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Working paper on local governance of the just transition to circular economy and the role of appropriate responsibility:

Lessons from real-life experiences governing decarbonization

November 2025

UN environment programme | Mediterranean Action Plan Barcelona Convention

GOBIERNO DE ESPAÑA
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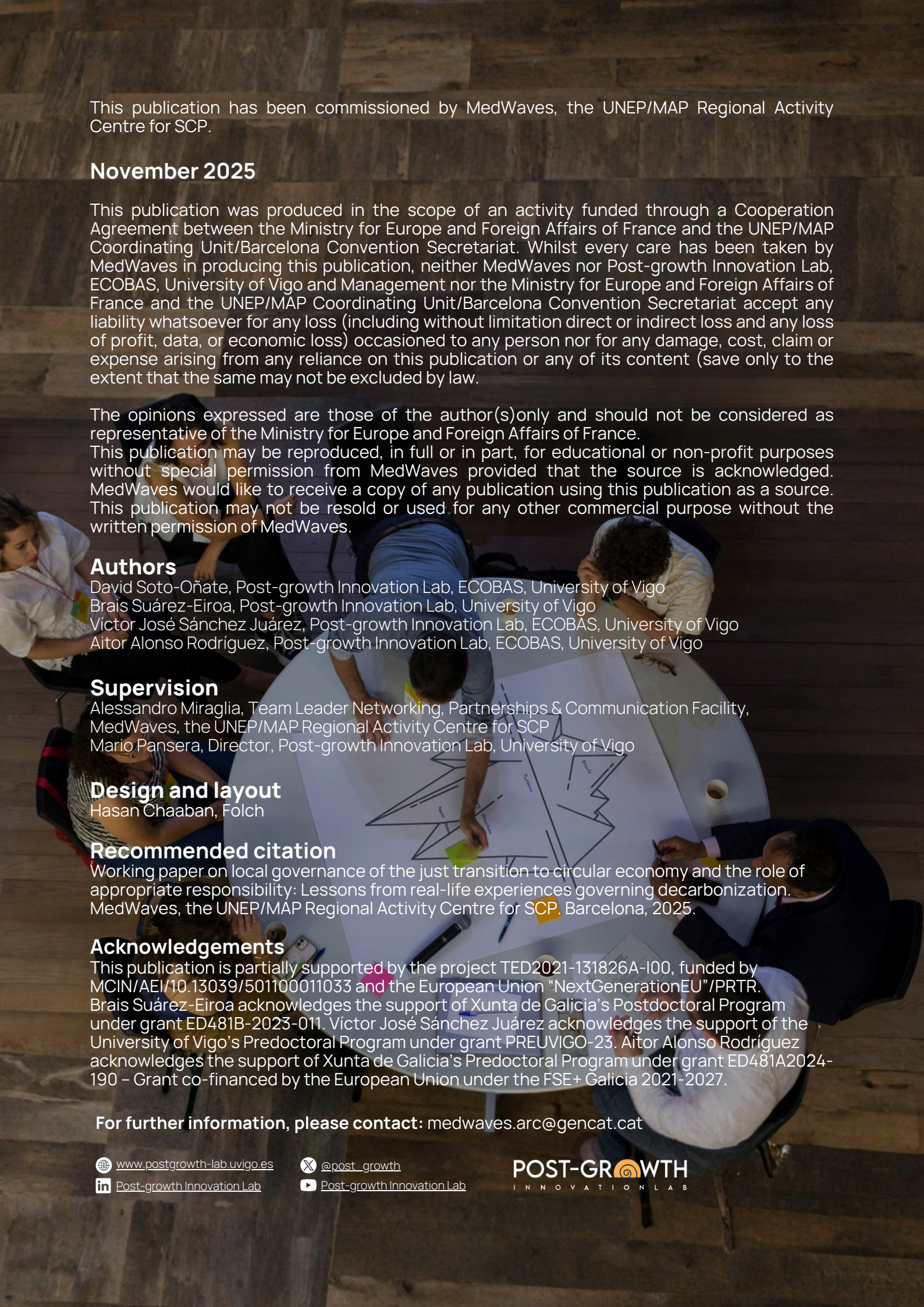

This publication has been commissioned by MedWaves, the UNEP/MAP Regional Activity Centre for SCP.

November 2025

This publication was produced in the scope of an activity funded through a Cooperation Agreement between the Ministry for Europe and Foreign Affairs of France and the UNEP/MAP Coordinating Unit/Barcelona Convention Secretariat.

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Recommended citation
Working paper on local governance of the just transition to circular economy and the role of appropriate responsibility: Lessons from real-life experiences governing decarbonization. MedWaves, the UNEP/MAP Regional Activity Centre for SCP. Barcelona, 2025.

Acknowledgements
This publication is partially supported by the project TED2021-131826A-I00, funded by MCIN/AEI/10.13039/501100011033 and the European Union "NextGenerationEU"/PRTR. Brais Suárez-Eiroa acknowledges the support of Xunta de Galicia's Postdoctoral Program under grant ED481B-2023-011. Víctor José Sánchez Juárez acknowledges the support of the University of Vigo's Predoctoral Program under grant PREUVIGO-23. Aitor Alonso Rodríguez acknowledges the support of Xunta de Galicia's Predoctoral Program under grant ED481A2024-190 – Grant co-financed by the European Union under the FSE+ Galicia 2021-2027.

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Table Of Content

Executive summary

This working paper examines how local governance can effectively facilitate a just transition to a circular economy (CE). For this purpose, it utilizes climate change mitigation governance as a benchmark. It emphasizes the importance of integrating justice into environmental governance and presents a comparative analysis of six real-world initiatives that exemplify local efforts toward carbon neutrality. The paper introduces the concept of Appropriate Climate Responsibility (ACR) as a key governance tool to align local actions with global climate goals while ensuring fairness. Other concerns related to the just transition are also examined.

Background and Motivation

The linear production-consumption model is a major contributor to environmental degradation. The CE model offers a promising alternative by promoting a regenerative economy that blends in with the cycles of nature through the implementation of diverse R-loops (e.g., reusing, repairing, recycling, or remanufacturing). However, transitioning to CE is more than a technical challenge. The dispersion of agency across actors and scales creates coordination problems that require innovative governance mechanisms. Furthermore, the justice of the transition pathway is increasingly a concern and must also be integrated into the governance approach. This includes environmental justice (e.g., distribution of environmental ills, North-South inequalities), labor justice (e.g., job quality and participation), and gender justice (e.g., recognition of care work). Local governments, due to their proximity to stakeholders and competencies in key areas, are uniquely positioned to lead this transition.

Methodology

The study employs a two-pronged approach:

- ·Literature Review: Synthesizes existing research on CE, just transition, and local governance to build an analytical framework. The analytical framework is represented as a 2x2 matrix that assesses justice and coordination concerns in both internal (within-jurisdiction) and external (beyond-jurisdiction) relations.
- ·Comparative Case Study: Analyzes six initiatives —four municipal networks (Covenant of Mayors, EU Mission Cities, PCAN, UK100) and two methodological tools that determine local ACR (Tyndall Tool, ARCA)— to assess how they operationalize governance and incorporate just transition principles.

Findings from Case Studies

Municipal Networks: All four networks promote local climate action through shared commitments, technical support, resource provision, and advocacy. They emphasize inclusive planning, expert collaboration, and multilevel coordination. However, enforcement mechanisms remain weak across all cases. Regarding the integration of just transition concerns, all four initiatives address justice within jurisdictions (e.g., energy poverty), but only PCAN integrates global distributive justice.

The selected methodological tools (ARCA and Tyndall's Tool) are strong in addressing global distributive justice concerns, but do not engage with governance or provide further guidance and resources. Tyndall's Tool uses a science-based, territorial approach to allocate carbon budgets. ARCA advances this by incorporating consumption-based accounting and allowing for historical emissions in its justice-sensitive scenarios.

Policy Recommendations

1. Reflect on justice and integrate it in governance and policies: Establish mechanisms to investigate and address justice (e.g., labor, gender, income, and global equity concerns).

2. Foster stakeholder participation: Institutionalize inclusive processes to co-design and implement climate strategies.

3. Strategic planning with experts: Integrate knowledge hubs and develop strategic planning documents to guide action and ensure accountability.

4. Adapt and innovate locally: Learn from existing models but tailor solutions to local contexts.

5. Strengthen multilevel governance: Align local, national, and international efforts through formal structures and shared goals.

6. Secure sustainable financing: Develop funding mechanisms for both governance processes and infrastructure investments.

7. Leverage networks: Join or create networks to build capacity, share knowledge, and amplify political influence.

Conclusion

This paper highlights the potential of local governance to lead the just transition to a circular economy. While promising models exist, significant gaps remain in integrating justice, coordinating actions, and securing resources. Future research should focus on replicability, financial frameworks, and the extension of ACR principles beyond climate change to address broader challenges in CE.

1 Introduction

1. Introduction

Climate change is one of the most important planetary boundaries being transgressed. This transgression puts at risk the Earth system's climatic equilibrium that has permitted the flourishing of human civilization (Rockström et al., 2009). The linear production-consumption model is identified as a fundamental component of this pressing environmental challenge. This linear system extracts resources from the ecosystems and returns a wide variety of residuals, having aggregate disruptive effects on both ecological and human health. Circular Economy (CE) can help solve or alleviate these socio-environmental problems, including climate change. Circularizing supply chains, by creating material and energy feedback loops, enables the use of extracted resources over a longer period and prevents or slows down ecosystem depletion and degradation.

However, the requirements for a CE transition to happen and be functional are far from straightforward. First, the transition to a circular economy is often depicted as a technical problem, while it also represents a major governance challenge (Dzhengiz et al., 2023; Kovacic et al., 2020; Patala et al., 2022). The most general issue is that agency over critical aspects of the production-consumption system (such as supply chain management, consumption behavior, product dismantlement activities, and regulation design and enforcement) is dispersed across a vast and heterogeneous set of actors. In the absence of entities with the authority to impose coordinating rules for the circular economy, this creates a collective action problem that necessitates complex forms of governance. Second, for this transition to be effective, it needs to be concerned with justice (Pansera et al., 2024) and consciously linked to sustainability (Suárez-Eiroa et al., 2019). Hence, the governance mechanisms addressing the transition must secure objectives and practices that align with ecological limits and incorporate principles of justice.

This working paper examines the interconnection between the just transition to a circular economy, climate change mitigation, and governance. More specifically, building on the "working paper on the contribution of circular economy to climate action" (Martinez Sanchez & Tatjer Recordà, 2023), this work focuses on operationalizing the just transition within the realm of local governance, particularly in the context of climate change. Given that climate change is a key concern for CE, the paper draws on knowledge developed in climate change mitigation governance to understand and illustrate the models, potential, and challenges of local governance in addressing environmental challenges.

The first major governance challenge is aligning dispersed local action with global objectives. In addressing this, climate governance is a significant benchmark for the CE. We explore the role of Appropriate Climate Responsibility (ACR) in promoting and coordinating massive autonomous actions while integrating justice considerations. ACR has a potential role in the articulation of local (and multi-scale) coordination through just transition-aligned, place-based methods, aiming to relocalize, adjust, and circularize the production-consumption system that sustains the local community's life. Additionally, the document examines other governance challenges related to functionality, capacity enhancement, the incorporation of just transition concerns, participatory inclusion, and multilevel collaboration.

This paper presents a comparative case study of six initiatives that aim to prevent global warming beyond a safe threshold by promoting local governance models for the transition to carbon neutrality. We analyze four existing municipal climate networks and two web-based methodological approaches that propose climate neutrality objectives for local jurisdictions: the Covenant of Mayors, EU Mission Cities, the Place-Based Climate Network, UK100, the Tyndall Center's local carbon budget tool, and ARCA. By defining net-zero targets, these six programs attempt to foster and coordinate local actions toward the common goal of mitigating climate change. Furthermore, the four networks have established governance mechanisms to strengthen coordination and share resources, thereby enhancing both individual and collective capacity. All integrate justice considerations into their governance approaches and practices.

Their experience serves to illustrate the modes and reach of local governance in pursuing ambitious targets and operationalizing the ideals of a just transition. We evaluate the potential role and limitations of ACR determination at local levels. Specifically, we will investigate various methodologies to determine the ACR, modes to make the process just and participatory, conditions that enable or hinder the process, its coordinative potential and limitations, its capacity to guide circularization strategies, as well as existing knowledge gaps and research needs.

The document proceeds as follows. The next section presents the methods and materials utilized. Section 3 reviews the background literature on the transition to a circular economy and the challenges of governing it. Additionally, it builds a framework to analyze the modes, potential, and limitations of local territories to contribute to a just transition from the local level. Section 4 describes the relevant traits of the selected local programs from the lens of our framework. Section 5 performs a comparative analysis to understand the general aspects and differences across the initiative. Section 6 summarizes lessons learnt from these experiences and offers a set of policy recommendations. Section 7 ends the working paper with some concluding remarks.

2 Materials and methods

2. Materials and methods

The method for this working paper is twofold.

It first conducts a literature review on the circular economy, just transition, and local governance, resulting in a preliminary conceptual framework that will help describe and assess models and policies to govern and support local jurisdictions in addressing just transition concerns. We especially focus on climate change: the urgency of this environmental challenge has put pressure on policy development that can now serve as a benchmark for developing policies and governance models to address other environmental concerns. As a crucial governance tool for connecting local governance with the global climate challenge, we delve into the concept of ACR, its usefulness, and the primary dimensions of ACR distribution methods.

ACR distribution proposals aim to address the primary governance challenge: coordinating small-scale, dispersed actions toward large-scale objectives. Additionally, as we will see, ACR can also integrate explicit justice concerns.

Secondly, it conducts a comparative case study on six ambitious initiatives aimed at supporting local jurisdictions in achieving area-wide carbon neutrality. The analysis relies on publicly available documentation for each program (see Table 2 in Appendix A) and explains the concerns addressed in their concept of a just transition, as well as governance matters, in light of the framework described in Section 3. The six initiatives are: Covenant of Mayors, UK100, PCAN, Mission Cities, Tyndall Center's Tool, and ARCA. The ARCA and Tyndall web-based tools are only evaluated by their ACR determination models, which are more comprehensive than the ones used by the networks.

However, the networks do provide mechanisms to address further governance challenges.

3 Literature review and conceptual framework

3. Literature review and conceptual framework

This section is divided into three subsections. Subsection 3.1 explains what a just transition to CE entails and the crucial role of governance. Subsection 3.2 explains how climate change is innovatively being addressed at the local scale through ACR frameworks. Subsection 3.3 presents some recurring governance problems, as well as the ways actors attempt to solve them through governance structures and practices. Finally, Subsection 3.4 presents a conceptual framework for characterizing the ACRs and governance structures implemented in the real-life cases described in Section 4.

3.1. Circular economy, just circular economy, and governance

The CE proposal recognizes that the current linear production-consumption system (extract, produce, use, and discard) is at the heart of the current environmental crisis, while also compromising the security of supply of essential resources for the future (Ghisellini et al., 2016). The economic system takes resources from the ecological system (in the form of matter and energy) and, after the processes of production and consumption, returns another flow of matter and residual energy to the ecosystem. From this, two fundamental problems emerge:

1. Some of these materials that are fundamental in the current production systems are "non-renewable" on a human scale (metals, fossil fuels, etc.). They are therefore susceptible to exhaustion.
2. Ecosystems have a limited capacity to assimilate the uses we make of them in the economic process. For example, the biosphere has a limited capacity to absorb the greenhouse gases (GHG) released into the atmosphere before significant destabilization of the climatic system occurs, and commercial fishing grounds have a regenerative pace that, if exceeded, leads to the depletion of the resource.

Therefore, to be environmentally sustainable, the human socio-metabolic system needs to be reorganized to align with the planet's carrying capacity. The circular economy proposes transforming the linear economic system into one based on renewable resources and adjusted to the regenerative pace of the ecosystem. Strategically, it is based on the implementation of practices such as reduction, reuse, repair, remanufacturing, or recycling throughout the life cycle of products, in order to keep them and/or their components in use as long as possible within the economic system.

The absolute reduction and the establishment of these circular flows alleviate the need for new inputs to be extracted from the ecosystem and reduce or delay the outputs to the environment. In addition to a more conscious use of the planet's resources, it can also generate economic efficiency gains for companies and provide a better means of compliance with increasingly strict environmental regulations (Geissdoerfer et al., 2017; Ghisellini et al., 2016).

The transformation into a circular system has been approached from various perspectives, but there is an observable tendency to consider the transition as an essentially technical problem (Dzhengiz et al., 2023; Kovacic et al., 2020). However, although cognitive and technological factors are fundamental, the nature of the problem and the solution is largely organizational. Among other things, the transition that is taking place in supply chains requires changes in governance models, making more intensive use of inter-organizational and multi-stakeholder mesostructures to establish and maintain circularities that involve more than one link in the product life cycle (Miller et al., 2025; Patala et al., 2022).

Additionally, the involvement of public actors at all levels is crucial in guiding autonomous actions towards circularity. Through regulation or resource management (including infrastructural investments, R&D funding, financial development, education, and technical training), the public sector can intervene in the incentive systems and foster the circular transition. International and national political powers are critical, but local jurisdictions possess some of the most important competencies for the transition and, by proximity, have the privileged capacity to actively engage with relevant actors or host multi-stakeholder processes to elaborate and agree on collective plans for transitioning to a decarbonized and circular economy.

As CE strategies and policies gain popularity, concerns about the justice of the transition are also increasing. Scholars are raising concerns about the tendency to frame and deploy technocratic versions of CE (Corvellec et al., 2022; Genovese & Pansera, Mario, 2021; Rivas Hermann et al., 2022) and call for its re-politization (Friant et al., 2020; Inigo & Blok, 2019; Kovacic et al., 2020; Pansera et al., 2021). Researchers studying the CE transition approach with critical lenses demand the consideration of sensitive justice dimensions. Pansera et al. (2024) highlight three often overlooked dimensions of justice: environmental, labor, and gender justice.

First, regarding environmental justice, current CE perspectives often ignore and reproduce North/South inequalities. The extractivist dominion —maintained through different mechanisms that involve, for instance, the overuse of the global commons by the wealthiest or outsourcing waste and hazardous recycling to the Global South— is generally left unchallenged.

Second, on labor Justice, CE literature predominantly focuses on job creation while ignoring workers' agency, job quality, and democratic participation in transitioning to circular systems.

Third, CE undervalues reproductive and care work, disproportionately performed by women, and reinforces gendered divisions in low-value circular activities.

Local jurisdictions worldwide are operationalizing just transition ideas in their governance systems and policies. This working paper will illustrate this through some real-world experiences.

3.2. Appropriate Climate Responsibility

Climate change is a global collective action problem, where mitigation costs are individual and benefits are diffuse, creating incentives for inaction. The conventional literature on collective action would consider the solution to this problem impossible without a higher-order agent capable of imposing rules, monitoring the performance of actors, and establishing sanctions for non-compliance. However, despite decades of international diplomatic efforts, neither that global authority nor any effective global agreement to tackle climate change has been established. Elinor Ostrom (2012, 2014) advocated for a polycentric approach to address climate change . She pointed out that, whether or not those international agreements are reached, there is a multitude of possible organized responses to mitigate climate change that can be (and are) carried out at different administrative levels, involving public organizations, the private sector, and local groups. Ostrom suggested that rather than focusing solely on global agreements, it would be preferable to encourage polycentric efforts.

However, two interdependent challenges prevail in this approach. First, large polluters tend to under-commit to climate mitigation due to a perverse distribution of incentives (those that contribute the most to the problem are likely less negatively impacted by its consequences), coupled with a strong diffusion of responsibility. Second, uncoordinated action does not ensure the resolution of the problem.

What we term Appropriate Climate Responsibility (ACR) allocation methods are currently being utilized to address these two challenges and advance the just transition to a decarbonized (and circular) economy. We define appropriate responsibility as the allocation (to an individual actor) of a specific quota, role, or task that is part of a shared responsibility. Assigning climate responsibilities is a central concern for the just transition (Ghosh et al., 2022). For the case of territories, a widespread way to define ACR is through emission reduction targets (e.g., reducing the territory's GHG emissions by a specific percentage from a particular year) and, more recently, a climate neutrality year.

ACR-based target years for neutrality are determined by applying carbon budget methodologies. The IPCC (2021) determined the budget of emissions that the planet can likely assimilate before crossing the dangerous frontier of a +2 ºC increase in average planetary temperature from pre-industrial levels. Accordingly, to prevent the exhaustion of that carbon budget, 2050 was recommended as the target year for humanity to reach climate neutrality. However, how can that budget be distributed? Territories have followed different behaviors in this regard: some have not yet committed to reaching neutrality, some have directly assumed 2050 as their target year for neutrality, and some have taken it a step further by integrating distributive justice considerations into their target year calculations.

3.2.1. ACR determination through budget-based targets

In recent years, detailed methodologies (Dao et al., 2018; Hickel, 2020; Suárez-Eiroa et al., 2022, 2024) and even web-based platforms (such as the Tyndall Local Carbon Budget Tool for the UK and the ARCA Project for Spain) were developed to guide the determination of territory-wide ACR. By utilizing carbon budgets and principles of distributive justice, they provide the territories with appropriate timeframes to reach climate neutrality.

However, these methods can substantially vary according to diverse dimensions:

- **Type of GHGs considered:** Some methods consider only carbon dioxide, and others comprehensively include more or all the identified gases with greenhouse effect (i.e., methane, nitrous oxide, fluorinated gases, etc.).
- **Attribution method and scope:** This criterion determines what emissions are attributed to the population of a given territory. The most common method considers only the so-called territorial emissions, i.e., those that physically occur within the jurisdiction's boundaries. In contrast, the consumption-based method attributes the GHG embodied in the goods and services consumed by residents, regardless of where they are produced or disposed of. Additionally, the emissions attributed to an actor are often divided into three scopes. Scope 1 refers to the direct emissions liberated within the range of control of the actor. Scope 2 considers the indirect emissions liberated by the generation process of the energy purchased by the entity. Scope 3 includes all the rest of the indirect GHG emitted during the production process of the consumed goods. Scope 1, therefore, equals direct emissions, while scopes 2 and 3 form together the indirect emissions.
- **Budget distribution method:** Some methodologies explicitly use distributive principles to allocate shares of the remaining budget to responsible entities (in this case, territories). There are diverse methods to distribute budgets (van den Berg et al., 2020) and the most common are the “equal per capita” (EPC), which gives everyone an equal share; the grandfathering method, which allocates more budget to high emitters, assuming a “historical” acquired rights of use or acknowledging a higher difficulty to reach net-zero because they are further; and the capability based, which allocates less budget to those with larger economies (Income, Gross Domestic Product or Gross Value Added), assuming that they have more transformative capacity through investments.
- **Targeted limit of global warming:** The Paris Agreement aims to hold “the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels”. Targets are usually linked to a point within that range. The most commonly used are 1.5 °C, 1.7 °C, and 2 °C. This is a fundamental parameter to compute carbon budgets.
- **Base year:** It is the year in which carbon budgets are calculated (and distributed) and from which the GHG emissions are individually (e.g., a nation) accounted for. Before that date, the entities are viewed as a single global jurisdiction with undifferentiated responsibilities. On that date, countries receive a budget based on the distributional criteria, and from then on, they consume it according to their GHG emissions. Therefore, from that moment on, the largest emitters will exhaust their budgets faster. For instance, choosing 1850 as the base year suggests that the countries that contributed most to climate change since the Industrial Revolution and that today have more comfortable living conditions should see their budgets reduced by the same proportion, among other reasons, to grant other territories the "space" to develop their capacities. Choosing the current year (2025) means starting with a clean slate and ignoring the fact that countries have contributed differently to the problem of (and benefited from) climate change. Since it could be argued that the largest emitters were, for a long part of history, unaware of the consequences of GHG concentration derived from burning fossil fuels, other intermediate years can be considered coinciding with key moments of open consensus and agreement on climate change. Those moments can be seen as originating the differentiated responsibility.

3.3. A challenging governance

Among other things, ACR determination methods aim to address the issue of coordination in the absence of an authority that can allocate and enforce responsibilities. By building on the resolution of the problem (i.e., not exceeding the budget) and distributing tasks (individualized carbon budgets), they reconcile small-scale agency dispersion with large-scale collective action. However, other governance problems persist. In the following, we reflect on other (interrelated) governance challenges and how supralocal organizational structures (like municipal networks) can contribute to overcoming them.

- **The problem of target misalignment when individual targets are not collectively agreed upon but self-determined.** Currently, diverse justice discourses coexist, and depending on each actor's circumstances, some resonate better than others. This leads to combinations of ACR distribution approaches that, when aggregated, might not resolve the climate problem. For instance, if actors use different emissions accountabilities (some territorial and some consumption-based), this mix leaves a substantial quantity of emissions "unowned". More importantly, the diverse distribution criteria affect the immediate interests of each actor differently. If each actor uses the distributive criterion that benefits it the most, the aggregate efforts will not add up to solve the complete problem. Networks have a role in homogenizing criteria among local jurisdictions and aligning targets with upper-level institutions through political advocacy (Bergman et al., 2025).

- **The problem of agency for responsible action.** Small-scale actors have limited agency (rights, resources, etc.), and the impossibility of honoring the attributed responsibility leads to frustration, disengagement, or resistance to responsibilization (Döbbe & Cederberg, 2024; Soneryd & Uggla, 2015). These are known as governance traps (Bulkeley et al., 2014; Newell et al., 2015). Intermunicipal networks (like the ones presented later) can play a crucial role in alleviating these problems. By sharing knowledge and other resources, these alliances aim to enhance both collective and individual agency. For instance, they offer training or financial resources to their members or can lobby together at higher administrative levels to enhance the endowment of resources for local jurisdictions.

- **The problem of responsibility distribution frames that atomize and isolate responsibilized actors.** The way we frame climate change is fundamental for collective action and governance (Lakoff, 2010; Newell et al., 2015), as it conditions how we perceive the problem and envision the solutions. Both ACR methods and municipal climate networks not only inform and provide resources but also frame the situation in ways that particularize responsibility in local actors to create responsible subjectivities (Bulkeley et al., 2012). However, particularizing the responsibility can atomize actors in such a way that they attempt to pursue isolated action and neglect collective opportunities. ACRs discourses need to emphasize the collective nature of both the problem and the solution. They need to frame the situation as a collective action problem that simultaneously requires the emergence of local leadership and the development of cooperative solutions to improve agency.

- **The problem of fair internal governance with heterogeneous stakeholders.** Local governments have limited control over emissions-related behaviors in the jurisdiction, so the agreement or acceptance by the rest of the relevant stakeholders (domestic consumers, firm owners, investors, workers, and environmentally affected collectivities, among others) is paramount to ensure a transformative intervention. Governance scholars tend to recommend the use of inclusive methods for establishing collective targets and strategies (Nasiritousi et al., 2016; Ostrom, 2005). However, it is not straightforward to align or reconcile interests when actors are diverse, having different priorities or even conflicting preferences.

- **The problem of compliance.** The risk of opportunism (or free riding) is always present in collective action situations (Frey S. & Stroebe, 1982; Ostrom, 2000). Even when agreements are reached, the parties may have incentives to default. This may result in what has been referred to as the commitment-action gap or the intention-behavior gap (Sheeran, 2002; Sheeran & Webb, 2016). Governance systems can develop formal centralized mechanisms of enforcement (monitoring activities, reporting and accountability, sanctions) and more informal and horizontal mechanisms of social enforcement (exposure to other stakeholders like citizens, peer pressure, and retaliation, repeated and simultaneous games).

- **The problem of conflict.** Cooperation with collective plans or among specific actors within the system can be hindered by conflict. Governance structures can provide arenas for negotiating and deliberating to achieve more accepted arrangements and establish conflict resolution mechanisms that can dissolve or prevent entrenched conflict (Heikkila, 2019; Howarth et al., 2024; Lubell et al., 2020).

3.4. A framework to characterize the integration of just transition concerns into local governance

This section outlines a framework for examining the way these net-zero initiatives envision and operationalize the contributions of local jurisdictions to the just transition. Table 1 presents the features used to characterize the governance structures along two dimensions: the nature of the concerns addressed (coordination and justice) and the locus of the entities involved or affected in the concern (internal or external to the local jurisdiction). As this 2x2 matrix indicates, both coordination and justice concerns can be developed in reference to internal and external actors. In total, four features will be covered:

1. **Justice concerns regarding internal relations.** We evaluate the issues affecting local stakeholders and related to justice that are problematized in the documentation, and how those issues are intended to be addressed. With varying degrees of detail, the documentation may explicitly acknowledge rights and assign responsibilities to different actors within the jurisdiction, specifying policies and institutions.

2. Coordination concerns regarding internal relations. We delve into the mechanisms established in the jurisdiction for target and strategy definition, implementation, enforcement, and conflict resolution. For instance, what procedures are in place or recommended to include stakeholders in decision-making or to monitor performance.

3. **Justice concerns regarding external relations.** This one mostly refers to the recognition of problems affecting the rights of actors outside the jurisdiction. We especially focus on the explicit recognition of environmental limits (especially related to climate change) and others' rights to use the planet to thrive. We detail the methods used to determine the appropriate responsibility and how it is intended to be integrated into the conduct of the local actors. Additionally, in the documentation, we also seek references to anticipated justice issues that may arise beyond territorial distributive fairness, such as those affecting dimensions of labor, gender, ethnicity, or income.

4. **Coordination concerns regarding external relations.** This item is interested in the way these initiatives understand and address vertical and horizontal relations with external actors. We detail the coordinative mechanisms to address collective action regarding both target coordination and capacity building. For instance, it depicts the actions mentioned to enhance agency (information sharing, collective investments, financial frameworks), to align or redistribute responsibilities (e.g., demanding action from higher-scale administrations), and to enforce multijurisdictional agreements.

Table 1. Governance dimensions to integrate justice concerns and coordinate actions

	Justice concerns (make it just)	**Coordination efforts** (make it happen)
Internal relations	Just transition issues that concern stakeholders within the jurisdiction.	Mechanisms for target and strategy definition, implementation, enforcement, and conflict resolution.
External relations	Anticipated justice-related consequences of the transition affecting actors outside the jurisdiction	Vertical and horizontal relations with external actors to pursue responsibilities' alignment and capacity building.

4 Cases:

Real-life examples of locally driven just transition to net zero

4. Cases: Real-life examples of locally driven just transition to net zero

4.1. Covenant of Mayors

The Covenant of Mayors for Climate and Energy (CoM) is a network of cities that share a strong commitment to climate action and aim to build a joint political voice to support global efforts. The CoM was launched in 2008 with the support of the European Commission and has evolved into the Global Covenant of Mayors (GCoM), a global alliance comprising over 13,000 cities, representing more than 1.2 billion people worldwide. According to its latest impact report (GCoM, 2024), seventy-five percent of signatory cities declared targets that exceed national targets, and up to 4.2 $GtCO_2$ can be saved annually by 2050 if local plans are funded and implemented at scale.

Globally, the CoM is more flexible, but in Europe, signatories acquire the commitment (in its most recent version) to achieve climate neutrality by 2050, with an intermediate target to reduce GHG emissions by at least 55% by 2030 compared to 1990 levels (Davide et al., 2025). Since this working paper focuses on local initiatives pursuing climate neutrality, we will refer to this recent ambitious commitment in its European section (EU CoM) hereafter.

Membership in EU CoM is voluntary, but subject to certain rules. Cities make a political commitment to the network by signing the Covenant, and within two years, they develop the Baseline Emission Inventory (BEI) and the Risk and Vulnerability Assessment (RVA). Then, by the third year, cities need to set more specific targets and define the Sustainable Energy and Climate Action Plan (SECAP). Thereafter, they report on progress every two years and update the inventories on a regular basis. There is an official template for information submission, which standardizes the content and enables monitoring and feedback. In any case, signatories can always review the SECAP and reprioritize actions as needed.

The EU CoM' signatories assume for their jurisdiction the EU climate target of achieving net-zero emissions by 2050, which in turn is the IPCC's recommendation for the global jurisdiction. Regarding the account of carbon emissions, the calculation is based on territorial, production-based emissions. By default, they must include Scope 1 (direct emissions within the territory) and Scope 2 (emissions related to electricity consumed in the territory).

Cities also have the option to apply alternative approaches, such as life cycle analysis and the inclusion of scope 3 (indirect emissions related to products consumed within the city's territory), but these are optional (Bastos et al., 2025; Melica et al., 2024). The sectors included are buildings (municipal buildings, equipment and facilities, public lighting, tertiary buildings, equipment and facilities, residential, industrial and agricultural/forestry/fishery facilities), transport (municipal vehicle fleet, public transport and private and commercial transport), waste (solid waste, biological treatment, incineration and open burning, and wastewater treatment) and energy supply (electricity generation, combined heat and power, district heating/cooling and decentralized local renewable energy generation).

However, other dimensions of the **just transition** are present in CoM's main documents. Particularly, three key aspects are highlighted: energy poverty, employment, and citizen engagement.

First, monitoring and tackling local energy poverty is one of the three pillars of the CoM framework, to which the network dedicates multiple resources developed jointly by the EU Covenant of Mayors Office, the Joint Research Center, and the Energy Poverty Advisory Hub (EU Covenant of Mayors, 2025; Pittalis et al., 2025).

Second, regarding labor-related justice, the CoM is not very detailed, but it emphasizes the links between investments in the sustainable energy transition and the creation of local jobs (GCoM, 2024).

Third, although there is no formal mandate in this sense, the documents often remark the desirability of stakeholder participation in decision-making. For instance, in the process of SECAP development, it is strongly recommended to mobilize all municipal departments involved and build support from stakeholders through diverse engagement techniques (Davide et al., 2025). The recent update of the guide to develop the SECAP acknowledges the neglect of social justice concerns in past climate action plans and defends the critical importance of prioritizing the needs and participation of the most vulnerable communities to the transition.

Regarding the **governance of the initiative**, the global secretariat and regional offices develop a common framework in collaboration with partner networks, and the Joint Research Center (JRC) of the European Commission establishes the technical criteria and reviews the submitted proposals for coherence and completeness. The core guidance emphasizes standardized data templates, comparability across cities, and routine monitoring (EU Covenant of Mayors, 2020; Melica et al., 2024). Public reporting makes progress visible across the network, and cities that do not meet the required standards may be suspended or removed from the initiative.

The network offers a diverse range of **services and resources to its members.** It provides technical advice, standards, and digital tools to streamline the access and implementation process. It is noteworthy that some tools are also designed to provide specific guidance on integrating justice considerations into mitigation and adaptation strategies. For instance, the GCoM offers the Toolkit for Gender Equitable and Inclusive Climate Action Planning, which outlines a step-by-step method for integrating analysis, participation, budgeting, and procurement into the SECAP cycle (Global Covenant of Mayors, 2025).
Furthermore, the GCoM also serves as a learning network, where cities share best practices through regional and global forums, technical workshops, and online resources, enabling successful actions to quickly spread to other contexts.

The CoM (EU Covenant of Mayors, 2021; Global Covenant of Mayors, 2021, 2023) strongly emphasizes the importance of multi-level governance, which is considered "critical to achieving the credible, just, and ambitious commitments required to avoid a climate catastrophe" (Global Covenant of Mayors, 2021, p. 2). Documents highlight that local governments need to be empowered with sufficient competencies and resources by upper levels, and that active cross-scale collaboration is necessary to articulate coherent targets and strategies, as well as to find horizontal and vertical synergies.

4.2. EU Mission Cities

The Mission on Climate-Neutral and Smart Cities (also known as Net Zero Cities or Cities Mission) is a network of cities promoted by the European Commission since 2021, as part of Horizon 2020 and Horizon Europe projects, that stresses the pivotal role of cities in the energy transition. Noting that cities occupy only 4% of the European Union's land area but they concentrate 75% of its citizens, the European Commission decided to establish this program, seeking to strategically promote demand-side climate policies (European Commission, 2021a). The mission originally targeted at least 100 cities and is currently working with 112 cities.

The program's aim is two-fold: 1) helping interested cities develop climate policies that could make them carbon neutral by 2030 and 2) turning them also into innovation hubs to develop replicable knowledge that could be extensible to the rest of European cities (European Commission: Directorate-General for Research and Innovation, 2025).

Access to the Mission's program is subject to the successful development of the Climate City Contract (CCC). The CCC is a "living" document in which the municipal authorities and other local stakeholders collectively co-create the city's path to climate neutrality. It is meant to be "updated periodically to review its effectiveness, accountability to commitments, and to include new stakeholders and commitments in line with budgetary and monitoring cycles and citizen engagement processes" (Net Zero Cities, 2023c, p. 4). The CCC has three main parts: the main commitments (core contract), a climate neutrality action plan, and a climate neutrality investment plan. After eligible cities express their interest in participating, they receive a "resource pack" with supporting materials to develop the CCC, including templates (Net Zero Cities, 2023d, 2023b, 2023f) and guides (Net Zero Cities, 2023c, 2023a, 2023e). These CCCs are subjected to an expert review conducted by the European Commission, with the assistance of expert bodies, including the European Investment Bank (EIB) and the Joint Research Center (JRC).

Successful candidates are awarded the Mission Label. To date, 92 out of the 112 mission cities hold the Mission Cities label (European Commission, 2025). Apart from the recognition of their neutrality plan, this label gives them access to funding and financing sources (especially private investment) and to the Climate City Capital Hub, which offers tailored financial advice in partnership with the EIB and the European Bank for Reconstruction and Development (EBRD).

Additionally, they receive support from the Mission Platform, which provides them with technical assistance, tools, and knowledge repositories, as well as spaces for peer learning and networking. Finally, they are given the opportunity to participate in large research and innovation projects under Horizon Europe and other frameworks.

The governance of the network itself is carried out by a diverse set of actors across various bodies. The program was designed and implemented by the European Commission (European Commission, 2021a). The Mission Platform is coordinated by Climate-KIC and a consortium of climate policy municipal networks, research institutions, and relevant private sector practitioners. Cities are also represented in the decision-making process through the Mayors Advisory Board, which assists the European Commission and the Platform coordination in strategic matters. Cities must report regularly (typically annually) on the implementation of their Climate City Contract.

It should be noted that cities are not penalized when they fail to fulfill their commitments, as the CCCs are not legally binding contracts. Nevertheless, the European Commission highlights the potential political cost of not fulfilling these contracts for local politicians (European Commission, 2021a).

This program brings important benefits to the multilevel integration of climate governance. Typically, CCCs' signatories include political representatives and administrative staff of national and regional governments (Palmia & Meskovic-Imsirovic, 2025). The program standardizes governance practices (including language, policies, and reporting standards), which improves mutual understanding, agreement, and accountability among the involved actors (Net Zero Cities, 2023c). Additionally, the Mission promotes the institutionalization of spaces or activities for stable, intracity, multi-stakeholder, long-term collaboration (Net Zero Cities, 2022, 2023g) and dedicates efforts to inter-city collaboration through, for instance, the Twinning Learning Programme (Net Zero Cities, 2025).

Climate neutrality targets were determined by the European Commission. Cities must reach climate neutrality by 2030, encompassing both Scope 1 (direct emissions) and Scope 2 (indirect emissions). Regarding Scope 3 (out-of-bound) emissions, only waste emissions should be tracked before 2030, and more sophisticated accounting techniques should be developed moving forward to 2050. Thus, while there is an interest in accounting for Scope 3 emissions, a key component of environmental justice, this desire does not fully materialize in the current form of Mission Cities. Additionally, the documents permit the use of carbon sinks and carbon credits to offset GHG emissions, but they should only be utilized when it can be ensured that they will be maintained as sinks permanently and only for emissions that are difficult to abate. Although some criteria are set vertically, there is also some flexibility in the usage of accounting methodologies to develop the municipal emissions inventory.

The European Commission considers the EU CoM/SECAP approach, the GCoM Common Reporting Framework, or the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC) as valid methodologies for setting goals and tracking achievements (European Commission, 2021b).

Beyond the ACR determination, initial documents explicitly engaged with the concept of just transition (European Commission, 2021a, 2021b). On the one hand, they are concerned about the so-called “territorial” just transition, which is addressed through the Just Transition Fund. This Fund supports EU territories “facing serious socio-economic challenges” in moving towards neutrality by fostering economic diversification and the reskilling and active inclusion of affected workers (European Commission, 2021a). On the other hand, these documents also recommend a series of efforts to “ensure that actions and policies do not worsen or create new inequalities” (European Commission, 2021b, p. 71), including assessing social vulnerability within cities and fostering broad social participation in decision-making processes. However, in the CCCs, so far, the “recognition of structural inequalities as a foundation for a just transition remains limited” (Palmia, 2025, p. 1).

The strongest emphasis is on establishing an inclusive and participatory process for both the planning phase of the CCC and for the implementation and monitoring stages. Furthermore, the Mission encourages the cities to build a multistakeholder and multidisciplinary “Transition Team” to “orchestrate a just transition to climate neutrality” (Net Zero Cities, 2022).

An analysis of the labeled mission cities in 2024 (ICLEI Europe, 2025) calculated that CCCs are signed on average by 25 stakeholders (including government bodies, regulatory agencies, research institutions, businesses, trade unions, and civil society organizations). These agents are individually committed to helping the city achieve climate neutrality by 2030 and sign a Climate Neutrality Commitment, which may include clear targets, actions, expected (measurable) results, and timing (Net Zero Cities, 2023c).

4.3. Place-based Climate Action Network (PCAN)

The Place-based Climate Action Network was built as a research project promoted by a research team from several universities (University of Edinburgh, London School of Economics, University of Leeds, University of Oxford, and Queen's University Belfast) and funded by the UK's Economic and Social Research Council (ESRC). Its goal was to translate climate policy into concrete actions at the local level by engaging the various affected communities in a co-production fashion. For this, the project brought together the research community with decision-makers from the public, private, and civil sectors, deploying its activities in three cities: Leeds, Edinburgh, and Belfast. This multilevel engagement between researchers and stakeholders was hosted at the so-called "climate commissions".

Climate commissions are arenas for the engagement of diverse local stakeholders to collectively drive climate action (PCAN, 2024). They can be seen as independent advisory boards that work collaboratively with local governments, but also as venues to reach multilateral commitments that bind diverse key local actors in the city. They host assemblies, workshops, training courses, and other supporting activities for a) mutual understanding and partnership building, b) researching, learning, and innovating, c) collective decision-making, and d) monitoring agreements or tracking results. One of the critical activities of the climate commissions is developing the "Roadmap" to climate neutrality for the city[1].

This roadmap estimates the carbon emissions attributed to the city, sets carbon reduction targets grounded in climate science and appropriate responsibility ideals using carbon budgets, identifies and evaluates carbon reduction opportunities, and establishes a clear strategy with a suite of objectives and performance indicators for key sectors. Based on these roadmaps, the climate commissions also elaborate further specific policy proposals and action plans (e.g., on transport, energy production, or housing insulation), seek funding for investments, and monitor implementation and performance. By providing evidence and confidence, the roadmaps delivered by the climate commissions promoted and supported the subsequent enactment of the cities' official climate targets, strategies, and action plans. After the project ended in 2024, these experiences continue in the three cities and in many other territories through the "PCAN plus" network.

The concept of a just transition is presented in varying degrees of detail across several of the network's documents. The report that most directly addresses the just transition, even explicitly mentioning its dimensions, is entitled "Trends in Local Climate Action in the UK" (Howarth et al., 2021). This document establishes the importance of two interrelated dimensions: participatory justice and distributive justice. Participatory justice requires that those affected by a decision be included in its formulation. It is therefore concerned with

[1] See Gouldson, Sudmant, Duncan, et al. (2020) for Leeds, Williamson et al. (2020) for Edinburgh, and Gouldson, Sudmant, Boyd, et al. (2020) for Belfast.

the decision-making process, particularly in relation to public policies that affect the transition. Following this principle, climate commissions deliberately seek to integrate multiple stakeholders from the various social sectors affected by decarbonization. Distributive justice, on the other hand, is concerned with the equitable allocation of rights, responsibilities, resources, or burdens in a society. It is generally integrated into the discourse as the idea of not leaving any social group of the jurisdiction behind. Particular concern is expressed for workers in affected sectors (coal mining, thermal power plants, etc.) and those with low incomes who may face so-called "energy poverty" or "fuel poverty". However, transitional distributive justice is also implicitly present in the ACR's self-determination in the roadmaps. Climate commissions apply a principle of equity in the allocation, assuming an equal right among humans to emit greenhouse gases to develop their territory's economic capacity. Therefore, they allocate a carbon budget to their territory proportional to its population.

Regarding the RCA determined by climate commissions, some of its characteristics can be discerned through the roadmaps. They establish a limit of +1.5 °C for global warming relative to pre-industrial levels. The accounting method they use to formulate their objective is territorial and based on Scopes 1 and 2, although their documents always recommend a more ambitious approach to include Scope 3 in the future. As a result, the roadmaps outline carbon reduction pathways that aim to achieve carbon neutrality for Leeds and Edinburgh by 2030 and for Belfast by 2050.

Regarding the governance of the local climate commissions and the coordinating network, there is a strong emphasis on securing the formal establishment of multilevel relations and the participation of the affected local actors. These values contribute in diverse ways to the justice, legitimacy, and functionality of the governance system and the decisions made within it. The network recognizes the polycentric challenge, implying that agency (rights, capabilities, etc.) is dispersed across multiple actors, and highlights the paramount importance of internal coordination. Specifically, it highlights that the scope of the necessary action significantly exceeds the local government's direct control and requires the active participation of independent and diverse stakeholders within the municipality. Furthermore, it also recognizes the challenge posed by the lack of agency in local territories (especially the smallest ones) and the need to leverage its multi-level relationships to enhance their capacities for delivering ambitious climate action (Christie & Russell, 2023; Howarth et al., 2021).

The Place-based Climate Action Network explicitly establishes a series of parameters and recommendations for the internal structure and operations of climate commissions. For instance, while climate commissions are independent of the local government, they are generally co-chaired by a member of the city council and a member of the participating university. It also recommends clearly defined and widely accepted governing structures and rules, as well as the determination of informed, detailed, and feasible missions, targets, strategies, and action plans. Additionally, it advocates for the establishment of supportive mechanisms related to performance monitoring and conflict resolution.

The Network also elaborates and distributes useful resources for the commissions. First, it shared a set of tools to assist the effective establishment and operations of the commissions, such as, for instance:

- The Roadmap maker tools are a set of supporting materials that guide decision-makers on the target definition and strategy design.
- The Just Transition Jobs Tracker estimates the quantity and types of jobs that might be compromised due to the ecological transition (Sudmant & Gouldson, 2020).
- The Climate Commission Cookbook is a guide to building and maintaining effective climate commissions (PCAN, 2024).

Second, the network also focused on developing the financial aspects of the quest. On the one hand, it formed the PCAN Finance Platform, which aims to connect the financial supply and demand to support investment needs within the jurisdictions. It was committed to building awareness about the importance of local investment for climate change mitigation goals and deliver a just transition (Robins, Gouldson, Andy, et al., 2019; Robins, Tickell, et al., 2019), promoted the creation of a community of practice called Financing a Just Transition Alliance, and designed practical models of place-based financing schemes (such as, the municipal green bonds)(Howarth et al., 2024). On the other hand, it established the PCAN Fund (endowed with £ 400,000) to support research projects and engagement activities related to the commissions.

Third, it researched, collected, and disseminated the lessons learnt from the experiences to strengthen the practices of present and future climate commissions (Howarth et al., 2023, 2024; Pringle, Rhona et al., 2023).

4.4. UK100

UK100 is a cross-party membership organization established in 2016 to help local authorities meet their climate targets. Its name comes from the first UK100 pledge at COP21, when several UK local leaders committed to achieve 100% clean energy by 2050 (UK100, 2021). The network currently comprises 117 members, representing over 41 million people and collaborating with more than 50 local authorities across the UK (UK100, 2024a). It is a not-for-profit organization, funded by membership fees, the European Climate Foundation, and its Business Supporters Network.

In its documents, the UK100 does not work with the notion of just transition but mentions some of its dimensions. However, the engagement with them is rather superficial. First, regarding the ACR, the selection of the target year to achieve neutrality in the jurisdiction (2045), although ambitious, is not underpinned by a reflection on international climate distributive justice. Regarding labor-related justice issues, documents (Barras & Ward, 2022; UK100, 2025) often refer to the creation of jobs by green investments or mention the need for a skill transition.

However, they are framed as functional requirements or benefits rather than as a justice concern. Regarding internal distributive consequences, energy poverty is mentioned as an advocacy concern on UK100's website, and some documents (Barras & Ward, 2022; Fenna & Evans, 2023; UK100, 2024b) do explicitly refer to the need to ensure "warm homes" by insulating residential buildings and alleviating fuel poverty. Finally, inclusion in local climate policy decision-making is also problematized (UK100, 2024c). UK100 recommends deliberative methods for citizen engagement, such as citizen assemblies, to design more informed and legitimate policies, as well as building trust and communication channels between local authorities and the stakeholders.

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The network's governance relies on a board of directors that comprises four co-presidents from different parties. Member cities are consulted to determine the direction of the organization and are free to explore how they utilize the UK100 network's support and how they engage with it (UK100, 2021).

When joining the network, the local governments acquire three commitments: 1) setting a net-zero target for 2030 for the council operations, and 2045 for area-wide emissions, 2) annually reporting their Scope 1 and 2 emissions from both council operations and area; and 3) to limit the use of carbon offsets, and if used, resorting to projects that are as local as possible (UK100, 2021).

The network offers a diverse range of benefits for the participating jurisdictions. For instance, they gain the right to use the UK100 image in communication activities, to access valuable online resources (such as the knowledge hub, training activities, expert webinars, policy briefs), to priority involvement in research projects, to request an annual 1:1 meeting with the UK100 team, and to join the UK100 Policy Advisory Group.

Beyond individual access to resources, the organization actively engages in public advocacy. It maintains frequent dialogue with the national public administration to push for reforms and policies that empower local leaders to fulfil neutrality goals. In fact, UK100 was mentioned twelve times in the UK Parliament in 2024 (UK100, 2024a). Several documents examine the potential and barriers of cities to deliver the net-zero transition and argue for the devolution of competencies and resources to local authorities (Fenna & Evans, 2023; UK100, 2024c, 2024b).

4.5. Tyndall Center's Local Carbon Budget Tool

In contrast to the previous initiatives, based on government networks, this initiative and the next one focus on methodologies and resources for allocating climate responsibility to local territories. The Tyndall Local Carbon Budget Tool is a digital interface developed by the Tyndall Centre for Climate Change Research at the University of Manchester. It aims to translate the global goals of the Paris Agreement into specific budget-based targets for municipal districts. Starting from the global carbon budget, each local authority can be allocated a fair share of it according to the criteria of distributive justice. These allocations form the basis for annual reduction trajectories that illustrate both the scale and speed of emissions reductions required locally (Kuriakose, et al., 2025).

When it was launched in 2018, the tool adopted a global energy CO_2 budget of 900 $GtCO_2$, as computed by the IPCC Special Report on 1.5°C (IPCC, 2018). In 2023, the Tyndall team updated the parameters and used a smaller global budget of 700 $GtCO_2$ for 2020 (for a 67% chance of not exceeding 1.7°C) (Schwanitz et al., 2023). The methodological process begins with the distribution of the selected global carbon budget to the national jurisdictions. The Tyndall approach distinguishes between developed and developing countries, allocating a higher per capita share to the latter to account for their right to development, given their historically lower emissions (Kuriakose, et al., 2025).

For the UK's domestic distribution, the national budget is then allocated to local jurisdictions using a 'grandfathering', 'per capita' or 'GVA' distributive approach, with the shares being determined by historical emissions in recent years. Prior to this step, a national 'overhead' is deducted to account for emissions from aviation and shipping, which are dealt with at the national rather than the local level. The resulting local budget is stated in tons of CO_2 and follows a declining trajectory. It requires faster reductions in the early years to improve the likelihood of staying within the budget. In addition, five-year sub-budgets set interim targets that are easier to monitor and adjust over time (Evans, 2020; Kuriakose, et al., 2025).

An important limitation is the scope of application. The methodology only covers CO_2 emissions from scopes 1 and 2 — direct emissions within the jurisdiction and emissions from purchased electricity — while other greenhouse gases, all emissions from scope 3, emissions from international aviation and shipping emissions, and emissions from land use, land-use change and forestry (LULUCF) are left outside the scope of local budgets (Schwanitz et al., 2023). This omission means that indirect emissions from goods and services consumed locally but produced elsewhere are not taken into account. For example, the climate impact of imported food or manufactured goods, even if significant, is not included in the local budget.

The instrument is neither a political network nor a formal association of municipalities. Any local authority has free access and can use the Tool without joining a membership program, meeting access requirements, reporting on progress, or facing enforcement mechanisms. Neither does it prescribe a governance model for deciding how the budget should be met. While it sets the maximum allowable annual CO_2 emissions, it leaves the strategic choice to the individual authorities. This neutrality allows flexibility in different political and institutional contexts. However, the value of the instrument lies in the standardization of targets. By providing a transparent, reproducible, and peer-reviewed methodology for calculating local carbon budgets, local governments gain a common technical language that can be embedded in broader governance frameworks and advocacy strategies (Clandillon et al., 2020).

The Tyndall Center reported that around 250 UK local authorities have adopted targets based on the Tool, representing approximately 18% of the UK population (The University of Manchester, 2021; Tyndall Center for Climate Change Research - Manchester Unit, 2021). The city of Manchester provides a clear example of direct application: it has a science-based carbon budget and five-year sub-budgets to monitor progress toward achieving a zero-carbon city by 2038. The city's framework documents the role of these budgets in shaping strategies across energy, buildings, and transport, and in communicating the scale of the challenge to stakeholders (Manchester Climate Change Partnership, 2024).

Regarding practical resources, the tool's website provided downloadable reports for each municipal district, containing a concise explanation of the methodology and an option to create aggregated budgets for multiple jurisdictions. External materials complement these resources: the Science-Based Targets for Cities guide signposts city stakeholders to the Tyndall approach as an option for setting science-based local budgets, and some local authorities (e.g. Derbyshire County Council) have published their own step-by-step guides to using Tyndall budgets and reduction pathways at district and county level (Clandillon et al., 2020; Derbyshire Council, 2021).

Although the origins and main user base of the tool are in the UK, its methodology has also been trialed in other national contexts. In 2023, the Tyndall method was experimentally applied to case studies in Norway, Sweden, and the Netherlands as part of an international comparative validation study. These trials served to test the robustness of the method in different government and energy system environments and are not, in themselves, indicative of formal adoption by authorities in these countries. Extending the approach internationally would require attention to the availability and comparability of data (especially for historical emissions) and the adaptation of allocation rules to national circumstances. The lack of a formal network structure facilitates uptake in different contexts, but also means that the impact ultimately depends on integration with other governance mechanisms and advocacy initiatives (Schwanitz et al., 2023).

4.6. ARCA

Funded by the European Union and Spain's Ministry of Science and Innovation, the ARCA Project (Spanish acronym for Appropriate Climate Responsibility Allocation) is an academic effort to rigorously articulate the distribution of climate responsibility across Spanish municipal territories.

Just as Tyndall's Local Carbon Budget Tool, ARCA is a web-based ACR distribution proposal for municipalities (at www.arcalocal.es) that aims to help local governments determine Science-Based Targets for their jurisdictions. It is not backed by any governmental body nor aims to serve any specific network of municipalities but provides stakeholders with a scientific benchmark for climate planning, directly linking local strategies to the global debate on distributive justice and responsibility.

More specifically, ARCA informs local political action by enabling each Spanish municipality to determine how much it can emit in the coming decades and by which year it should reach carbon neutrality. It outlines a transparent methodology (Suárez-Eiroa et al., 2025) for downscaling global carbon budgets to the municipal level, utilizing both international databases and national and local statistics. Regarding the ACR determination method, ARCA introduces several innovations compared to the previous ones. Traditional accounting focuses on territorial emissions, i.e., those generated within geographical borders, which can obscure the real climate impact of consumption patterns, since emissions may be "outsourced" to other regions through imported goods. ARCA addresses this gap by adopting a consumption-based perspective: it considers all GHG emissions associated with the life cycle of goods and services consumed by municipal residents, regardless of where production takes place. In this way, by using Environmentally Extended Input-Output Analysis (EEIOA) and EXIOBASE database, it is capable of embracing Scope 3 emissions.

The distribution of carbon budgets to municipalities follows similar logic to Tyndall's method: it first applies a per capita distribution among nations, and then the national budget is distributed to municipalities using a grandfathering approach. Additionally, as Tyndall's Tool, ARCA provides a standard proposal for distributing carbon budgets to municipalities and estimates local climate pathways to neutrality.

However, ARCA moves a step further by enabling local decision-makers to explore different scenarios beyond this standard proposal. Operatively, users can modify diverse parameters using a web-based interactive interface. While the baseline proposal calculated neutrality targets based on a global warming limit of +1.7 °C and did not consider historical emissions, the interface allows for exploring how the neutrality target changes when using different global warming limits and base years to account for past differentiated emissions.

Regarding the base years, ARCA proposes five symbolic dates that represent major events for the history of climate policy and can be argued to constitute the birth of differentiated responsibility:

1850 This year marks the beginning of the industrial period, characterized by the intensive use of fossil fuels. Counting from this date allows us to fully capture the differentiated contribution of territories to the problem of climate change.

1990 This date denotes the beginning of international discussions on climate change. In 1990, the first IPCC assessment report was completed, concluding that the climate, due to GHG emissions, had already begun to change. In 1992, the United Nations Framework Convention on Climate Change (UNFCCC) was established.

2000 This is also a critical moment in climate policy history. The Kyoto Protocol (1997) was recently agreed upon and would enter into force in 2005. This binding agreement committed the largest emitters to dedicate efforts to limiting emissions and put into practice the principle of "common but differentiated responsibility."

2015 This is the year in which the Paris Agreement was signed. It sets the goal of limiting global warming to "well below 2°C above pre-industrial levels, and pursuing efforts to limit the temperature increase to 1.5°C". It establishes a system of Nationally Determined Contributions, in which each country independently suggests its reduction efforts.

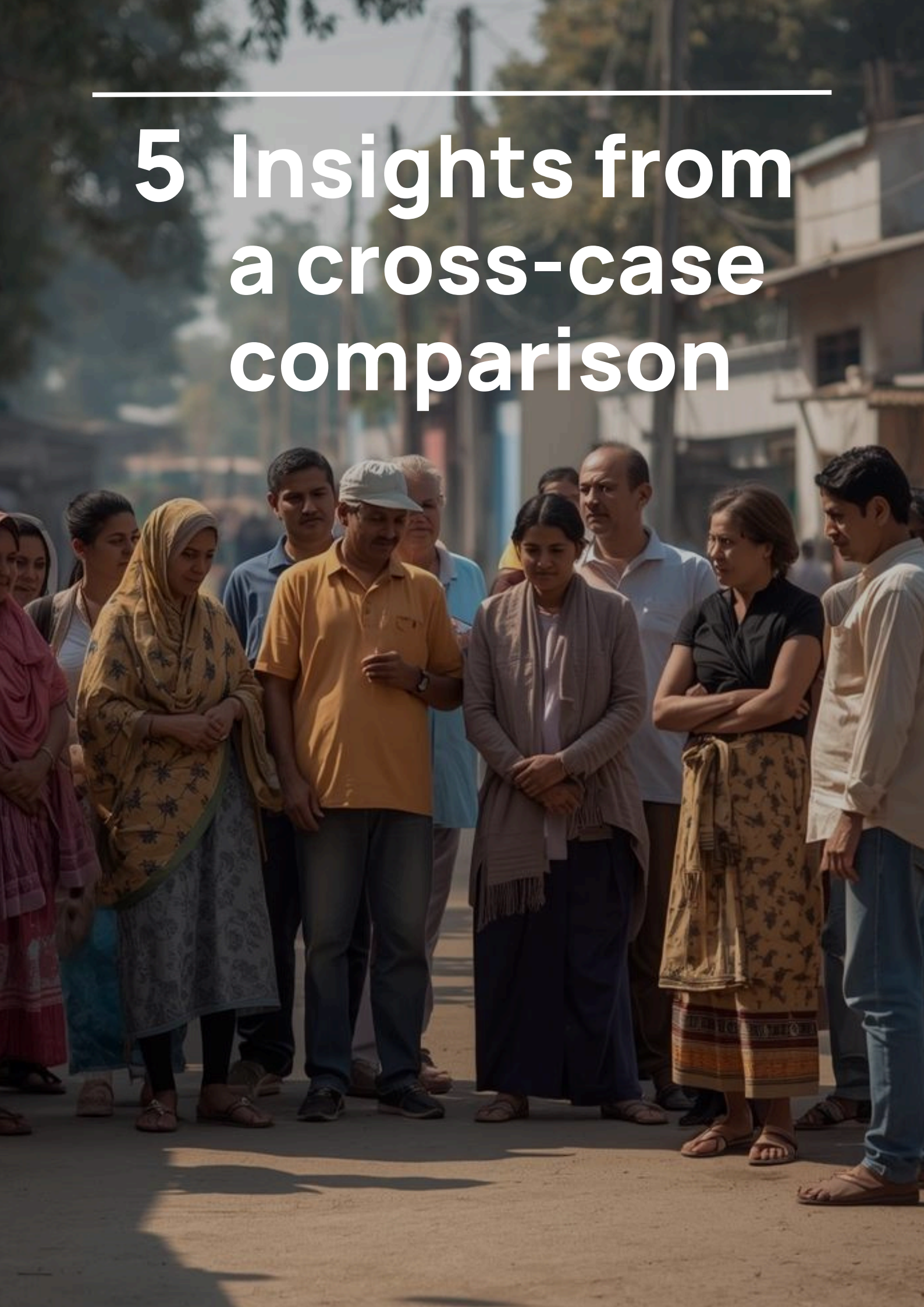
2025 Choosing this year means applying a clean slate. Starting from today's date ignores the fact that there has been a differentiated contribution to the problem of climate change, which, in fact, is related to current differences in living conditions across territories.

Hence, ARCA's method implies an advance in the implementation of distributive justice by allowing municipalities to consider historical emissions in their target estimations.

Although ARCA does not explicitly intervene in the local governance model, it does assist in governance tasks beyond target definition. For instance, the ARCA project discloses its emissions estimations for each municipality and breaks them down by product type (e.g., food, transport, etc.). This enables stakeholders to prioritize actions among consumption categories in their mitigation strategies. Furthermore, the website features a comprehensive digital catalogue of potential mitigation actions that municipalities of various sizes can undertake within their usual areas of competency. The actions are accompanied by illustrative real-life cases.

Among many other virtues, this permits municipalities to learn from existing practices developed elsewhere and adapt them to their own circumstances, directly contact experienced jurisdictions to seek advice, and stimulate the envisioning of a decarbonized future for their jurisdictions.

5 Insights from a cross-case comparison



5. Insights from a cross-case comparison

The previous section described the four municipal network-based initiatives (Covenant of Mayors, PCAN, UK100, and Mission Cities) applying the two-by-two framework outlined in Section 3.4. The initiatives limited to ACR determination (ARCA and Tyndall's Tool) were evaluated solely based on the characteristics of their methodologies. In this section, we follow a similar approach for comparing the cases: the complete framework is applied only to the four networks, and then the ACR will be evaluated for the six initiatives.

The networks differ essentially in the architecture and governance approach of the collective structure, but share some key characteristics:

- Structurally, they are networks of municipalities aiming to join forces against climate change. However, the consortia initiating or managing the networks are nurtured by other types of actors, preeminently research institutions and top national or European governments.
- They established similar formal access requirements, which are based on written net-zero commitments and plans, detailing targets and informed strategies.
- These networks explicitly acknowledge the need for multistakeholder participation to define local climate action targets and plans. The PCAN network is based on the Climate Commissions, Mission Cities requires that the CCC is participatory, UK100 developed programs to conduct effective participatory processes, and the CoM strongly recommends public engagement at every stage of governance.
- They exhibit limited or no enforcement capacity. Initiatives can withdraw the label when cities fail to make sufficient progress or comply with their obligations. Apart from this, the network's centralized enforcement is limited to reporting and exposing information, and thus, the sanctioning power mostly relies on the actions of third parties, especially civil society.
- Networks leverage the collective power of the members in two directions:
    - Collectively developing and sharing knowledge resources through advisory services, guidebooks, digital tools, research outcomes, and technical training. They recognize the critical importance of learning and innovation in climate policy at the local level and the crucial role of local actors in adapting that knowledge to contextual circumstances.
    - Sharing a voice to enhance their communication power. They aim to spread climate action across local jurisdictions and enhance upward advocacy.
- They are all aware of the need for financial development to face the required investments. Beyond orientation and training on seizing financial opportunities, the networks establish frameworks to fund climate action projects or mechanisms to connect external financial resources with local financial needs.
- Besides the fundamental role of horizontal collaboration to enhance cities' transformative capacities, these networks also emphasize the multilevel nature of the governance challenge and recommend active multiscale collaboration. They mentioned the need to vertically align climate targets and integrate action plans across administrative levels.

- Regarding the just transition, networks are mostly concerned about the effects of the transition in the domestic domain, but they are still not thoroughly addressed. Energy poverty within the local jurisdiction is the most frequently mentioned issue, for which networks investigate and recommend specific policies. On labor issues, references are often limited to the quantity of jobs generated by the green transition or the need for new skills in the workforce, and are rarely embedded in a justice discourse. Similarly, gender justice is rarely referred to as a central concern for the specific domain of climate policy, and is only mentioned as a general gender-equality principle to be applied in every procedure, such as parity in the composition of governing bodies.

Regarding ACR determination, we can assess the comparative strictness of the methods applied by the six initiatives. Stricter ACRs employ a comprehensive and transparent method to distribute carbon budgets according to fair-share criteria, encompass a broader range of GHGs, and account for a wider scope of emissions. Weaker ACRs do not apply or display any method of fair distribution and either assume the global target of achieving carbon neutrality by 2050 or are simply based on willingness.

Additionally, they encompass a narrower scope and only account for a limited set of GHGs (typically, only CO_2). Table 2 summarizes the characteristic dimensions of the methods employed by the six initiatives (including now ARCA and Tyndall's Tool). The strictest method is used by ARCA, which encompasses all scopes and GHGs, and offers diverse base years to integrate historical emissions.

It is also fair to say that ARCA is the most recent initiative and is built on the experience of the previous methodological generations. It is also noteworthy that, except for PCAN, the networks seem to be unreflective about climate-related distributive justice at the international scale.

	Covenant of Mayors	EU Mission Cities	PCAN	UK100	Tyndall's Tool	ARCA
Distribution criteria	Inherited from a larger scale	No explicit criterion	Per capita	No explicit criterion	Several stages involving grandfathering, per capita and capability approaches	Two stages: Per capita for international allocation and grandfathering for municipal allocation
Temperature limit	+1.5ºC	Not applicable	+1.5ºC	Not applicable	+ 1.7ºC	+ 1.7ºC
Accounting type	Territorial	Territorial	Territorial	Territorial	Territorial	Consumption based
GHG included	Flexible. Recommended at least CO2, CH4 and N2O	CO2, CH4, N2O, SF6, NF3, and F-gases.	Flexible	Flexible	CO2	CO2, CH4, N2O, SF6, NF3, and F-gases.
Scope	1 + 2	1 + 2 + 3 (only waste)	1 + 2	1 + 2	1 + 2	1 + 2 +3
Targeted year for neutrality	The most recent commitment for the European section is 2050	2030	2030 Leeds 2030 Edinburgh 2050 Belfast	2045	It varies across regions as a result of the calculation method	Standard is 2032, but it offers other proposals based on alternative parameters

6
Lessons learnt and policy recommendations

6. Lessons learnt and policy recommendations

This section summarizes some key lessons learned from the experiences of these initiatives and provides policy recommendations to integrate and operationalize the just transition into local governance.

1. Conscious and comprehensive reflection on the justice of the ecological transition

This working paper has detected that local climate initiatives are rarely concerned with just transition issues outside their borders. One step of progress is underpinning the determination of net-zero targets with justice-sensitive methodologies. The two detailed methodologies seen in this paper (Tyndall's Tool and ARCA) use budget-based methods, which are the most common. Incorporating distributive justice concerns in the ACR definition ensures the effective implementation of the UNFCCC principle of common but differentiated responsibilities (CBDR).

However, the budget-based determination of the RCA is just a small piece of the diversity and complexity of issues related to the just transition. Governance structures can and should develop their own approach to the justice of their social-ecological relationships and find the appropriate ways to address them.

2. Strategic planning (in collaboration with experts)

Both the climate action plans and their development process are fundamental pillars of governance for these networks. CoM's SECAP, PCAN's Roadmap, and Mission Cities' CCC are identified as the backbone of their initiatives and a powerful starting point for local climate action. Inasmuch as they establish clear targets, strategies, responsibilities, and deadlines, they improve the chances of delivering on climate commitments. Along with transparent follow-up information, in the form of reports and indicators, they enable local authorities to track progress and stakeholders to monitor performance and hold those responsible for each action accountable.

It is remarkable the role that researchers play in the coordination of these networks and the development of general knowledge. For instance, the Joint Research Center of the European Commission has been actively participating in the technical development of both Mission Cities and the European section of the Covenant of Mayors. However, it is also noteworthy that universities can assume a fundamental task in developing tailored plans for nearby cities, as demonstrated in the PCAN experience.

3. Multi-stakeholder engagement in local governance

The inclusion of affected actors in strategic planning and policy development is a key concern for a just transition. All the governance initiatives recommend the integration of stakeholders into climate decision-making beyond mere box-ticking. They ask for the creation of institutional environments that facilitate the effective participation of relevant actors in the co-design of climate action plans, leveraging the diverse range of available public engagement and participatory techniques (Bryant, 2024; Davide et al., 2025; PCAN, 2024; UK100, 2024c).

The principle of inclusion, apart from being normatively desirable, it is also considered to be functionally necessary to reach city-wide agreements and successfully implement projects: a) improves the project's credibility, rigor and legitimacy, b) facilitates and strengthens partnerships, c) fosters a culture of sustainability, d) contribute to policy innovation, and e) mitigate social risks (Davide et al., 2025; Howarth et al., 2024; Involve, 2024; Pringle, Rhona et al., 2023).

4. Learning from existing knowledge and adapting it innovatively to the local context
Just as these experiences recognize the power of learning from existing knowledge, they also emphasize the need to embrace complexity and develop place-based innovations. These initiatives are repositories of substantial practical knowledge, resulting from extensive experience in local governance of the climate transition. However, each jurisdiction needs to perform adaptation efforts to integrate that knowledge into the local circumstances.

Furthermore, the accumulated knowledge on these initiatives is primarily developed within and for the European context by European actors. Mediterranean territories in North Africa and West Asia may encounter major cultural, legal, material, and geographical differences that deserve new or substantially revised practices.

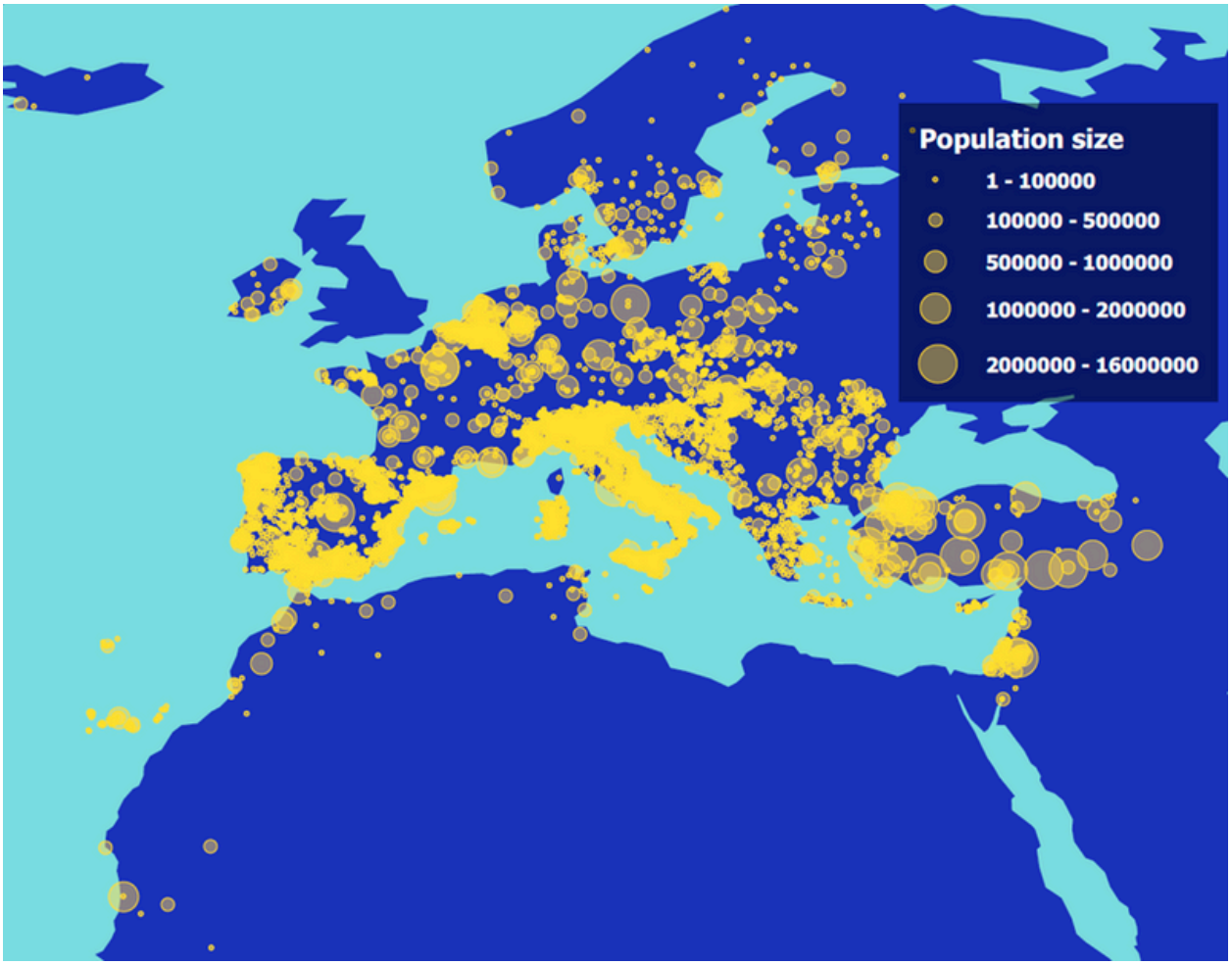
5. Formalized multilevel governance structures backed by multilevel mindsets
The initiatives emphasize the importance of active, multilevel governance efforts to align targets and integrate strategies, thereby scaling capacities and resolving inconsistencies. Additionally, upward political advocacy has been identified as of paramount importance in enhancing the agency of local jurisdictions to deliver ambitious climate action. From their experience, networks also defend in their documents the institutionalization of mechanisms and spaces for supporting the flourishing and maintenance of vertical and horizontal collaboration (both internally and externally to the local jurisdiction) (Christie & Russell, 2023; EU Covenant of Mayors, 2021; Global Covenant of Mayors, 2021; Fenna & Evans, 2023; UK100, 2024c).

6. Finance for governance and delivery
These experiences concur on the need for innovative funding frameworks, both to support governance operations (e.g., activities for multistakeholder engagement, performance monitoring, and technical problem-solving) and to finance the required investments in action planning (e.g., infrastructural adaptation) (Pringle, Rhona et al., 2023; UK100, 2024c). On the one hand, they emphasize the importance of securing stable funding and resources (e.g., dedicated staff) for governance operations, which often implies diversifying financial sources while establishing mechanisms to preserve independence. On the other hand, they consider it paramount to develop place-based financial programs that can serve as investment pipelines for net-zero projects (Howarth et al., 2023; UK100, 2024b), connecting public and private financial resources with the funding needs of planned climate action.

7. Join or initiate a network

The plans for a (just) transition from the local scale are grounded in good intentions, but their transformative power is constrained by the limited agency of local jurisdictions. Capacity-building strategies aimed at addressing capacity gaps (e.g., in terms of finance, knowledge, and political advocacy) are crucial to achieving ambitious transitional objectives. Networks like the ones presented here guide, train, empower, and connect actors to take effective action and advocate for regulatory shifts in national and international frameworks that improve institutional environments and facilitate access to resources.

Figure 1. Signatory cities of the Global Covenant of Mayors in the Union for the Mediterranean Member States

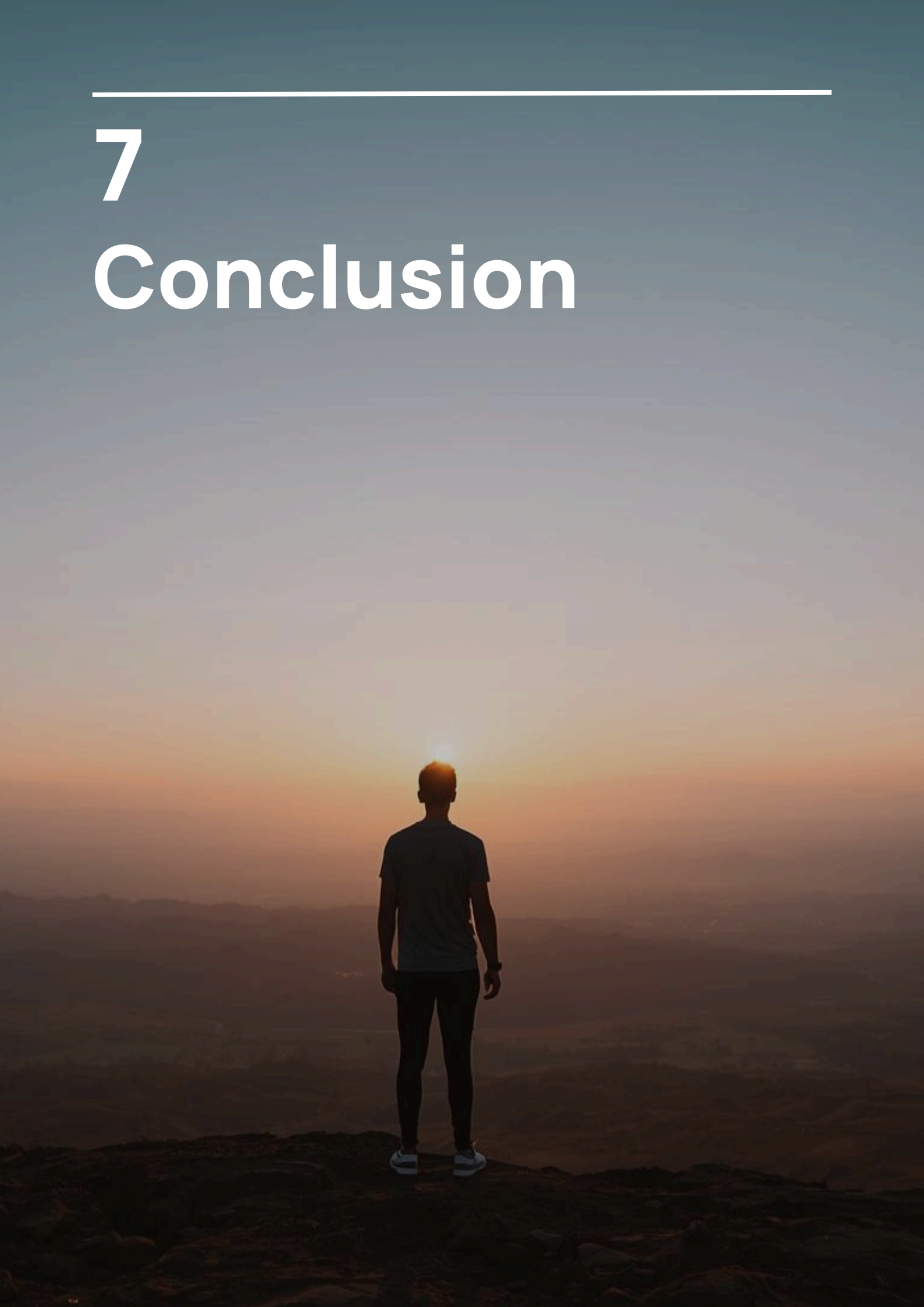


Note: Own elaboration from data of the Global Covenant of Mayors (https://www.globalcovenantofmayors.org/our-cities) as of September 2025. Each yellow circle represents a signatory city and its size increases with population. Only cities from the Union for the Mediterranean Member States are represented.

Non-European Mediterranean nations (i.e., those in North Africa and Western Asia) can leverage existing networks or knowledge to develop new ones under their own approach. For instance, currently, more than 300 cities in those areas are members of the Global Covenant of Mayors (see Figure 1).

Governments at all levels can dedicate efforts to expanding the network among their cities or initiating new ones that are better contextualized in local realities.

7
Conclusion



7. Conclusion

Relying on evidence of climate change governance as a benchmark, we have provided an overview of how the just transition to the circular economy can be governed from the local sphere. The covered experiences illuminate some pathways for progress in the governance of the transition toward an economic system that is adapted to the regenerative capacity of the planetary ecosystem.

However, in this emerging domain, significant knowledge gaps remain. We are still far from understanding what, and in what way, justice dimensions are affected by the transition to CE and what policies can effectively address them in different circumstances. For instance, there is still sparse research on how local policies can ensure a just transition for vulnerable populations or for workers and communities reliant on affected industries (e.g., fossil fuel industry). More research is also needed on locally promoted business models that can support the circular transition, how they can effectively incorporate just transition concerns, and how policy can intervene to facilitate this.

The methods that distribute appropriate responsibility are relatively new and require time to provide sufficient evidence of their applicability and outcomes. One of the most pressing issues is determining how to apply the appropriate responsibility allocation logic to environmental concerns beyond climate change. It is also paramount to understand under what conditions the particularization of responsibility avoids atomization and enables (or even fosters) collective action mindsets. Another step forward is to develop practical and transparent methods to extend justifiable "appropriate responsibilities" to CE-relevant actors, which would entail allocating fair roles to producers, consumers, and public bodies in reducing overall throughput and extending product lifetimes, while coordinating action across different scales.

Regarding governance models **to design and implement (just) transition-related policies and coordinate multilevel and multistakeholder actions,** we have more uncertainties than certainties. More research is needed on the **replicability** of the incipient and incomplete European governance models to other contexts. It is also urgent to develop effective and feasible methods for achieving legitimate and agreed-upon **distributions of responsibilities** among heterogeneous actors at all levels. Additionally, there is still a long way to go in developing **financial frameworks** that can keep pace with the financial needs of local transformations. Finally, we need to advance our understanding of the institutionalization of multilevel governance mechanisms that could **align local circular policies** with national and regional frameworks without losing a legitimate and functional degree of small-scale autonomy.

Climate governance is a pathbreaking and rapidly evolving domain that serves as a guide for the governance of emerging environmental challenges. Researchers and practitioners in circular economy and just transition governance will find in it a useful repository of evidence to inspire progress in their fields.

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Appendix A. Table of documents

Year	Authors	Title	Publisher
PCAN			
2024	Howarth et al.	Final report of the Place-Based Climate Action Network (PCAN)	PCAN
2024	Bryant, Sarah	A framework-based exploration of typologies for climate governance: Lessons learned from the Edinburgh climate commission	PCAN
2024	PCAN	Climate Commission Cookbook: PCAN's Recipe for Place-Based Climate Action	PCAN
2023	Howarth et al.	Enabling Place-based Climate Action in the UK - The PCAN Experience	PCAN
2023	Pringle et al.	Evaluation of the impact of PCAN-supported Climate Commissions - Final Report	PCAN
2023	Christie and Russell	On multi-level climate governance in an urban/rural county: A case study of Surrey	PCAN
2021	Howarth et al.	Trends in local climate action in the UK: A report by the Place-Based Climate Network	PCAN
2020	Gouldson et al.	A net-zero carbon roadmap for Leeds	PCAN
2020	Williamson et al.	Edinburgh Net-Zero Carbon Roadmap	PCAN
2020	Gouldson et al.	A net-zero carbon roadmap for Belfast	PCAN
Covenant of Mayors			
2025	Global Covenant of Mayors	Gender equitable and inclusive climate action planning: Toolkit for cities and local governments	Global Covenant of Mayors
2025	EU Covenant of Mayors	Reporting Guidelines on Energy Poverty	Covenant of Mayors Europe
2025	Davide et al.	How to develop a Sustainable Energy and Climate Action Plan (SECAP) – Covenant of Mayors Guidebook Main document	Publications Office of the European Union
2025	Pittalis et al.	How to develop an energy poverty assessment – Covenant of Mayors Guidebook – Complementary document 3	Publications Office of the European Union
2025	Bastos et al.	How to prepare a greenhouse gas emission inventory – Covenant of Mayors Guidebook	European Commission, Joint Research Centre
2024	Melica et al.	Covenant of Mayors: 2023 assessment: 15 years of climate action at local level in Europe	European Commission, Joint Research Centre
2023	Global Covenant of Mayors	The multilevel climate action: Guide for decision makers	Global Covenant of Mayors
2021	Global Covenant of Mayors	The multilevel climate action playbook for local and regional governments	Global Covenant of Mayors
2021	EU Covenant of Mayors	Multi-Level Governance in Climate Action Co-creating policy solutions to tackle climate change	Covenant of Mayors Europe
2020	Covenant of Mayors - Europe	Reporting Guidelines	Covenant of Mayors Europe
EU Net Zero Mission Cities			
2025	Net Zero Cities	CCC Highlights - Diverse Perspectives on Climate Justice	Net Zero Cities
2025	Net Zero Cities	CCC Highlights - A Diverse Ecosystem of Supporters	Net Zero Cities
2025	European Commission	Climate-neutral and smart cities	Publications Office of the European Union
2023	Net Zero Cities	Climate City Contract—2030 Climate Neutrality Commitments document (Guidance and Explanations) V2.1	Net Zero Cities
2023	Net Zero Cities	Climate City Contract—2030 Climate Neutrality Action Plan (Guidance and Explanations) V2.1	Net Zero Cities
2023	Net Zero Cities	Climate City Contract—2030 Climate Neutrality Investment Plan (Guidance and Explanations) V2.1	Net Zero Cities
2023	Net Zero Cities	Climate City Contract—2030 Climate Neutrality Commitments document — Template	Net Zero Cities
2023	Net Zero Cities	Climate City Contract—2030 Climate Neutrality Action Plan — Template	Net Zero Cities
2023	Net Zero Cities	Climate City Contract—2030 Climate Neutrality Investment Plan — Template	Net Zero Cities
2023	Net Zero Cities	Framework for Spaces for Encounter	Net Zero Cities
2022	Net Zero Cities	Transition Team Playbook: Orchestrating a just transition to climate neutrality	Net Zero Cities
2021	European Commission	100 Climate-Neutral and Smart Cities by 2030: Implementation plan	Publications Office of the European Union
2021	European Commission	100 Climate-Neutral and Smart Cities by 2030: Info kit for cities	Publications Office of the European Union
UK100			
2025	UK100	Beyond targets: The Wider Benefits of Climate Action	UK100
2024	UK100	Annual Review 2024: Powering local climate action	UK100
2024	UK100	Local Net Zero 2.0: The moment to deliver	UK100
2024	UK100	Zero In: Accelerating Climate Action	UK100, Mission Zero Coalition
2023	Sally Cupitt	Local Climate Engagement Programme: Evaluation of Part 1, 2021-23	Involve, UK100, Climate Outreach, Shared Future
2023	Fenna and Evans	Powers in Place: The handbook of local authority Net Zero powers	Quantum Strategy & Technology Ltd., UK100
2022	Barrass and Ward	End the wait. Insulate-Social housing energy efficiency and the energy crisis	UK100
2022	Lloyd	Energy Networks: Insight Briefing	UK100
2021	UK100	Join us: Be the local solution to the net zero challenge	UK100
Tyndall Center's Local Carbon Budget Tool			
2018	Tyndall Centre for Climate Change Research	Local and regional implications of the United Nations Paris Agreement on climate change	University of Manchester
2023	Schwanitz et al.	The interpretation of science-based targets for cities—Validating Deadline 2020, One Planet City Challenge, and Tyndall Local Carbon Budget Tool.	University of Manchester
2020	Evans	Local Authorities and the Sixth Carbon Budget	Climate Change Committee
2020	Clandillon et al.	Science-based climate targets: A guide for cities. Science-based targets network	Global Commons Alliance
2021	The University of Manchester	Empowering local organisations to help meet global climate change goals	The University of Manchester
2024	Manchester Climate Change Partnership	Manchester's Emissions Report 2023	Manchester Climate Change Agency
2021	Derbyshire Council	Derbyshire County Council's Climate Change Strategy: Achieving Net Zero.	Derbyshire Council
ARCA			
2025	Suárez-Eiroa et al.	Informe Técnico del Proyecto ARCA: Metodología y datos para estimar objetivos climáticos municipales basados en criterios de distribución justa. Aplicación al caso de los municipios españoles	ARCA
2024	Suárez-Eiroa et al.	The responsibility of the EU in climate change mitigation: assessing the fairness of its recent targets	Mitigation and Adaptation Strategies for Global Change

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