforts through new governance models and innovation centres. Overall, the pilot projects focus on a holistic approach to sustainability, integrating social innovation, culture, policy, regulation, green technology, sustainable finance, and new business models.

The common challenges and barriers described by cities towards achieving carbon neutrality and combating climate change (based on the segment "**Barriers and challenges**" of the Pilot City applications) include factors such as bureaucratic procedures, lack of leadership, limited knowledge and investment capacity, cultural and behaviour patterns, limited engagement and participation of

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citizens and private sector, financial complexities, technological limitations, regulatory contradictions, physical and socio-demographic barriers, multi-level governance, and a lack of enabling policy and distributed leadership. Additionally, there are challenges in implementing circular economy practices, reducing carbon footprint in industrial development, and promoting the participation of the cultural sector in climate action. These findings were used to inform the structure of the Collective Learning Session, which aimed to provide inspiration and increase the ambition of the pilots at their early stage, and they have also been relevant to structure the general PCP support offer, through the offer of NZC expert partners and through peer-to-peer learning and sense-making between cities.

Analysing the Learning Enquiries

The insights drawn from pilot city applications in the previous section primarily centred around the projected activities and anticipated challenges of the pilot projects. Thus, these insights don't necessarily encompass the specific needs of the PCP teams for expert support and learning. To address this, the Boot Camp started a process of iterative engagements with PCP teams to delve further into their challenges and needs for support and learning. To guide this process, 'Learning Enquiries' were co-formulated to serve as guiding beacons for their exploration throughout the Boot Camp programme, and to enable the PCP teams to procure and develop the knowledge and expertise they require to navigate the challenges and opportunities presented by their projects. The formulation of the Learning Enquiries commenced with one-on-one calls between the NZC consortium experts and PCP teams. These in-depth conversations provided a comprehensive understanding of pilot activities, context, and goals, and served as a platform to critically assess and align on the project's objectives and nuances, fostering clearer communication and collaboration. The Learning Enquiries were further refined through subsequent calls or written communications until finally validated by PCP teams by **April 30th** . These validated Enquiries helped design the currently on-going coaching support and the Thematic Learning sessions delivered on **May 10th and 11th**, as part of the PCP Boot camp.

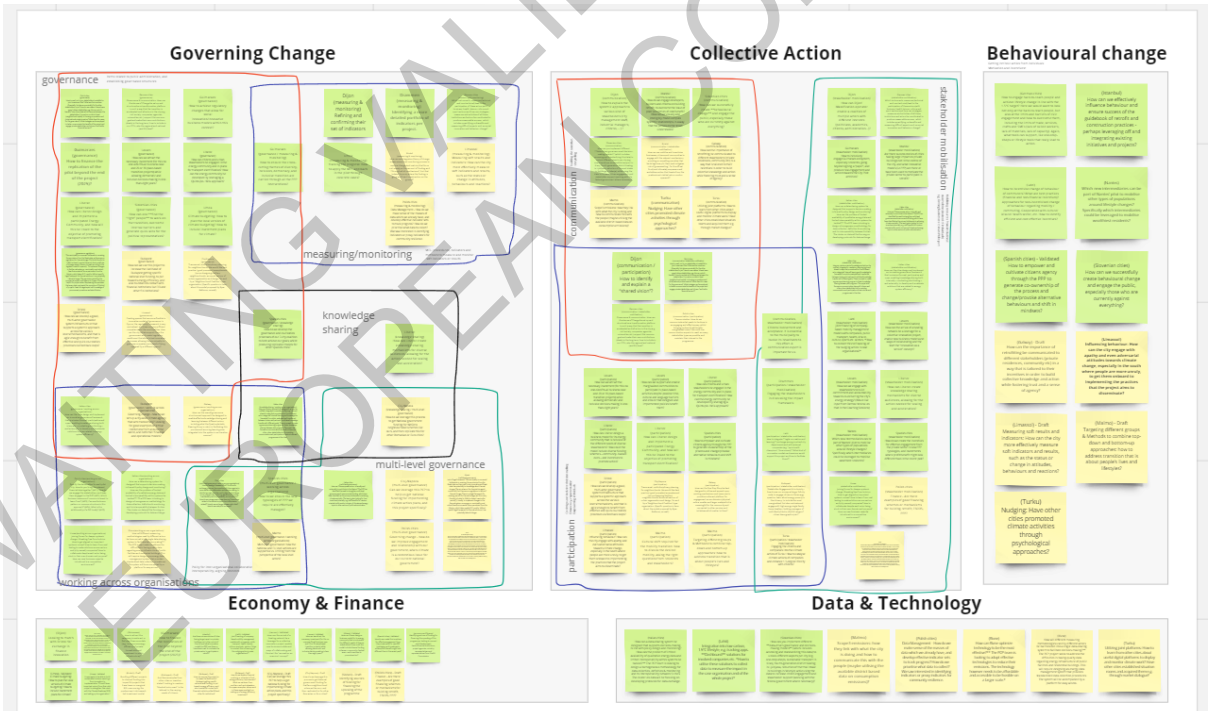

Figure 1. Clustering of Learning Enquiries

The analysis of these Enquiries followed an inductive analysis similar to the PCP applications. Each Learning Enquiry was openly-coded, then labels clustered by similarity in broader categories, and then further grouped into 5 final themes. Interestingly, the Learning Enquiries addressed **"Levers"**, more

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than they did **"Emission Domains".** It has been observed, for example, from the engagement with the pilot teams, that in the field of Mobility and Transport, Cities often have already invested in sustainable mobility and implemented measures related to public transport and active mobility. Therefore, most of their enquiries centred around behavioural change and incentives, citizen engagement, co-creation of new measures, holistic and multi-modal approaches to mobility and/or how to involve the private sector (companies and employees). It is plausible that similarly in other Emission Domains, cities may have a more nuanced understanding of Emission Domain challenges, which tend to be more technical in nature, while the Levers are more comprehensive, focusing on developing the capacities and strategies to attain such goals, which are less clear due to the novelty, complexity of the pilots, coming from the uncertainty, novelty, and the array of interdependent stakeholders needed for their successful implementation. Therefore, Learning Enquiries are primarily concerned with understanding how to enact change, build capacity, engage stakeholders, and leverage resources to address the environmental challenges outlined by the Emission Domains.

Among the emerging categories: **Behavioural Change**, **Collective Action**, and **Governing Change** correspond to different levels of influence intended by the pilots, overlapping with the Levers Governance & Policy, Democracy & Participation, Social Innovation, and Learning & Capabilities in different ways. **Behavioural Change**, addresses individual decision-making and driving individual and collective shifts in behaviour and lifestyles, it includes aspects of "Social Innovation" and "Learning and Capabilities". At a mid-level, **Collective Action** addresses democracy, participation, and mobilisation of stakeholders' resources, overlapping with the Levers of "Democracy and Participation," "Social Innovation," and "Learning and Capability Building." At the broadest level, **Governing Change** involves governance innovation, in terms of organisation, policy, instruments and similar. It overlaps with "Governance and Policy" and "Learning and Capability Building" when addressing the development of internal capacities. The **Economy, Finance and Funding,** and **Technology and Data** categories correspond more directly to the Levers of "Financing and Funding" and "Technology and Infrastructure" respectively, and operate transversely to the three other categories.

	Br	Bu	Cj	Di	Dr	NL	Ga	DE	Gu	Is	IT	Kz	Lh	Lv	Lb	Lm	Ma	Na	PO	Ri	Sl	ES	Tk	Um	Up	
Collective Action																										**25**
Governing Change																										**20**
Economy and Finance																										**14**
Behavioural Change																										**11**
Technology and Data																										**7**

Table 5. Thematic Groups of Learning Enquiries

Thematic Groups

Among thematic groups, Collective Action, divided in 3 subcategories, was the largest proportion of challenges, present in 52% of all Learning Enquiries (49/95) and across all 25 pilots. This widespread interest underscores the significance of stakeholder / citizen mobilisation and meaningful active participation in addressing the multifaceted challenges of the projects (see **Deliverable 8.1**). Governing Change exhibited a similar frequency, with 41 Enquiries (43% of the total) in 20 pilots, however more widely spread across 6 subtopics. This suggests a recognition of the complex governance landscape and the need for innovative strategies to drive transformation. The third most prevalent area of exploration was Economy, Finance, and Funding, with a smaller share of 21 enquiries (22% of the total) in 14 pilots. In contrast, Behavioral Change and Technology and Data were more niche areas of interest. Behavioral Change was present in 12 Learning Enquiries across 11 pilots, while Technology and Data were the focus of 8 Learning Enquiries across 7 pilots. The distribution of Learning Enquiries across these categories reflects a comprehensive approach to the transition, and reflects the intricate nature of the pilots, where the interdependence of various

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stakeholders, the need for policy innovation, and the requirement for effective communication and engagement strategies are all equally necessary to the achievement of outcomes.

Collective action

- **Stakeholder mobilisation** includes enquiries related to mobilisation of resources -primarily financial, but also non-financial- from private and institutional stakeholders, and was the most frequent category, present in 19 pilots. For example, the City of Leuven is concerned about how to engage with different stakeholders to build commitment and accountability towards co-delivering the city's energy strategy. This emphasises the importance of mobilising diverse stakeholders to collectively contribute towards achieving the city's energy strategy goals. It addresses the challenge of fostering commitment and accountability among stakeholders to actively contribute to the implementation of the energy initiatives.

- **Democracy and Participation** groups Enquiries that reference political representation, processes of participation, co-creation, inclusive decision-making, and empowering individuals and communities. For instance, Cluj Napoca is concerned about fostering effective co-creation and inclusive decision-making processes in the design of Net-Zero neighbourhoods encompassing various urban sectors by facilitating dialogue with Neighbourhood Coalition organisations. This Enquiry highlights the city's intention to involve residents, community organisations, and local institutions in the planning and design of the Net-Zero neighbourhoods, encouraging community involvement, and empowering local stakeholders to contribute to the creation of carbon-neutral urban spaces.

- Finally, **Narrative and Communication** groups Enquiries that seek strategies to effectively communicate the importance of the pilots and urgency of the transition, and the creation of coherent and compelling narratives able to obtain buy-in of diverse internal and external stakeholders. Istanbul, with ~15,5M inhabitants, aims to engage developers, builders, and citizens on retrofitting. For this, they need to be able overcome the perception of unfavourable cost-benefit of retrofit by effectively and persuasively communicating complex systemic relationships in a way that is understandable by the broader audience. This example captures the essence of the communication challenge and the importance of conveying the intricacies of the transition efforts in an accessible and impactful manner.

Governing Change

- **Multi-actor governance** is by large the most repeated theme in the Governing Change group, and is present in half of the pilots (13 out of 25). This category groups Enquiries regarding innovative governance arrangements that are inclusive of diverse stakeholders. They explore strategies for collaboration, coordination, and synergy between different entities. For instance, Budapest explores how to establish a city-wide climate public agency that operates (operations, but also finance) transversely, which demonstrates a need for a collaborative and multi-department approach in addressing climate-related challenges. Similarly, Galway's exploring governance structures and approaches that allow agile learning, with a pivotal role on their 'Quadruple Helix Steering Group'.

- Similar to the above **Multi-level governance** is concerned with the decision-making processes, and power dynamics among various levels of government, in terms of funding, but also political support. For example, Malmo's enquiry revolves around the supportive and constraining aspects of national and EU-level actions at the local level, and the need to better understand and navigate the intricate interplay of governance levels in pursuing climate-related objectives. This category also includes Enquiries regarding strategic coordination across cities, particularly in the context of Group Cities Pilots who require to align portfolios and interests of multiple cities with diverse contexts and settings, as is the case of the Dutch cities, who are exploring how to effectively coordinate their seven pilots. This entails structuring inter-city consortiums to facilitate collaboration and decision-making, distributing project tasks, integrating local initiatives into a unified plan, ensuring the plan's relevance and potential replicability across cities, managing peer-to-peer learning, and establishing connections with the national support structure.

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- **Policy innovation:** Explores approaches, and strategies for experimentation and innovation of government policies and regulations. For example, in Kozani, there is currently no regulatory framework for the kind of projects that they are developing in energy. Similarly, Limassol is also asking for regulatory sandboxes where they can test new policies and regulations

- **Measuring and monitoring** groups Enquiries regarding innovative methods and tools to assess results that are difficult to quantify, and to track complex processes. For example, the German Cities' Enquiry seeks for instruments and measures, both technical and non-technical, to 'quantify' co-benefits and measure difficult aspects such as social innovation and behaviour change, which underscores the need for new methodologies to effectively capture and evaluate the multifaceted impacts of the Cities' pilots.

- **Knowledge exchange**: Groups Enquiries addressing how information, learnings, and best practices can be disseminated to be successfully applied in different contexts or replicated to achieve similar outcomes. For example, Liberec is researching sharing mechanisms for diverse audiences, allowing for the action needed for scaling and acceleration, which is crucial to achieve the climate-neutrality targets. This category was also found important in Group Cities Pilots due to the inherent need for cross-city collaboration and learning for the success of the collaborative effort.despite varying local contexts. Such is the case of the Italian Cities, who are exploring a mechanism for multi-knowledge transfer with different goals, to harvest learning and knowledge from pilots and transfer it across pilots, clusters and partners in their consortium.

Behavioural Change: Enquiries in this category revolve around fostering shifts in both individual and collective actions towards more sustainable choices and lifestyles. These enquiries specifically address the challenge of motivating people to adopt environmentally conscious behaviours, which cumulatively contribute to achieving climate neutrality in scope 3 emissions. This research area delves into understanding the psychological, social, and contextual factors that influence behaviours, aiming to identify effective strategies that lead to lasting and positive changes aligning with climate objectives. Different approaches are explored in this category. For instance, the German cities' focus on engaging hard-to-reach individuals to achieve lifestyle changes aligned with the 1.5°C target. Lahti's Enquiry explores financial, but also non-financial and cost-effective incentives to promote behavioural shifts among commuters. Meanwhile, Nantes' strategy targets the wealthier population who contribute the most to emissions, involving intermediaries to promote shifts in behaviour

Economy, finance & funding: The category "Economy, Finance, and Funding" expanded upon the original "Financing and Funding" Lever to encompass a broader spectrum of inquiries about financing, investment, and economic strategies. While many of the Enquiries address the need to secure funds and create sustainable funding streams, others reflect a more comprehensive understanding of the economic opportunities of the climate neutrality transition, highlighting the potential of the pilots to enable new economic markets and enable innovative business models and structures that leverage the transition for economic growth, and job opportunities, all while staying aligned with environmental goals. For example Cluj-Napoca is exploring how to leverage the pilot to secure National funding to implement Climate Action plans and the replication of NetZero neighbourhood schemes in other Romanian cities. On a different strand, Bristol aims to challenge the predominant risk/reward-led investment paradigm to channel funding into impactful projects that may not have conventional returns. While Leuven's district energy and retrofitting interventions aim to foster the emergence of new business models under the concept of 'renovation as a service', and attract investment for other 20 to 30 place-based projects.

Technology & Data: This category encompasses Enquiries aimed at harnessing technological advancements and data-driven solutions to drive climate-neutrality transitions. This includes addressing data governance and security issues, as in the case of the German Cities' privacy concerns for initiatives of local individual green deals; data utilisation, as in the case of the Italian cities focus on designing data-sharing systems for informed decision-making and overcoming data availability hurdles; or data harmonisation for interoperability, as in the case of Group City pilots like the Slovenian or Italian cities, who inherently require it to facilitate collaboration, knowledge sharing, and decision-making across multiple cities within the pilot.

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Theme		Learning Enquiries*	Pilots
Collective action		**49**	**25**
	Stakeholder mobilisation	25	19
	Democracy & participation	18	14
	Narrative & communication	16	12
Governing change		**41**	**20**
	Multi-actor governance	19	13
	Policy innovation	9	8
	Multi-level governance	9	8
	Measuring and monitoring	9	9
	Knowledge exchange	4	4
Economy, finance & funding		**21**	**14**
Behavioural change		**12**	**11**
Technology & Data Total		**8**	**7**
Other		**9**	**7**
Total		**95**	**25**

(*) Note that Learning Enquiries may have been coded with more than one category, as they often include more than one area of concern, and broader categories are not necessarily mutually-exclusive.

Table 6. Analysis of Learning Enquiries

1.2 Support

Once an understanding of the strategic challenges and barriers had been identified and organised into themes, a programme of activities was designed to respond to the Pilot Cities' needs. As the initial analysis of obstacles on the climate neutrality pathway and of the applications were completed, learning programmes responded to the insights gained at this stage. This included a session on Monitoring, Evaluation and Learning, as well as a Collective Learning Session and Thematic Group Session. Pilot City teams attended these sessions as a collective, selecting activities that were relevant to them based on the themes being discussed. All sessions were hosted on the online platform Zoom, with attendees having the opportunity to share their individual questions, reflections and own knowledge using the chat function or participate in Q&As and discussions with speakers/presenters. In addition, the Collective Learning Session included breakout rooms, in which Pilot City representatives were partnered with one or more teams to discuss and further explore their own projects and their reflections on the session(s) they had just attended.

1.2.1 Monitoring Evaluation and Learning Session

Monitoring, Evaluation, and Learning (MEL) for NZC Pilot Cities are interlinked activities that support measuring progress towards climate-neutrality through respective pilot activities, as well as build synergies amongst Pilot Cities based on collective learnings for impacts.

The learning and 'sensemaking' activities for NZC Pilot Cities shall comprise structured, facilitated, and continuous processes of observation, reflection, stock-taking, and synthesis to generate real-time insights. This practice aims at enabling 'reflexive governance' (also known as adaptive management) which helps cities understand which solutions are working, in what contexts, for whom and why.

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The webinar *Pilot Cities Programme Bootcamp: Monitoring, Evaluation and Learning (MEL) Session* was conducted in March 2023 and it aimed at creating space for questions and challenges raised by cities' representatives in regards to MEL activities. The session was facilitated by NZC experts from the Climate-KIC, AIT, Metabolic, Democratic Society, and Polimi. A Miro board was used as the online workspace to gather the insights of four break-out rooms.

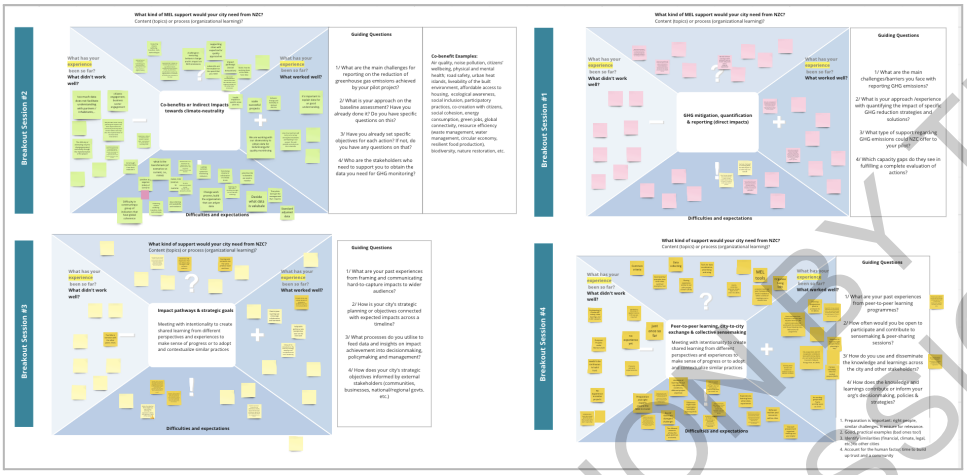

Figure 2. Insights from MEL session

Key messages from cities

Learning – Ensuring a continuous learning process capable of re-orienting activities, this means using the impact pathways as a planning tool but also to undertake an iterative process during pilot implementation.

City-to-city exchange – Developing trust and making visible common interests for successful peer-to-peer learning. A background of relatedness will facilitate exchanging of experiences; this will be particularly relevant when it comes to clustering cities by common challenges and interests.

Policy ambition – Influencing policy-making processes at the national and international levels through an upwards learning strategy.

Expectations from cities

Organisational learning

- Providing tools for sensemaking to build capacity in the Transition Teams that will soon be established in each city.
- Having adequate preparation prior collective sensemaking events, meaning engaging the right stakeholders and experts, at the right levels.
- Finding a mid-point between the two-year time frame of pilot projects and the ambitious goals we are aiming at to avoid spending the grants on process.
- Designing a strategy to engage political stakeholders beyond the two-years pilot (*making clear what's next*). This will also help ensure additional investments.
- Organising Living Labs.
- Helping cities to stay on target: CO2 emission reduction.
- To convene a session twice per year if preparation work is needed or rather a series of meetings over a shorter time.

Measurement and monitoring

- Measuring indicators related to behavioural change and its impact on GHG emissions.
- Monitoring indicators at different scales e.g., individual (well-being, quality of life), district (co-benefits and local needs), city (aggregated to be able to capture transitions in the city).

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- Tools, baselines, and methodologies for measuring human well-being.
- Methodologies to make co-benefits more explicit.
- Tools for data collection, coordination, prioritisation and usage.

Exchange mechanisms

- Public procurement procedures.
- Business engagement, finance innovation and citizen engagement around this (Bristol).
- Showcasing examples from champion cities even if they don't belong to the Pilot Cities Program (including also stories that were not successful).
- Peering with cities with the same level of ambition and/or similar pilot project focus e.g., financial, climate, legal, etc.

GHG emissions estimation

- Estimating the GHG emissions reductions projected from the use of the new financial instruments some cities have created and tested.
- Selecting the best framework, methodology for GHG emissions reporting at larger scales (region, country).

Questions from cities

- What is the connection between the MEL framework and the impact pathways?
- How can cities translate their CDP reporting to the Pilot (and to the Mission City work)?
- How can banks be engaged in pilot projects?

Challenges so far

- Strategies for citizens, and business sector engagement.
- Too much data does not facilitate understanding with partners.
- The pilot WPs cover mainly planning/soft aspects and their impact within the community, economy, environment will be seen only after the implementation of the theoretical interventions.
- Estimating the change generated exclusively through the implementation of the project.
- Estimating the indirect changes generated by the project among private stakeholders, for example, what changes are generated among companies by the fact that they find information about this pilot?
- Setting clear expectations: it is important to communicate the expectations for the peer-to-peer planning session in advance. This can include the objectives, agenda, and any pre-work that needs to be completed before the session.

Positive aspects so far

- Relating the NZC documents to the main city strategy helps to keep the process less complicated and more feasible.
- Peer-to-peer learning can encourage collaboration and teamwork.
- Getting a new perspective about one's role and input towards a broader city goal.
- Keep providing sessions of this nature.

In addition to the questions and challenges above, some cities suggested using a different tool of collaboration to work remotely.

1.2.2 Collective Learning Session

Following the initial analysis stage, a selection of overarching themes around challenges and barriers that emerged were chosen as focus points for further exploration and support as part of a Collective Learning Session.

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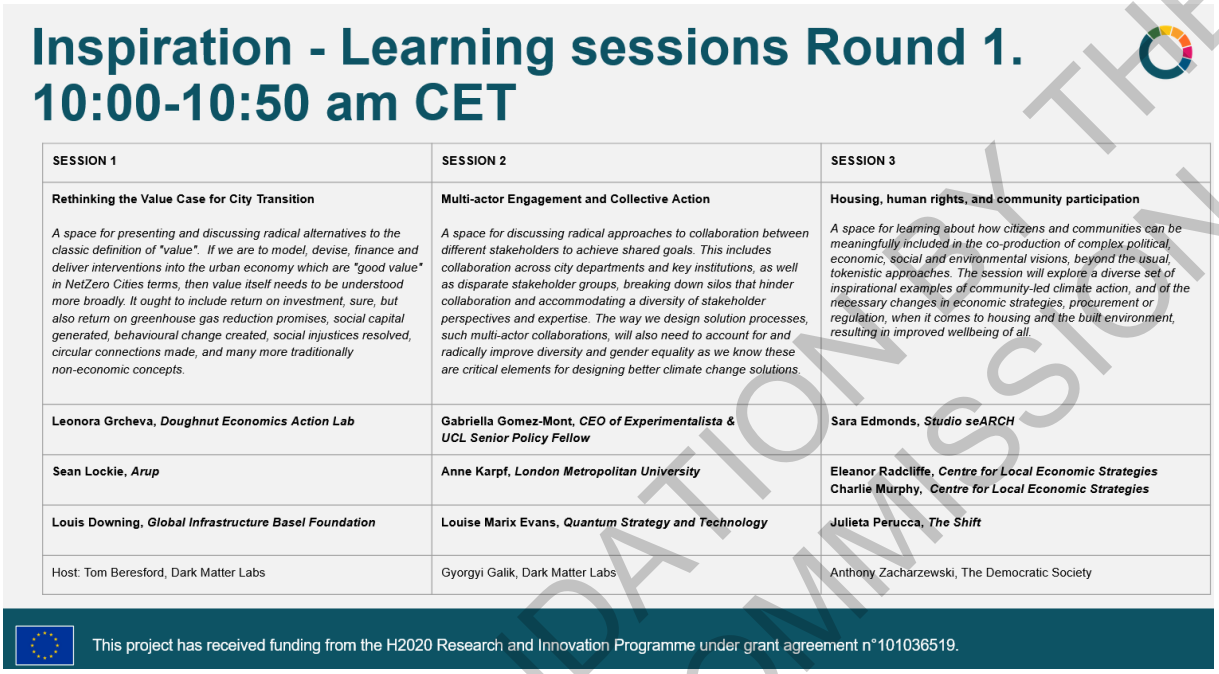
The structure of the event was to host two slots of expert panel sessions (one in the morning and one in the afternoon), with three topics discussed simultaneously in each slot. In each session, up to four expert speakers presented their own work, research and wider case studies on their specialist subject. This was followed by a facilitated panel discussion. Attendees would then move to break out rooms in which they could discuss reflections among a smaller group, before then sharing summaries of these reflections with everyone else in plenary.



Inspiration - Learning sessions Round 1. 10:00-10:50 am CET

SESSION 1	SESSION 2	SESSION 3
Rethinking the Value Case for City Transition *A space for presenting and discussing radical alternatives to the classic definition of "value". If we are to model, devise, finance and deliver interventions into the urban economy which are "good value" in NetZero Cities terms, then value itself needs to be understood more broadly. It ought to include return on investment, sure, but also return on greenhouse gas reduction promises, social capital generated, behavioural change created, social injustices resolved, circular connections made, and many more traditionally non-economic concepts.*	**Multi-actor Engagement and Collective Action** *A space for discussing radical approaches to collaboration between different stakeholders to achieve shared goals. This includes collaboration across city departments and key institutions, as well as disparate stakeholder groups, breaking down silos that hinder collaboration and accommodating a diversity of stakeholder perspectives and expertise. The way we design solution processes, such multi-actor collaborations, will also need to account for and radically improve diversity and gender equality as we know these are critical elements for designing better climate change solutions.*	**Housing, human rights, and community participation** *A space for learning about how citizens and communities can be meaningfully included in the co-production of complex political, economic, social and environmental visions, beyond the usual, tokenistic approaches. The session will explore a diverse set of inspirational examples of community-led climate action, and of the necessary changes in economic strategies, procurement or regulation, when it comes to housing and the built environment, resulting in improved wellbeing of all.*
Leonora Grcheva, *Doughnut Economics Action Lab*	**Gabriella Gomez-Mont, *CEO of Experimentalista & UCL Senior Policy Fellow***	**Sara Edmonds, *Studio seARCH***
Sean Lockie, *Arup*	**Anne Karpf, *London Metropolitan University***	**Eleanor Radcliffe, *Centre for Local Economic Strategies*** **Charlie Murphy, *Centre for Local Economic Strategies***
Louis Downing, *Global Infrastructure Basel Foundation*	**Louise Marix Evans, *Quantum Strategy and Technology***	**Julieta Perucca, *The Shift***
Host: Tom Beresford, Dark Matter Labs	Gyorgyi Galik, Dark Matter Labs	Anthony Zacharzewski, The Democratic Society

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Figure 3. Programme of Learning Sessions Round 1

Inspiration - Learning Sessions Round 2. 11:45 am - 12:45 pm CET

SESSION 1	SESSION 2	SESSION 3
New Ways of Seeing and Working *A space for discussing the necessary shifts in mindsets, institutional and organisational design, and ways of working that will be necessary to enable systems transformation. The session will explore the psychological insights of individual behaviour change and how they relate to systems change, collective action, and principles of how we bring about just and equitable outcomes.*	**Built Environment Challenges and Opportunities** *A diverse look at a range of challenges and risks in developing systemic interventions in the urban context, not leaving out the opportunities that some of these very 21st century challenges present. From harmonising standards for "green" infrastructure to addressing data variability or scarcity with a variety of different digital planning tools.*	**The Elements of Resilient Places** *Creating better experiences for people in their daily lives and achieving net-zero are often considered to be separate goals. This session will challenge that notion, showing that the design of systems within cities and urban spaces are key to both improving people's day-to-day experiences but also creating resilient cities. Using case studies, examples of 'quick wins' and exemplar practice while also considering challenges, we will explore how we can design places we gather, meet and socialise so well that people and nature can thrive, while also creating long-term resilience.*
Ryan Bellinson, *Oregon Dept of Environmental Quality*	**Aurel Con Richthofen, *Arup Cities***	**Emily Walsh, *Systra***
Robert H Frank, *Cornell University*	**Euan Mills, *Blocktype***	**Maayan Matz Ashkenazi, *Independent Consultant***
Isabelle Anguelovski, *Barcelona Laboratory for Urban Environmental Justice*	**Simon Widmer, *ecos***	**Andrew Grant, *Grant Associates***
Host: Gyorgyi Galik, Dark Matter Labs	Mike Duff, Dark Matter Labs	Sigrid Ehrmann, EIT Urban Mobility

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Figure 4. Programme of Learning Sessions Round 2

The Collective Learning Session revealed particular concerns around communications – communications with political stakeholders, local communities, helping businesses and investors understand systemic change and revealed a desire for common tools and resources that Pilot Cities could draw on to aid their work. This has highlighted narrative, storytelling and communications as a key emphasis for focus in future support offered as part of the Programme.

1.2.3 Thematic Group Sessions

Feedback from the Collective Learning Session, both at the event and anecdotal feedback after, revealed a strong desire among the Pilot Cities to learn more about each others' projects and work, as well as to engage with each other, especially where commonalities in type of project and approaches to them could be identified. In addition, there was a recognition that Pilot City teams are made up of experts in their own right whose knowledge and experience could be shared with fellow Pilot Cities.

The Thematic Group Session responded to this interest, and was structured as four sessions taking place over two days. The topic for each session corresponded to the theming exercise resulting from the analysis of the Learning Enquiries outlined above. At each session, up to three Pilot Cities presented their project and Learning Enquiry in relation to the theme. Subject experts, selected from across the Consortium Partners and who had familiarised themselves with the Pilot Cities' project and Learning Enquiry in advance, then responded to the presentations. Responses included expert feedback, advice and guidance to the cities, as well as case studies to which Pilot Cities could refer as precedents. Each Pilot City presentation was followed by a discussion, facilitated by a host selected from the Consortium Partners. The discussion took place among presenting Pilot City representatives, subject matter experts and all event attendees from Pilot Cities.

While the Learning Enquiries were organised into five overarching themes, the four Thematic Group Sessions focused on four of these: Governing Change, Collective Action, Behaviour Change and Data & Technology. The fifth theme, Economy & Finance was treated as a cross-cutting theme that would feature in all discussions, due to being integrally related to all other themes.

The Thematic Group Session created the opportunity for Pilot Cities to present and discuss their project and its complex challenges to a diverse group, while also exploring how their project may have aspects in common with other projects on the Programme.

Moreover, the desire for peer to peer learning has also been recognised and operationalised through the peer-to-peer sensemaking clusters taken forward through Task 4.4 "Sense-making, learning and cross-fertilization activities between pilots" in NetZeroCities (NZC) and the complementary task Task 4.4 from NZC-SGA1 "Peer-to-peer learning and collective sensemaking for Pilot Cities" (see Section 2.3 below).

1.2.4 Tailored Coaching

There was recognition that, as greater and greater granularity was uncovered about Pilot City projects and the challenges faced in their delivery, bespoke guidance and support would be needed to complement the collective sessions. Tailored Coaching support was introduced to address the unique challenges faced by pilots in a personalised manner to their needs.

The Tailored Coaching support system was structured to build upon the existing 1-on-1 calls and the Learning Enquiries that emerged from the conversations with the PCP teams. Pilot Cities' Learning Enquiries were mapped out to allow representatives from across all Consortium Partner organisations to match their subject expertise to particular topics and offer their guidance as a coach. Each Pilot City team benefited from a dedicated team of coaches, organised based on the specific Learning Enquiries of each city to ensure tailored fit for addressing individual needs. For continuity, at least one member from the original 1-on-1 call hosting groups remained on the Coaching Support team.

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The Coaching Support consists of 3 x 2-hour coaching sessions, with each session dedicated to a specific aspect of the city's Learning Enquiry. To guarantee alignment with the city's requirements, the focus of each coaching session was determined in advance in collaboration with the PCP team. The Tailored Coaching sessions began in **May**, and are currently undergoing, set to conclude by the end of September, accommodating summer holidays.

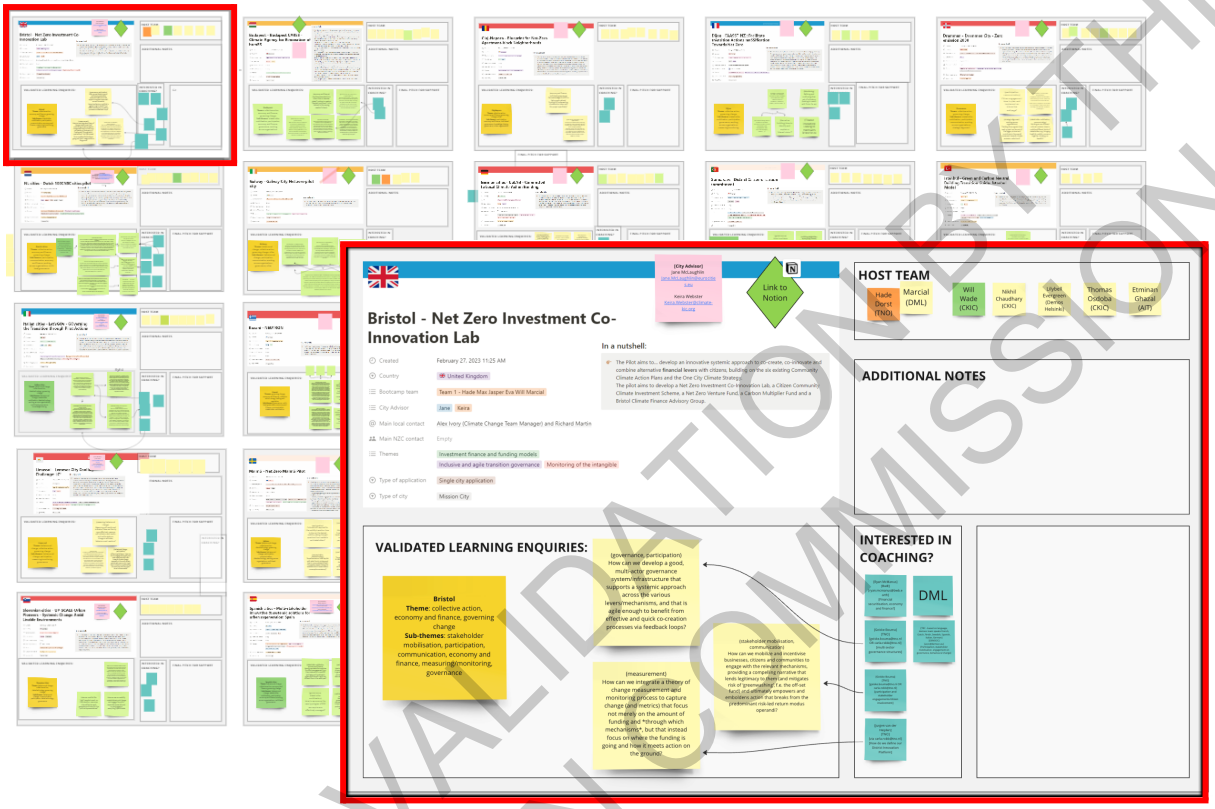

Figure 5. Design of Coaching Support Groups

1.3 Refined analysis

At this stage we pull together the learning, from the high-level and strategic themes through to the nuanced details that we have gained an in-depth understanding of. This synthesis aggregates a wealth of information sources, encompassing the learnings withdrawn from previous reports (such as D6 and D13.1), the analyses of PCP applications and Learning Enquiries, observations from support activities, and inputs from domain experts within the consortium who have been supporting the PCP teams through coaching support. This multifaceted array of knowledge is amalgamated to distil refined understandings regarding the systemic innovation needs of the Cities.

Key learnings from the content analyses:

These learnings encompass insights gathered from both Pilot applications and Learning Enquiries submitted by the Pilot City teams, and synthesise them to provide a comprehensive high-level understanding of the initiatives and their underlying challenges.

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Understanding and categorising the areas of focus within emission domains or lever categories can be challenging, highlighting the systemic nature of many projects and the blurred boundaries between categories. This complexity is particularly evident in the lever domain. For example, energy system projects often intersect with activities related to the built environment, such as district-level interventions or residential block retrofits. It is noteworthy that these two were also the most frequent areas of focus across Emission Domains. Similarly, initiatives in waste management, circular economy, and land-use frequently involve interrelated aspects, like waste upcycling and nature-based approaches to waste reduction and treatment. However, few initiatives were found to significantly address industrial processes. While some mention private sector involvement, it's often related to resource mobilisation or engagement with local businesses, with no specific actions identified for comprehensive industrial transition.

Across lever categories, Pilot City teams displayed less in-depth knowledge of these areas, which is reflected in more explorative enquiries. For instance, while many cities mention behavioural change and participation, there is limited development of the intricacies involved in these initiatives. Activities focused on participation, for instance, often tend towards superficial engagements rather than reaching the meaningful level of co-production and ownership required for pilot project success. Furthermore, as seen in the analysis of Learning Enquiries, some areas of focus like behavioural change, intersect with multiple levers, including participation, democracy, and social innovation. Similarly, activities related to multi-stakeholder assemblies for policy decision-making may encompass aspects of governance, participation, and social innovation, making precise classification challenging. This can also provide some light to why levers in pilot applications were found to be 'overused' (see **1. Analysis of Pilot City Applications**).

Lastly, most of the challenges faced by the pilot initiatives do not primarily address emission domains or technical aspects of the projects. Instead, they predominantly fall under the lever categories. For example, the Bristol pilot exclusively focuses on Finance Innovation without addressing any specific emission domain. This reflects the need for extensive support within Pilot City teams regarding aspects like stakeholder mobilisation and enhancing capacities at the local government level.

Key learnings from support activities:

The learning from the Support activities included both, the topics on which Pilot Cities experienced challenges and also how they would like their needs addressed. The nuances of the Pilot Cities' challenges and needs that were obtained from Support activities is encapsulated in Section 2 of this report.

An understanding of how the Cities would like these challenges addressed was obtained from anecdotal evidence and formal feedback requested from attendees who participated in support activities. These are described below.

- **Monitoring, Evaluation and Learning (MEL)**: Pilot Cities expressed interest in further sessions on MEL, due to its complexity. While Cities appreciated developing their understanding on the NZC Theory of Change, a selection of Cities fed back that it would have been useful to have a deeper dive into the topic. Lahti in particular, suggested one-on-one sessions on MEL, rather than webinars.

- Collective Learning Session: The Collective Learning Session was generally felt to be inspiring but not targeted enough to individual Pilot Cities' projects. The Slovenian Cities felt that follow-up, one-to-one sessions in which Pilot Cities could delve into the topics from the Collective Learning Session and how they related to their individual projects would be beneficial. This would enable a shift from inspiration to practical delivery.

- **Thematic Group Sessions**: The Thematic Group Sessions were of most use to attendees in allowing them to hear and learn from each other, emphasising the importance and value to Pilot Cities of peer-to-peer learning. Nantes in particular identified fellow-Pilot Cities working on projects with similarities to their own, established contact and set up meetings with Lahti and German Cities.

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- Tailored Coaching: The Tailored Coaching was being undertaken at the time of this report's development. Feedback received from completed coaching sessions was predominantly enthusiastic, with Pilot Cities expressing strong results from the one-to-one format and the consequent tailored response to the city's Learning Enquiries.

Overall conclusions are that while the Pilot Cities found the collective and group sessions useful in terms of inspiration, sparking ideas and building relationships with each other, it is of best value when accompanied by one-to-one sessions in which the nuances of individual projects and circumstances could be addressed. Most importantly, opportunities to hear from other Pilot Cities' representatives about their programmes, and discuss proposals and challenges with them was felt to be the most impactful.

This feedback and subsequent knowledge about Pilot Cities preferences for learning is informing the planning and design of the Boot Camp for the second cohort. In recognition of the interest in inspirational content that covers more generalised themes, the Boot Camp will commence with activities that allow for supporting Cities on topics that are broader but will be generally relevant to a majority, if not all, projects. As the Boot Camp progresses, activities will become more targeted to individual projects in structure and content, while also enabling much greater interaction among cities through an in-person event and developing specific opportunities for Cities to share their projects, experiences, challenges and solutions.

2 The Learning

By harnessing data from diverse sources and structures, the subsequent segment of this report will be systematically structured into thematic clusters for clarity and conciseness. The findings will be primarily organised around the Levers and Emission Domains categories as in the **Pilot Programme Guidebook** (Note that the Emission Domains in this document differ slightly from the ones used in the PCP applications and their analysis), these clusters will then be expanded or elaborated to incorporate any emerging themes that have been identified. The overarching goal of this analysis is to identify recurrent patterns, emerging trends, and overarching motifs that underscore the unique endeavours of the Pilot City Projects.

2.1 Emission Domains

This section provides an overview of some trends and highlights of the emission reduction efforts and challenges across Pilot City projects.The domains are organised based on the **Pilot Cities Guidebook**'s categories (Energy Systems, Built-Environment, Mobility and Transport, Circular Economy, Nature-Based Solutions, and Green Industry), which differ slightly from the categories defined for the PCP applications. The categories have been sorted from those with the most challenges and activities found across pilots, to those receiving comparatively less attention.

It's important to note that challenges within a specific Emission Domain often interconnect with other domains, leading to comprehensive pilot activities that span multiple categories (e.g. Retrofit projects span both Energy Systems and the Built Environment). Moreover, challenges and pilot activities frequently encompass multiple Systemic Levers simultaneously, (following the example, retrofit projects requires Participation & Democracy, Financing and Funding, Governance and Policy, etc.). So, the next section will attempt to highlight the aspects of each that are most relevant to each Emission Domain, while leaving cross-cutting lever-related challenges for the next section (e.g. all projects in all domains struggle with financing, participation, or policy innovation).

2.1.1 Energy Systems

The realm of energy systems encompassess a broad spectrum of projects and activities that often interconnect with various other domains. Initiatives such as neighbourhood retrofits and fleet electrification for example delve into the sphere of energy systems while concurrently intersecting with domains as the built-environment, mobility and transport, or circular economy. Consequently, this section will predominantly focus on critical facets of both electricity and non-electricity energy

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generation, distribution, management and consumption, as well as the governance of the energy projects, and energy justice.

- **Scaling renewable energy:** Scaling up renewable energies is a multifaceted challenge that extends beyond technical aspects. While cities grapple with the difficulties of scaling the renewable energy generation infrastructure, and modernising the distribution network, they also face the complex task of reshaping consumption preferences and patterns from consumers that for a myriad of reasons may be reluctant or opposed to embracing renewable energy. This necessitates a change in how energy is generated and distributed, but also on how it is consumed and communicated to the end-user. One of the key hurdles in scaling up renewable energy consumption lies in persuading consumers to embrace cleaner and more sustainable energy sources which entails not only increasing the availability of renewable energy options and fostering a cultural shift towards more sustainable energy choices. For instance, Liberec's pilot emphasises social innovation alongside technical upgrades, such as deploying rooftop PV systems, aiming to reshape consumer preferences through the Energy Community Liberec. This holistic approach promotes cleaner energy adoption and underscores the need for both technological advancements and a cultural shift towards sustainability.

- Comprehensive infrastructure projects (Net-Zero Neighbourhoods, Positive Energy Districts): infrastructure undertakings, such as the revitalization of energy systems, frequently involve substantial economic investments and engagement of a wide array of stakeholders, including government agencies, suppliers, businesses, residents, and property owners. Given the substantial commitment already invested, cities frequently perceive energy infrastructure initiatives, often closely related to build-environment renovations, as broader opportunities for more comprehensive interventions that span multiple domains and that are able to yield co-benefits, or foster new economic prospects. For instance, the Dutch cities explore the model of Positive Energy Districts (PED), energy-efficient urban areas or clusters of connected buildings designed to achieve net-zero greenhouse gas emissions. These districts actively manage surplus renewable energy production on a local or regional scale. PEDs are characterised by the integration of various systems and infrastructures, including roads, cables, green spaces, water management, mobility solutions, energy production, buildings, subsoil utilisation, and social cohesion. The key concept is the strategic placement of these elements to mutually reinforce one another. For instance, greenery can provide cooling for buildings, while buildings may generate electricity. This integrated approach enhances resilience and attracts investment by mitigating risks. Similarly, Cluj-Napoca's Net-Zero Neighbourhood pilot which includes a comprehensive intervention across multiple domains including energy systems, built-environment, and mobility and transport. Such a project inherently poses a significant challenge in engaging a multitude of stakeholders in multi-pronged approaches to transform multi-family apartment neighbourhoods into energy-efficient, climate-neutral zones. In Leuven's district-level interventions to decarbonise heating and enhance energy efficiency, the arrival of the new heating network is also regarded as a leverage for a collective renovation project that can enable new business models under the concept of "renovation as a service", and new forms of community organisation and collaboration.

- **Energy poverty and energy justice**: Energy poverty is a pressing concern in many pilot city projects. Vulnerable populations often struggle to access affordable, reliable energy services. Moreover, outdated heating methods and lack of energy-efficient infrastructure contribute to prevalent energy poverty, particularly in buildings with inadequate insulation. There is a concern across several cities that the transition may disproportionately affect those with less resources. In Budapest, many low-income households who struggle to afford their energy bills live in privately-owned houses of poor technical condition, a legacy from the 1990s privatisation wave. This exacerbates their financial vulnerability, increasing their energy expenses and hindering their ability to afford energy-efficient solutions. To address it, Budapest pilot proposes a sustainable energy-efficiency incentive program aimed at providing lasting institutional solutions and deploying smart technical solutions in building renovations. Similarly, Leuven's pilot aims to address energy poverty by prompting various programs to promote energy efficiency and reduce energy poverty. These initiatives offer targeted financial support to low-income households, raise awareness, and collaborate with local energy cooperatives to execute renewable energy projects, all contributing to alleviating energy costs for the community.

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- Energy communities: Energy communities are a pivotal focus within some pilot city projects. Energy communities orchestrate collaborative and citizen-led initiatives that advance the transition with a strong emphasis on citizen involvement. They play a vital role in bolstering public support for renewable energy endeavours and simplifying the attraction of private investments in the shift toward cleaner energy sources (European Commission, n.d.). Most prominently, the city of Liberec pilot proposes to establish a sustainable energy community to bolster citizen engagement and build capacity in addressing climate change issues while promoting greater utilisation of renewable energy sources. The goal is to create a participated energy community aligned with transport electrification promotion and establish knowledge-sharing mechanisms for informed and engaged citizens.

- **Energy security and seasonality**: Energy consumption varies throughout the year, with some cities experiencing peak energy demand in the summer for cooling and others in the winter for heating. Additionally, energy production is affected by weather and environmental conditions, creating variations in the availability of renewable energy sources. Some cities are concerned over the challenge of ensuring a reliable stock of energy to meet these seasonal variations and ensure a reliable energy supply throughout the year. Kozani has been historically reliant on lignite-based energy which has been a major part of the region's economy for the past 50 years. The city is committed to transition to renewable energy but the recent geopolitical events and the energy crisis have exacerbated the uncertainty in the energy supply. One of Kozani's main concerns is how to ensure consistent renewable energy, especially during the winter months when district heating is in high demand, and days are cloudier and shorter. To overcome this, they are collaborating with an energy aggregator through a two-way contract, purchasing renewable energy during peak demand and selling surplus energy in the summer.

2.1.2 Built-Environment

The built-environment domain is another widely extended area of focus across pilots. It is closely interconnected with the energy systems in projects of buildings or neighbourhood renovation, so some of the challenges discussed in the energy systems section are equally relevant in built-environment activities, from the intricate coordination and engagement of multiple stakeholders in extensive renovation endeavours to the issues of energy injustice experienced at the residential level, manifested in houses that fall short of technical optimization, whether it be in terms of insulation, energy efficiency, or related aspects. This section will therefore focus on the challenges encountered in retrofit projects, public spaces, facilities, and public infrastructure.

- **Complex Ownership Structures**: The presence of privately owned buildings with diverse social structures in the cities pose challenges across several pilots. Addressing this challenge requires tailored and flexible strategies that accommodate various ownership models and social dynamics. Budapest's pilot focuses on energy efficiency challenges in the city's housing sector, particularly in privately owned buildings. However, one of the primary difficulties highlighted in this project is the presence of complex ownership structures in Budapest's housing sector. The city's housing stock is predominantly privately owned, and ownership is diverse, ranging from capital-poor homeowners to various types of housing. Many homeowners are financially vulnerable and unable to invest in building upgrades or afford their maintenance, leading to infrastructure gaps and energy poverty.

- Industry / supply-chain constraints: Across many cities, a common challenge to scaling up retrofit and renovation projects lies in the availability of skilled-workers. Cities have often expressed concerns regarding the limited availability of a workforce with skills on energy-efficiency renovation services (equally valid for energy systems as for the built-environment). For instance, Istanbul faces difficulties due to a limited skilled workforce necessary for scaling up the supply of net-zero renovation services. Istanbul's struggle to upskill its workforce in green building technologies directly impacts the pace and scale of emissions reduction initiatives in the city. The rapid urban transformation, lack of awareness, cost constraints, and regulatory changes contribute to the complexity of this issue, hindering the city's efforts to adopt and implement green building practices effectively.

- Embodied carbon and upcycling of materials: The challenge of embodied carbon in building and district projects is of interest to cities focusing on the construction sector and circular economy. These

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cities are increasingly recognizing the importance of addressing this issue and are exploring strategies such as using low-carbon materials, innovative construction methods, and upcycling to reduce carbon impact. Overcoming the lack of strong social and environmental incentives for adopting low-carbon technologies in these projects is crucial for successful implementation. For instance, among the Spanish Cities, Vitoria-Gasteiz is integrating bio-products into its construction practices to reduce embodied carbon. This approach involves retrofitting buildings using innovative local techniques and materials, prioritising bio-products to enhance energy efficiency. However, the city faces challenges, including sourcing an adequate supply of bio-products, managing initial cost disparities, ensuring technical expertise, fostering community awareness and acceptance, and aligning with existing regulations. Vitoria-Gasteiz is actively working to overcome these hurdles by collaborating with stakeholders, educating the community, and seeking ways to make bio-products more accessible and cost-effective, highlighting their commitment to sustainable construction practices.

- Perceived Budens/Benefits of renovations. A challenge to many activities in the built-environment domain lies in the perceived imbalance between the costs and benefits of retrofit investment. These projects typically involve significant upfront expenses and complex bureaucratic processes to access incentives, deterring participation. On the other side, stakeholders often struggle to see the long-term advantages and the urgency of embracing sustainable materials and construction practices and investing in energy-efficient solutions. This emphasises the need for effective communication of the benefits and urgency of the transition to encourage greater engagement and adoption. Istanbul is addressing this challenge by developing a communication strategy to get businesses and residents to build energy-efficient houses in reconstruction. Their pilot includes the development of a manual to make information easily accessible to residents and stakeholders and accelerate the adoption of sustainable construction practices. This strategy seeks to emphasise the advantages of retrofitting, including energy efficiency and cost savings, in a way that resonates with the community.

2.1.3 Mobility and Transport

Like the previous domains Mobility and Transport presents both technical and societal hurdles, necessitating comprehensive approaches. Particularly, due to the dynamic interconnectedness of mobility networks, challenges in this group require integrated, multi-level governance and collaboration in addressing these issues. Moreover, cities addressing these challenges also necessitate substantial investments in strategies that promote behavioural change, challenging deeply ingrained preferences for unsustainable transportation modes.

Integrated mobility: At the broadest level, comprehensive interventions in the transport service requires meticulous planning and coordination to create a seamless and efficient transportation network, and careful orchestration of diverse transportation modes. In the Italian Cities pilot, a significant challenge is reconciling diverse transportation systems across multiple regions and municipalities, each with its unique infrastructure and regulations. To address this, the pilot emphasises innovative multi-level governance models that facilitate collaboration among different administrative levels and foster knowledge sharing. Additionally, the project focuses on improving data sharing and standardisation, critical for informed decision-making in integrated mobility projects. By creating shared data exchange protocols, the pilot aims to break down data silos and enable data-driven choices.

Electrification of fleet and infrastructure: Transitioning to electric vehicles and implementing smart transportation systems entails hurdles spanning technical and societal dimensions. Some of the challenges related to his projects are akin to other previously discussed infrastructure initiatives, such as the complexities of stakeholder coordination for seamless integration, substantial infrastructure expenses, or provision of sustainable energy. Additionally, scaling the use of public transportation requires considerations of convenience and sustainable modes of multi-modal travel, while adoption in private transport requires perception considerations such as charging speed and range anxiety. For instance, Rivne aims to transition its transportation systems towards electric vehicles (EVs) and develop smart transportation solutions. Their challenges include establishing a robust charging infrastructure, ensuring charging speed and convenience, and addressing range anxiety to encourage consumer adoption of EVs. To overcome these hurdles, the city is planning to develop an integrated

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online system to manage data related to EV charging and energy consumption. This system will support the expansion of EV charging networks, optimise charging station locations, and enhance user experience. The Slovenian Cities data-driven approach seeks to make sustainable transportation more attractive by offering real-time information on public transport schedules, routes, and traffic conditions. Additionally, there's a focus on enhancing public transit efficiency and reliability, optimising routes, and creating incentives like reduced fares to motivate commuters to switch to sustainable modes.

Behavioural change and lifestyles: Transitioning to more sustainable modes of transportation presents substantial challenges beyond availability of public transport or sustainable alternatives to micro-mobility. It entails challenging deeply ingrained habits, as people often prefer the familiarity and convenience of private cars over alternatives like public transport, cycling, or walking. But also weather conditions, gender differences, and socio-economic factors influence travel choices. Lahti's comprehensive approach to this challenge involves the improvement of the public transport network and enhancement of the safety and accessibility of walking and cycling routes, but also incentivising commuter behaviour change by developing efficient and cost-effective incentives, both financial and non-financial incentives through co-creation and learning exchanges that connect sustainable commuting with other aspects of daily life.

Shared mobility: Shared modes of transportation can contribute to substantially decreasing the number of private vehicles on the road, thereby curbing emissions. However, it poses challenges such as resistance to change due to the convenience of private cars and the need for equitable access. Successful shared mobility relies on effective governance structures and collaboration among local authorities, transportation providers, and community organisations. Liberec aims to create a community-driven electric vehicle sharing program integrated in their broader sustainable energy community. The project aims to strengthen communal involvement and cooperation to advance sustainable transportation and propel sustainable mobility through shared resources, knowledge, and decision-making, which requires ensuring ongoing community engagement and financial viability, establishing effective community governance structures and securing sustainable funding.

2.1.4 Circular Economy

Circular Economy represents a transformative domain encompassing activities aimed at minimising waste, optimising resource use, and reshaping consumption patterns. Circular Economy activities often intersect with other domains, such as the use of bio-materials in the built-environment domain, or share sustainable mobility in transport and mobility. However, some cities like Guimaraes, Umea or Uppsala, place a distinct focus on circularity, making it a central aspect of their initiatives.

Consumption-based emissions and behavioural change: Tackling Scope 3 consumption-based emissions and implementing circularity strategies pose complex challenges for several pilots. These endeavours involve influencing behaviours beyond their direct control and overcoming deeply ingrained cultural resistance that prioritises convenience and disposability. Cities are working to promote sustainable consumption behaviours, incentivize local businesses to adopt sustainable practices, and foster a sense of responsibility among citizens. This encompasses efforts to reduce food waste, single-use plastics, or encourage e-waste recycling.

Another challenge of implementing a circular economy strategy is promoting practices such as upcycling, repair and reuse of goods among consumers. Fostering consumer awareness and demand for these upcycled products, overcoming the preference for new items due to perceived quality and reliability, as well as navigating the difficulties of supply chains involved in circular products, from collection to refurbishment and distribution further adds complexity to this challenge**.** For instance, Umeå's strategy includes education and awareness campaigns to engage citizens and local businesses in adopting more sustainable practices, and promoting circular economy initiatives, like repairing and upcycling workshops, to extend the lifecycle of products and reduce waste. There is an intention to establish a circular business 'park', where companies could benefit from being near each other. Umeå is also collaborating with local businesses to enhance the availability of sustainable and locally sourced products, encouraging residents to make environmentally conscious choices.

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Reconciling city growth with circularity: Maintaining climate-positive goals and transitioning to a circular economy that encourages efficient resource consumption and reduced waste can be a complex task in the context of fast-growing cities, as it can limit the flux of materials typically associated with urban growth. This challenge is particularly evident in fast-growing cities like Uppsala, which confronts the formidable task of accommodating rapid urban growth, with a projected population of 350,000 inhabitants by 2050, all while advancing towards a circular construction sector. To address this, Uppsala is focusing its pilot activities on enhancing circularity in construction projects. Through innovative approaches, such as circular renovations, creating local marketplaces for building materials, and streamlining the reuse of construction materials in ongoing development projects.

2.1.5 Nature-Based Solutions

Additional to “Nature-Based Solutions”, this section also incorporates discussions related to "Land-Use (Agriculture, forestry, and other land uses)”, as that is how the category was named in the PCP applications (different to the NZC Guidebook). Consequently, when cities refer to "Land-Use" in their applications, they tend to address activities more related to urban land-use planning, than to agriculture, forestry or other land-uses, and therefore closer to built-environment in focus than to nature-based solutions. In some of the cases, “Land-Use” and “Nature-Based Solutions” has been addressed in relation to waste-management and circular economy (e.g. as in landfill and waste disposal locations (land-use), or by nature-based strategies to water-waste treatment, although the reviewed documents don’t delve to further detail), however little elaboration is made about these activities. Overall, there is little focus to nature-based solutions or land-use related activities.

Land-use planning: Cities emphasise the importance of effective land use planning to reduce emissions. Using land effectively and in a way that does not deplete natural resources, harm biodiversity, or contribute excessively to greenhouse gas emissions through densification, reuse, and transformation of developed areas are common strategies. Drammen’s pilot highlights the importance of a compact city, with a focus on reusing, densifying, and transforming already developed areas to maximise the use of existing infrastructure and minimise the need for expanding into new areas. By promoting densification and reuse, Drammen aims to reduce emissions associated with urban sprawl and long commuting distances.

Green infrastructures and carbon storage: Some cities underscore the importance of natural areas, green spaces, forests, and arable land in carbon storage, and have dedicated activities to safeguard and promote these areas as carbon sinks, contributing to emissions reduction and environmental preservation. Guimaraes recognises the importance of their green fields for carbon capture, but for the restoration of the natural ecosystem, promotion of local economy, and support of healthier lifestyles, either by enabling organic food production, or enhancing outdoor activities and air quality. The pilot proposes a green belt, and the promotion of urban private gardens as means to capture CO2, enhance biodiversity, and address bio-waste issues.

Tactical green infrastructures: A different approach found is addressing the challenge of carbon capture in a more tactical manner, by proposing smaller-scale green interventions in available spaces of the city to introduce nature-based solutions that contribute to carbon capture, among other benefits. For instance, Limassol’s pilot proposes greening and deploying solar energy production in small open spaces, rooftops, pedestrian streets, squares, and bus stops. These green spaces would serve as natural carbon sinks, and improve the city’s microclimates, making it more comfortable for residents and reducing the need for energy-intensive cooling.

Integrative Nature Based Solutions (NBS): Integrative NBS emphasise interventions for multiple purposes, as opposed to traditional singular-purpose environmental interventions characteristic in much of current environmental policy. Nature-Based Solutions can contribute to climate change adaptation while saving costs and increasing benefits. In Dutch cities, a new environmental law underscores this shift towards multifunctional spatial planning, where functions synergize for greater efficiency. For instance, a water storage area not only aids in flood control but also supports nature, water purification, recreation, and potential future agricultural activities, yielding economic, social, and ecological benefits. This approach, exemplified by NBS, demonstrates the potential to save costs and

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increase benefits across various domains, from climate change adaptation to financing and multi-purpose infrastructure design. Additionally, fostering collaboration and knowledge exchange among involved parties can further amplify these transaction benefits, highlighting the social advantages of this integrative approach.

2.1.6 Green Industry

Challenges related to emissions in industrial processes were found often related to emissions of the Construction Industry (reducing emissions in the construction industry are already included in the Built-Environment Emission Domain), the transport industry (In mobility and transport), or seen as part of implementation of a Circular Economy strategy with a reduction in the emissions in the products' lifecycle and waste from (consumption-related) businesses. It is worthy to note that while 5 cities (Bristol, Malmo, the Slovenian Cities, Turku, and Uppsala) expressed in their PCP applications to address Industrial Emissions, no dedicated and detailed activities or challenges were found in the applications, Leaning Enquiries, or other reviewed documentation. Challenges in this category would include industrial transformation, technological adoption and innovation, etc.

2.2 Systemic Levers

This section delves into needs and key initiatives regarding the systemic levers of change, mechanisms through which cities aim to achieve climate targets. It's noteworthy that some projects display a greater focus on some specific Levers over any particular Emission Domain. For instance, Bristol's pilot primarily emphasises financial innovation to fund a wide range of climate initiatives, rather than focusing on a particular Emission Domain. Similarly, Nantes' project, centred around intermediaries of behavioural influence, while not addressing any Emission Domain in particular, explores significantly the lever of Social Innovation.

2.2.1 Governance & Policy

Overarching challenges and strategies from cities to guide their carbon-neutrality action initiatives and manage the complexities of the implementation of their pilot projects. It involves challenges related to governance models and structures, organisational change, policy and regulatory innovation, innovative instruments, among others, which address the need for effective decision-making, coordination and collaboration, regulatory adaptation, equity considerations, innovative tools, and comprehensive monitoring to facilitate the successful implementation and ensure the long-lasting impact of the pilots.

- Multi-actor governance: As seen from the Learning Enquiries Analysis, there's a general interest by most cities in the adoption of multi-level and multi-stakeholder governance structures to better align efforts, share resources, and create a unified vision for successful implementation. Interest in this topic responds to the challenge of complex decision-making and coordination inherent to the pilots, which require collaboration across departments, and public organisations, but also with external entities, in the industry and businesses sectors, or civic society. For example, Bristol's pilot aims to implement a "Net Zero Investment Co-Innovation Lab" to co-create, research, pilot, deliver, and evaluate financial levers. Given the participatory approach of this initiative, the lab requires rapid learning and adaptation through feedback loops. One of Bristol's key concerns is how to develop a dynamic and integrative multi-actor governance infrastructure that supports a systemic approach across the various levers, and that is agile enough to benefit from effective and quick co-creation processes via feedback loops. The Dutch Cities pilot explores how local public climate finance could maximise leverage from private and government sources. The pilot introduces District Investment Platforms in seven cities as a tool to kickstart the development and implementation of Climate Investment Plans. In order to speed up investments and improve their effectiveness, there is a great need for insights on stakeholders, projects, budgets and possible financial partners at district level; this also raises questions on how the governance is developed around the platforms.

- Multi-level / inter-sectoral / inter-departmental alignment: Another frequent challenge comes from integrating new climate policies and strategies into existing frameworks and coordinating efforts across levels of government, different sectors, or across cities. This involves avoiding conflicts between policies, while ensuring a coherent holistic approach to climate objectives. For instance, the Italian cities' consortium emphasises the challenge of aligning efforts across and within their member

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cities, which involves overcoming the "silo mentality" within municipal departments to enable more streamlined and interconnected processes. As regulatory constraints and bureaucratic obstacles hinder the administrations' ability to integrate actions and learn from each other efficiently, the consortium proposes to integrate climate neutrality as a key objective of all activities in all municipal sectors, to foster a more integrative governance framework that encourages knowledge sharing.

- **Limited National and European Support**: Another shared challenge faced by many cities relates to the lack of substantial support from their national and regional authorities. This is especially evident where their political tendency diverges from those at the federal level. But also, urban areas often concentrate more progressive and highly educated individuals, which tend to result in a greater ambition (and more ambitious targets) in regards to climate action, which is not always shared by their corresponding central governments, which represents more diverse interests of both urban and rural areas. Cities like Leuven, Budapest, and others have expressed their need for increased political and financial assistance from the European level due to the hurdles they encounter at the national level, highlighting a broader trend among these urban centres seeking stronger European backing.

- Policy and regulatory hurdles: Complex regulatory frameworks, bureaucratic processes, and conflicting regulations can also slow down the implementation of the pilot projects. For instance, Galway's challenges in retrofitting its social housing stems from the bureaucratic processes and complex regulations that require navigating a maze of permits and approvals and lengthy application procedures for funding, that lead to delays and increased costs hinder homeowners willingness to uptake the retrofit incentives. Moreover, due to the novelty of the pilots, some projects may not have the necessary supporting legal frameworks at the local or central government level, limiting their ability to implement these projects effectively. For example, Kozani is concerned about bottlenecks in receiving the permissions for their energy-focused pilot, as the central Government has little experience and no regulations regarding thermal storage, which would extend the permitting process a lot longer than the usual 8 to 12 months. These examples highlight the need to enhance institutional capacities in terms of policy and regulatory experimentation, to enable and accelerate the implementation of pilots projects and policy

- Embedding justice and equity in policy and projects: Many cities have expressed their commitment to ensuring that the shift towards climate neutrality does not disproportionately burden vulnerable communities, and that the advantages of this transition are fairly shared. In general, the ambition of a 'Just Transition' is shared across cities, and called expressly in at least 12 of the 25 PCP applications, with more notable emphasis in Bristol, Budapest, Kozani, and Leuven. However there is limited elaboration on what this entails. Effectively addressing at the same time social and economic dimensions of the transition demands meticulous planning and supportive policy and governance framework that guarantee that justice is an integral part of all actions, both internally and in collaboration with external partners. For example, one of Guimaraes' key concerns is how to ensure that the values of inclusion, equity and democracy are embedded into PPP implemented projects, and maintained throughout all interventions, which includes comprehensive inclusive governance strategies, inclusive stakeholder participation, and ongoing evaluation.

- Measuring complex processes and results. Several cities have expressed their interest in developing better instruments for the monitoring of complex processes -such as a Just Transition- and measuring outcomes that are often difficult to quantify, such as behavioural change or shifts in the attitudes of people. The German Cities pilot aims to encourage citizens to embrace climate actions while recognizing a spectrum of obstacles encompassing psychological, social, and structural dimensions. In order to comprehensively assess the effectiveness of their pilot and climate initiatives, they require instruments to quantify the generated co-benefits and measure difficult aspects such as social innovation or behaviour change. Limassol shares a comparable interest, expressing concern about widespread apathy and, in some cases, resistance towards climate initiatives within their population. Consequently, they are keen to explore methodologies for measuring public attitudes in complex contexts of possible polarised opinions and rebellious attitudes towards climate initiatives.

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2.2.2 Participation, Culture and Democracy

The pilot projects consistently highlight the importance of meaningful, inclusive, and active involvement of citizens and various stakeholders in their climate initiatives. Cities acknowledge that achieving the necessary change to reach their ambitious climate-neutrality goals, and ensuring that the transition is fair, demands not only involving multitude of stakeholders; but also empowering citizens and bringing diverse voices in decision-making processes. Given the intricate and context-dependent nature of these challenges, cities require tailored strategies and continuous effort to nurture a genuine sense of ownership and commitment to climate action processes and outcomes.

- Inclusive representation and participation: Ensuring that participatory processes are inclusive and represent diverse voices can be challenging. Overcoming barriers to access, participation, and power dynamics is necessary. Many cities struggle to ensure the inclusive participation of marginalised and vulnerable populations in decision-making processes. Overcoming barriers to participation, addressing representation gaps, and creating accessible platforms are crucial for equitable democracy. At least 11 pilot applications explicitly emphasised the significance of incorporating the perspectives of vulnerable and underrepresented groups in decision-making. Most notably, Bristol recognises the structural barriers that these communities face, such as limited access to resources, unequal power dynamics, and historical underrepresentation. Thus, the pilot includes the creation of accessible platforms for participation: the Citizen Community Carbon Investment Scheme and the Community Leadership Panel on Climate and the Just Transition create open and inclusive avenues for engagement.

- Meaningful and active participation: Cities recognise the importance of empowering citizens and local communities to take the lead in and driving climate initiatives. This requires going beyond consultative participation and superficial involvement to create spaces that grant actual agency and influence in decision-making, and cultivating a genuine and shared sense of ownership and influence over processes and outcomes. The German cities' pilot proposes "radical collaboration" by integrating all stakeholders as equal co- producers in decision-making through a "House of Change", a Local Green Deal platform to empower them to take specific climate-friendly action, fostering a shared sense of ownership and commitment to climate action processes and outcomes. By making the citizens the "owners" of this initiative, the pilot intends to overcome barriers to citizen-led climate action, including values-action gap, uncertainty, scepticism about climate issues, and mistrust of authorities.

- Raising awareness and overcoming apathy: Some cities have expressed their concerns about a lack of awareness about climate issues in their population, or even indifference or resistance towards taking climate action. Addressing this issue requires a multi-faceted approach that combines effective communication, relatable narratives, and ongoing engagement to craft messages that resonate with the values and interests of the communities. Turku aims to actively involve citizens through a climate ambassador network, climate dialogues, and a 1.5-degree city communication campaign. The climate ambassador network will be set to represent citizens' voices and act as messengers between the community and the city. The ambassadors will experiment with sustainable lifestyles, demonstrating that it's possible to reduce emissions while maintaining a good quality of life. The climate dialogues provide a platform for citizens to discuss climate challenges and solutions, fostering participation, supported by a dedicated ICT platform.

- Engaging with the private sector: Cities acknowledge the private sector's pivotal role in their climate initiatives, given that they hold significant resources, expertise, and innovation capacity that is indispensable for the success of the pilots. However, issues like the need for regulatory frameworks, and harmonising profit motives with long-term climate benefits hinder this engagement. Effective public-private collaboration requires strategies to foster a shared commitment to a low-carbon future, addressing the central tension between profit-driven objectives and the global imperative to mitigate climate change. For instance, Liberec, like many other cities, is struggling in involving businesses in their pilot's Energy Community. Mainly, because of the lack of awareness among local businesses about the opportunities of the energy community and low-emission solutions, and constraints in human-resources to effectively engage with the private sector. To overcome this, the city is actively identifying key stakeholders, particularly local SMEs, and conducting surveys to understand their perspectives. The city is also collaborating with NGOs experienced in public engagement and

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education to bridge the gap between the public and private sector, aiming to foster awareness and encourage local businesses to participate in climate initiatives.

2.2.3 Social Innovation

The initiatives and challenges in this sector are closely related to the levers of Governance and Policy, and Participation and Democracy; however, instead of focusing on the aspects of policy implementation, of citizen involvement in decision making, these initiatives aimed to reshaping societal norms, values, behaviours, and institutional, and the way different actors interact and collaborate within the ecosystem.

- Behavioural change and cultural shifts: The interest for behavioural change is widespread across pilot cities, with at least 20 cities calling for behavioural change in their applications. Most notably, the German Cities, Cluj-Napoca, Nantes, Umea, and Lahti. Overcoming deeply ingrained cultural norms and resistance to change to encourage individuals and communities to adopt new sustainable behaviours requires a deep understanding of underlying factors, values and motivations that sustain these habits. Nantes pilot focuses on engaging with residents to support their transition to a low-carbon lifestyle. The city is collaborating with universities, neighbourhood and place-based special purpose organisations, as well as company associations, to explore the role of these intermediaries in influencing cultural norms and values, sustainable choices. This engagement work is meant to identify key barriers for people to change their lifestyle and inform the city's policy making. In particular, Nantes is exploring the potential of engaging with the wealthier population, which significantly contribute to emissions and consumption patterns. The identification of intermediaries for change with this segment of population is particularly a challenge.

- Community-based projects and collective ownership: Some cities foster community-based initiatives, including community-owned infrastructure projects, that empower them to collectively contribute to the development of innovative solutions, while also contributing to a more equitable distribution of benefits of the transition. For instance, Liberec's Energy Community engages citizens and stakeholders for greater use of renewable energy while promoting community-owned renewable energy infrastructure projects. Similarly, the Dutch Cities' Direct Investment Platform serves as a collaborative platform to alight public and private funds tor district-level investments including community-based projects of infrastructure or renewable energy cooperatives. It is important to make use of the local networks that exist to help in building the ecosystem, community needs are key. A real challenge is to connect the Public private partnership with the civic partnership, how to really connect and develop a joint network.

- Multi-actor advisory boards / steering groups: Some cities are establishing multi-stakeholder institutions (quadruple/quintuple helix framework), composed by the government, industry, academia, civil society, and the environment sectors. These entities enable a comprehensive understanding of the complex issues that the transition faces, and foster collaborative solution-building. These institutions recognise the interplay of the various sectors in driving innovation and change, placing them in a broader ecosystem of societal transformation and innovation. Galway's pilot addresses the challenge of improving residential energy efficiency and overcoming systemic barriers hindering the retrofitting of residential buildings. To achieve this, the city is establishing a Quadruple Helix Steering Group to streamline the bureaucratic retrofitting process, shorten the timeline from initial inquiry to completion, and develop push/pull policy mechanisms to encourage building retrofits, particularly in low-income areas. However, implementing this strategy entails challenges related to stakeholder mobilisation such as balancing sectoral priorities and interests, building trust among them, and maintaining their commitment, all while safeguarding independence and transparency. Also sustaining the Quadruple Helix Steering Group (i.e. a partnership) for the longer term is seen as a challenge.

2.2.4 Finance and Business Models

This section provides an overview of key trends and challenges regarding finance and funding, but also economic considerations. It encompasses funding strategies for climate projects, the need to

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challenge traditional investment norms, inclusive financial instruments, and overcoming market barriers for scalable net-zero initiatives.

- Funding pilots: Cities are actively seeking financial support to pilot and scale their climate projects. The challenges and strategies associated with securing these funds are diverse, ranging from the competitive landscape for national and EU grants and subsidies, the need to align various, often disparate, financial streams into a unified funding strategy, and the mobilisation of private resources within blended finance schemes. For example, Cluj-Napoca is concerned about resource limitations, which present hurdles for large-scale initiatives like Net-Zero Neighbourhood pilot and its applicability. The fierce competition for grants and transfers, which could potentially make these vital resources available, further compounds the challenge. A similar concern from Guimaraes revolves around how to leverage the pilot to secure funding for its implementation beyond the PCP programme conclusion in 2025. To surmount this barrier, the Dutch Cities and Bristol are pioneering platforms aimed at aggregating diverse funding sources. This involves aligning various fund streams, including fees, taxes, subsidies, and grants, into a unified public funding strategy. And also attracting private investments into blended funds dedicated to financing the projects and ventures.

- **Investment platforms for integrated investment**: An investment platform, as proposed by the Dutch Cities pilot, functions as a collaborative mechanism that brings together multiple stakeholders, including municipalities, financial institutions, and public, private, and civic investors. Its primary purpose is to align different sources of investment and streamline the financing of sustainable initiatives. This overcomes the current approach of investors and their financiers to decouple their investments than investing comprehensively in the entire system (e.g. energy generation, housing). The Dutch Cities investment platform proposes to strategically integrate various urban systems and infrastructures to create resilient PEDs, thus aligning the objectives of diverse investors, enabling both integration of sustainable elements and minimising risks while advancing the development of PEDs.

- Challenging conventional investment: Mobilising private finance for climate goals requires overcoming investor hesitancy and risk. This entails questioning entrenched beliefs underpinning traditional financial investments. Overcoming this challenge requires mitigating the risks associated with sustainability projects, and a strong narrative that makes them more attractive to private investors. It also entails recognising the multifaceted value of these projects, extending beyond immediate and material returns to a more comprehensive grasp of the projects' advantages. Bristol, for instance, recognises that resources are available in the private sector (e.g. ESG funds), but they are not reaching the initiatives that would be necessary to accelerate the transition. They acknowledge the investor's reluctance to invest in these initiatives, and are exploring the possibility of developing a government-backed certification to provide legitimacy to the investment funds. Another strategy explored is to peg impactful projects with low- to marginal-returns to more lucrative initiatives, thereby channelling funds into underfunded projects with high societal impact. More broadly, Bristol's concerns is to overcome the predominant risk-led return investment model and convince private investors to commit, take action, and invest resources in climate-initiatives.

- Inclusive financial instruments: Cities aim to make climate investments more inclusive by designing financial instruments that ensure equitable distribution of funds and cater to vulnerable populations. They are interested in instruments that promote accessibility and social equity in climate finance. Developing and implementing inclusive investment instruments requires careful design and alignment with local needs. Cities must address disparities and ensure that marginalised communities benefit from climate finance opportunities. Dutch Cities' recognise the structural barriers that may hinder vulnerable populations' participation in their financial platform, including low awareness or limited understanding of financing and financial institutions. To overcome this, the pilot focuses on inclusive instrument design to ensure that financial instruments are accessible to all. Similarly, Budapest intends to make financial incentives for retrofitting accessible to low-income households by collaborating with commercial banks and international financial actors to develop tailored models that meet the needs of various building types and residents, including those in energy poverty.

- Market lock-ins: Several cities, particularly in their activities related to energy systems and built-environment, are grappling with challenges in stimulating and creating the conditions for a

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scalable net-zero market. A core issue underlying this challenge is the perception of an insufficient market size, which often fails to incentivize suppliers and contractors to expand their operations. This perception creates a self-perpetuating cycle: limited supply maintains higher prices, resulting in lower demand for sustainable materials and services, ultimately stalling market growth. Cities are keen to explore innovative strategies to break free from these lock-ins and unlock opportunities to accelerate the transition to climate neutrality. Bristol, for example, has identified that suppliers and service providers in their private sector are hesitant to scale up without the assurance of sufficient demand, thus perpetuating stagnation in demand. Bristol aims to address this by investing in longer-term, place-based businesses, supporting the development of local skills, and creating incentives for practitioners to invest in climate initiatives. Similarly, Galway is tackling the challenge of a shortage of contractors for retrofit projects by investing in local SME growth and skill development. By supporting the growth of businesses capable of carrying out retrofit projects, the city aims to establish a resilient and sustainable supply chain. This, in turn, will help meet the increasing demand for climate initiatives and drive economic growth within the community.

2.2.5 Learning & Capabilities

This section discusses the challenges and approaches related to equipping individuals, communities, and institutions with the necessary skills and understanding for the success and long-term impact of the pilots. It highlights the shared objective of creating enduring institutional solutions that can be replicated by other cities, emphasising the importance of scalability and knowledge dissemination. Additionally, it explores the collaborative approach adopted by many projects, promoting partnerships between academia, government, industry, and citizens. This approach not only aims to accelerate knowledge dissemination but also to nurture a culture of continuous learning and adaptability.

- Stakeholder capability development: As observed in the previous sections, cities place significant importance on stakeholder and citizen involvement in their pilot initiatives. Thus, building necessary skills and knowledge among them is critical. In this regard, two distincts approaches can be identified. Some cities opt for a more direct method, emphasising knowledge transfer and, in some instances, structured training for their stakeholders, while other cities adopt a more facilitative role as enablers of learning by promoting an environment for peer learning and exchange. It's worth acknowledging that differences in these strategies may stem from contextual factors and priorities, such as the scale of the ‘audience’, the nature of the learning content and process, or resource availability.

For instance, **Istanbul’s** pilot centres on the reconstruction of residential buildings and implementation of a large-scale carbon-neutral district. The pilot has a direct approach to capability development, which is more guided by city authorities and regulations. Their strategy focuses on skill and knowledge transfer to citizens, contractors, and businesses in construction-related industries by promoting a comprehensive "Green and Carbon Neutral Building Transition Guide" to guide the transformation process. This includes organising dialogue events and workshops to engage stakeholders. In contrast, the **German Cities** tackle Scope 3 emissions through behavioural change and 'radical' participation. Their strategy emphasises broader knowledge sharing by promoting open dialogues and exchange that enable stakeholders to glean insights from one another's experiences. The Pilot City group proposes to orchestrate an environment for peer learning, where stakeholders can collectively identify obstacles, learn from failures, and draw lessons from successful strategies, while emphasising the importance of testing and adaptation based on real-world experience.

- Enabling learning across cities and with partners: Cities are eager to collaborate and learn from one another, sharing knowledge and experiences to discover innovative and efficient solutions for common challenges and adapt successful strategies to their unique contexts. To achieve it, cities require robust communication channels and build capacities for effective collaboration and cross-learning. The Italian cities pilot, for example, employs a collaborative learning and assessment plan across network, cluster, and city levels, enhancing knowledge creation, sharing, and management. The project's core inquiry involves facilitating knowledge harvesting and transfer between clusters, pilots and partners, to enable knowledge to be used to address different goals. The team also proposes the creation of an “Observatory of Follower” cities to promote cross-learning and replication of successful strategies

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- Internal capabilities and learning: Some cities grapple with internal capacity challenges within their organisations, including gaps in specialised skills and knowledge related to the pilots, and capacity for organisational change. To address these issues, cities are resourcing to diverse strategies including outsourcing and partnerships with external parties. Also to develop capabilities internally some cities are implementing capacity-development programmes, and more broadly aiming to foster a culture of learning and collaboration. For example, Umea has identified entrenched siloed working practices that hinder collaboration among their city organisations and stakeholders. To overcome this, the city is developing a capacity-building programme to establish a shared understanding and work methodology of systemic innovation among employees. Additionally, they've integrated learning circles into their project structure, facilitating iterative, reflective learning and knowledge exchange.

2.2.6 Technology and Infrastructure

This section discusses critical aspects related to technology, most particularly data management and digital governance, which are common concerns among many cities striving to enhance their urban environments and services while addressing the technological and digital challenges of the contemporary information era, such as data-driven decision-making, data sharing and protection, accessibility to digital public services, among others.

- Data management and utilisation: Currently, the technical capacities for data processing, analysing for decisions-making is limited. The need and extent for data collection is precisely determined (i.e. which data and for what needs), even as certain types of data continue to accumulate. The absence of real-time data exacerbates these challenges, as seen in data from Statistics authorities, real-time monitoring of urban parameters like CO2, noise levels, and air quality, as well as data necessary for managing public assets, such as heat and electricity consumption. Consequently, there's a pressing need for an overall enhancement of city information system architecture to enable in the long-term for a more effective utilisation and analysis of data. The Polish cities' pilot underscore the pivotal role of data in understanding emissions and measuring progress towards decarbonization, considering it a crucial step in their strategy. They've identified a notable increase in emissions in public utilities, contrasting with declining trends in other sectors. Consequently, precise data collection and the continuous monitoring of urban parameters become paramount to decipher these patterns. The Pilot City team places particular emphasis on crafting effective indicator sets to monitor the progress of their climate initiatives and navigate the wealth of existing data.

- Standardisation, harmonisation and interoperability: Often, data is collected in varying formats and granularity levels, obstructing efficient utilisation. For instance, statistics authorities provide data that is not based on regions, and data from different databases are often not compatible with each other. This incompatibility arises from localised, single-government-centred systems that hinder cross-database communication. Addressing this issue necessitates the development of software capable of bridging diverse databases for seamless data exchange. Additionally, establishing data connections with neighbouring municipalities, even those in adjacent countries, is vital for integrated data-driven management, collaboration, and service integration. Improving the information city architecture is crucial for enhancing compatibility between local and national registers. For example, Rivne's pilot addresses the difficulties of having quality data of energy infrastructure, public facilities and residential buildings for their 2030 energy plan. One of the City's key concerns revolves around harmonising various measuring methodologies and data formats used by different organisations to create an online user-friendly platform to enable effective energy-data management and facilitate informed decision-making. The city aims to utilise the aggregated data to model energy development scenarios to assist decision-makers in determining the most optimal path to climate neutrality. They are initiating the process of mapping their data availability, identifying their requirements, and identifying stakeholders with whom they will need to engage, starting from automating and harmonising the data collection of municipal buildings. The main challenge will be finding a way to standardise data collection methods and establishing incentives to encourage data sharing.

- Open data, data protection and security Municipalities possess extensive databases that are often underutilised and lack visibility. Meanwhile, private companies express interest in leveraging open data

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to develop innovative solutions. Balancing the provision of data to citizens, organisations, and private firms for the creation of new services while ensuring its legitimate and secure management is a complex issue. Furthermore, the contemporary information society demands an increasing focus on IT security (ISKE) and data protection. Navigating the intricate landscape of data protection, including compliance with GDPR and cyber security regulations, proves to be challenging for local governments. The German cities are concerned about the protection of personal data in the context of the "individual" green deals aimed at encouraging private citizens to take environmentally friendly actions. These actions may involve sharing personal data or information related to behaviour, such as energy usage, transportation habits, or waste disposal practices. The cities are aware that collecting and using such private data requires strict adherence to data protection regulations and privacy concerns.

Digital public services, accessibility and digital divide: Accessibility to public services for all target groups in a user-friendly manner is a pressing concern. Communication with residents often lags in efficiency, as the increasing volume of information complicates daily life management and access to critical services. Finding appropriate channels of communication that cater to diverse age groups' capabilities and interests is essential. Increasing the quantity and quality of e-services and promoting their adoption among the population, especially in smaller cities where population is declining, is imperative to ensure service quality. Moreover, enhancing document management systems to enable procedural monitoring would significantly enhance efficiency, transparency, and overall service quality.

2.3 Post-Bootcamp Learning

After the Bootcamp activities, it is evident that there will be an ongoing need for support. This is taken forward in several ways.

Firstly, NetZeroCities PCP cities will take part in the learning and sense-making process already mentioned above (section 1.2.3), undertaken through other Tasks across the NetZeroCities consortium. This sense-making process is a facilitated cluster-based learning process through which cities are invited and enabled to reflect on their progress, insights gained and next questions in semi-regular workshops (four in total taking place between end 2023 and mid 2025 for the NetZeroCities PCP). This process will start in November 2023 (and a similar process will take place for the NZC-SGA1 Pilot Cities, starting from mid 2024). For this purpose, NetZeroCities PCP cities have been clustered in groups, based on a mixture of considerations such as Emissions domain, Levers of change and pragmatic factors like group size. The following groups have been created:

- **Group 1 - Citizen action for climate neutrality:** German cities, Guimaraes, Umeå, Limassol, Nantes and Turku
- **Group 2 - Multi-sectoral and city-wide ambition for climate neutrality:** Dijon, Malmö, Uppsala, Lahti and Drammen
- **Group 3 - Removing barriers of innovative financing models:** Bristol, Dutch cities and Budapest
- **Group 4 - Decarbonising the built environment:** Polish cities, Istanbul, Galway and Cluj-Napoca
- **Group 5 - Built environment and heating systems:** Spanish cities, Kozani, Leuven and Liberec
- **Group 6 - Better data, knowledge and capacities:** Italian cities, Slovenian cities and Rivne

Secondly, NetZeroCities PCP cities will benefit from the city support structure put in place in SGA1-NZC, namely the City Support Group infrastructure through which consortium experts will provide core support on a range of transversal themes (Governance and participation; Finance; and Measuring, Evaluation and Learning), as well as being able to connect to more detailed expert advice, whether from consortium experts or from other sources of expertise, via the City Expert Support Facility. In this manner, the wide range of systemic support needs uncovered so far can be addressed in an agile manner.

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3 Synthesis and Conclusion

The outcomes of the PCP journey so far reveal many important insights in the specific systemic obstacles preventing progress on current policy / investment in cities. They largely confirm previous NetZero Cities analysis of city needs, with the heavy emphasis on for example the need for governance innovation, new forms of civic and multi-stakeholder engagement and finance innovation.

It is notable that most successful proposals have a greater focus on levers of change than on emission domains, focussing on growing cities' overall capacity to implement transition measures rather than on particular domain-specific solutions. New ways of organising the transition, forming expanded teams that bring together stakeholders and investors and, and an emphasis on multi-level governance are aspects that come to the fore This shows that cities are embracing the Mission's emphasis on systemic transformation, through devising transversal approaches that can benefit new ways of working across emissions domains, and also shows that the intent of the PCP - to enable cities to focus on what they find hardest, whilst keeping the scale of potential emissions reductions impact that can be achieved, directly or indirectly, in mind - has been achieved in this regard.

The analysis undertaken in this report also adds a few important nuances. In particular, it is noteworthy that many cities are focussing on aspects of their climate neutrality journey where they indicate that they lack the 'traditional' levers of change that cities have at their disposal, like municipal investment, procurement or regulation. Instead many cities are using the PCP opportunity to explore issues like consumption-based emissions, behaviour change or even culture change, as well as innovation ecosystem development and multi-stakeholder relationship development in new governance solutions, as well as new multi-actor financing models. This indicates that cities are using the Mission not just as a way of accelerating policy domains where they broadly know what to do, but also as an innovation and experimentation space to enable them to orientate on next steps that require even more systemic transformation beyond cities' current capabilities, and

It has to be emphasised that this is only a first analysis of needs; at the time of writing, not all bootcamp activities are complete in all cities due to some delays on the cities' part. It is also evident that cities are still mostly in the planning and early deployment phase, having signed their grant agreements in June. This means that no doubt, new barriers and systemic change support needs will emerge over the period ahead. The sense-making process, which tightly interlinks with cities' grant reporting obligations, will therefore yield new insights that will be relevant to analyse, and next rounds of PCP applications under the NZC-SGA1 will equally provide further insight in the learning priorities of Mission cities.

Finally, it is relevant to note how much cities emphasise the desire for peer learning alongside tailored expert advice - cities are keen to understand best practices or indeed emerging insights in their peer cities, as well as being keen to get tailored support around specific aspects of their own learning journey. This confirms that NetZeroCities - and the Mission more generally - will benefit from the creation of such peer learning settings, as is already being achieved through the Summer Schools (part of the Capabilities Building programme) and the planned sense-making clusters, as well as peer learning settings to be planned and deployed through the City Support Groups.

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