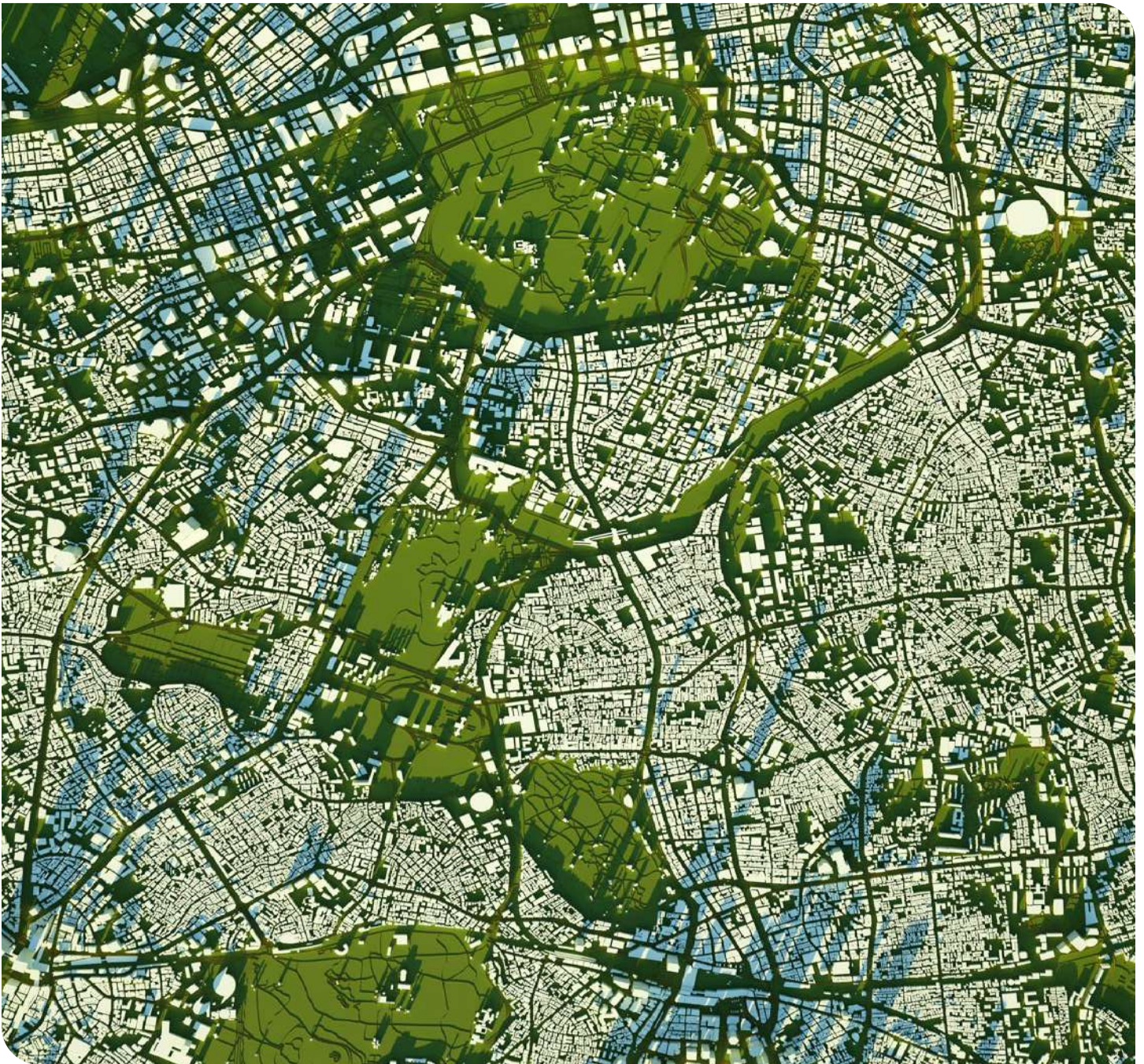




CITY CDR INITIATIVE
Building Carbon Sink Cities



PATHWAYS TO CARBON SINK CITIES

PART 3: IMPLEMENTATION GUIDE

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CITY CDR CONSORTIUM

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Atlanta
Baltimore
Boulder County
Bristol
Copenhagen
Curitiba
Flagstaff
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Developers:

Airbuild
Applied Carbon
Capture6
Carbicrete
Carbon Neutral Initiative
Carbon Reform
Carbon Upcycling Technologies
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EXECUTIVE SUMMARY

Cities can lead global climate restoration efforts by integrating carbon dioxide removal (CDR) within the fabric of urban life. Achieving City CDR readiness – ability to systematically develop urban carbon removal and carbon sinks – requires coordinated and sustained action across governance, policy and infrastructure. While cities differ widely in their starting points and capacities, they face a common set of institutional and political barriers. This Implementation Guide helps local governments navigate these challenges.

Progress starts with transforming challenges into opportunity pathways with sector-specific urban CDR solutions. Gaps in policy integration, for example, can become opportunities to embed CDR objectives within existing municipal functions, such as waste, water and buildings, complemented with cross-sectoral roadmaps and measurable targets. Local governments operate within tight political, fiscal and jurisdictional constraints, but targeted advocacy and effective storytelling can unlock momentum. Anchoring CDR in recognizable policy priorities allows cities to translate quotidian, immediate and practical aspects of urban governance into platforms for CDR deployment – an essential step toward becoming a Carbon Sink City.

CDR should not compete with existing urban policies; it should strengthen them. By leveraging synergies across policy areas, cities can amplify climate action while delivering co-benefits, such as economic development, urban resilience and financial innovation. CDR can be integrated directly into the systems that shape urban life – planning, infrastructure and governance – rather than treated as a standalone intervention. To support this approach, the Guide introduces a ‘Framework for Embedded CDR Planning’ alongside ten policy intersection factsheets that illustrate where and how CDR can reinforce existing city priorities.

Urban CDR is not a one-size-fits-all solution. Cities differ vastly in governance capacity, infrastructure, socio-economic conditions and the political context. Assessing project suitability is essential for aligning CDR with broader city priorities, ensuring efficient use of municipal resources and capacities, strengthening community trust and legitimacy, and accelerating scalable and replicable CDR models. The Guide provides an ‘Urban CDR Suitability Assessment Framework’ to help cities evaluate proposed interventions across social, economic and technological dimensions.

Cities stand at the centre of the transition to climate neutrality and climate restoration. This Guide shows that progress on carbon removal depends less on the maturity of individual technologies than on governance clarity, institutional coordination, planning capacity and the confidence to take early steps. Becoming a Carbon Sink City is an institutional, social and economic project. Together with the Vision Paper and Need-Gap Analysis, the Implementation Guide shows how cities can undertake this journey – and position themselves as leading agents of climate restoration.

GLOSSARY

AFOLU - Agriculture, Forestry, and Other Land Use

BECCS - Bioenergy with carbon capture and storage

BioCCS - Biomass with carbon capture and storage

CAP - Climate Action Plan

CCS - Carbon Capture and Storage

CCU - Carbon Capture and Utilisation

CCUS - Carbon Capture, Utilisation or Storage

CDR - Carbon Dioxide Removal

CHP - Combined heat and Power plant

CO₂ - Carbon dioxide

CO₂eq - Carbon dioxide equivalent

CRCM - Carbon Removal Credit Mechanism

DAC - Direct Air Capture

DACS - Direct Air Capture and Storage

DOC - Direct Ocean Capture

ERW - Enhanced Rock Weathering

ETS - Emissions Trading Scheme

EU - European Union

GHG - Greenhouse Gas Emissions

GJ - Gigajoule

Gt - Gigatonne

ha - Hectare

ICLEI - International Council for Local Environmental Initiatives

IPCC - Intergovernmental Panel on Climate Change

kg - Kilogram

kt - Kilotonne

KPI - Key Performance Indicator

kWh - Kilowatt-hour

LCA - Life-Cycle Assessment

LULUCF - Land Use, Land Use Change and Forestry

MLG - Multi-Level Governance

mm - millimetres

MRV - Monitoring, Reporting and Verification

Mt - Megatonne

NBS - Nature-based Solutions

NDC - Nationally Determined Contributions

NGO - Non-Government Organization

OAE - Ocean Alkalinity Enhancement

PM - Particulate Matter

PPP - Public-Private Partnership

SCS - Soil Carbon Storage

SOC - Soil Organic Carbon

TRL - Technology Readiness Level

UNFCCC - UN Framework Convention on Climate Change

WtE - Waste-to-Energy plant

WWTP - WasteWater Treatment Plant



INTRODUCTION

There is momentum behind sub-national climate action. Building on this, the City CDR Initiative is assessing the opportunity of carbon dioxide removal (CDR), carbon sinks in urban and peri-urban environments and the options local governments have to unlock this at scale. The Initiative recognizes that cities must accelerate emissions reductions and enable adaptation, and aims to support cities to increase carbon removal where this is complementary. The focus of this assessment is on systemic approaches, looking at how CDR and carbon sinks can support other urban priorities, while enabling climate restoration. Local governments are the target audience, specifically officials from such departments as environment, public works, planning, community development, sustainability, climate resilience and health teams.

Pathways to Carbon Sink Cities: Implementation Guide (Part 3) is part of CityCDR’s opportunity baselining phase and concludes a three-part report series, building on the **Vision Document (Part 1)** and the analysis and conclusions on the local dynamics shaping urban CDR presented in **Need-Gap Analysis (Part 2)** (available [here](#)). Together, these publications form a single narrative: imagining the future of our cities as carbon sinks, expanding the horizon of what local governments can do and showing how they might do it. With the Implementation Guide, the opportunity assessment moves from structure to practice: how to organize the CDR function, align with multi-level governance, advocate across arenas, assess project suitability and embed removal horizontally in policies such as waste, energy, land use and resilience.

The Vision Document was developed in collaboration with the Carbon Neutral Cities Alliance (CNCA), XPRIZE, Skidmore, Owings & Merrill (SOM), Climate High-Level Champions and Conservation International. The Need-Gap Analysis and the Implementation Guide were prepared by the CityCDR consortium, which consists of 20 cities, 22 partners and 18 technology and project developers. The analysis relies in part on data collected from 15 of the cities and all developers on issues of governance, policy, urban systems and infrastructure. This data repository is intended to be expanded over time as new cities and developers join CityCDR to help inform an increasingly granular understanding of the opportunity and pathways to scale.

The Implementation Guide presents different approaches to achieving CDR readiness as a local government. It offers actionable tools and frameworks, from readiness assessments and governance models to cross-policy integration strategies. It does not present a final model or a prescriptive set of solutions. Instead, it aims to make emerging processes easier – to give cities a practical entry point into a complex and evolving area of climate action. The Guide recognizes that the path toward urban CDR is local: institutional capacity, infrastructure and political context shape what is feasible. Yet, the underlying message is consistent – city action on CDR is possible and it can begin now.

As with climate action more broadly however, the politics of carbon removal can be challenging for local governments to navigate. CDR has the potential to bring meaningful benefits to city residents and advance environmental justice, but it can also be used to deter mitigation efforts, save otherwise ‘stranded’ fossil fuel assets, entrench injustice and sow divisions within communities. Different models of carbon removal development are being put forward by diverse interest groups. For cities to adopt an effective, just, and resilient CDR model, local decisionmakers must educate themselves on these dynamics and engage with the public in a meaningful way, while ensuring that benefits flow directly from the projects to local communities. As with most of the considerations in this Implementation Guide, this imperative for a sound carbon removal policy extends beyond the jurisdictional boundaries of the city.

The extent of municipal involvement in CDR projects and the ability to foster public support may very well depend on the model local governments pursue; driven by the idea of providing a public service, such as the public utility model, or more informed by the notion of fostering innovation and economic development, such as the model in which CDR is primarily a privatized tradable commodity. Variations of both models have their rightful place when setting the goal of scaling urban CDR, though some of the central ideas in this Guide speak to the idea of embedding CDR in existing public services, systems and infrastructure, and associated policy domains as the preferred foundation. Cities are well-placed to think and act on CDR beyond market-based mechanisms. This Guide shows how local governments have a real opportunity to shape the future politics of CDR as a public benefit.



CHAPTER 1: **ACHIEVING READINESS**

Cities are emerging as pivotal actors in global carbon removal efforts, yet their ability to deploy CDR solutions varies widely. As urban areas confront intensifying climate pressures, understanding their readiness to implement both nature-based and technological CDR approaches is essential for effective planning. The analysis presented here provides a clear view of where cities currently stand, the factors shaping their readiness and the opportunities and barriers that influence their ability to scale carbon removal in the coming years.

Fifteen global cities were assessed to understand their readiness to develop a comprehensive CDR strategy and implement carbon removal projects or develop carbon sinks. Using a comprehensive three-framework methodology encompassing governance, policy and infrastructure, our analysis reveals significant variation in readiness levels (see Annex for methodological details). A segmentation of the readiness levels is translated into timelines for achieving readiness within a maximum of five years. The time frame estimations are ideal scenarios, assuming linear progress, resource adequacy, optimal sequencing of actions, learning curve efficiency, and a favorable context. They should therefore be taken as generic yard sticks, requiring application tailored to individual cities for greater accuracy.

The analysis shows that City CDR readiness is within reach but requires coordinated and persistent action across governance, policy and infrastructure dimensions. Four cities (31%) are ready to develop a comprehensive CDR strategy and begin or increase deployment at scale immediately, eight cities (62%) are at a developing stage and could reach readiness within 12-36 months, and one city (8%) requires foundational development efforts to become ready to develop and implement a comprehensive CDR strategy within in 3-5 years. This distribution reveals that the majority of assessed cities (93%) have achieved at least developing status, indicating foundational climate capacity exists globally. However, only 31% demonstrate immediate CDR implementation capacity, highlighting the substantial capacity-building requirements for scaling urban carbon removal.

READINESS LEVEL	INDICATIVE TIMEFRAME	CHARACTERISTICS
Ready	6-12 Months	High performance across governance, policy and infrastructure; minor gaps only. Cities can launch comprehensive CDR programs rapidly.
Developing	12-24 months	Moderate performance with notable gaps requiring targeted strengthening before full deployment.
Emerging	3-5 years	Low scores across most frameworks; major gaps require foundational capacity-building before implementation.

PATHWAYS TO CDR READINESS

The analysis reveals distinct development pathways according to a city's starting point. Each pathway focuses on targeted strengthening of the weakest frameworks while leveraging existing strengths.

CITY CATEGORY	TYPICAL ACTIONS & PRIORITIES
CDR-ready cities	<ul style="list-style-type: none"> • Deploy multi-pathway programs within 6–12 months. • Lead regional or national CDR infrastructure coordination. • Launch demo projects and share knowledge internationally. • Scale existing strengths while addressing remaining gaps.
High-performing developing cities	<ul style="list-style-type: none"> • Achieve readiness within 12–18 months. • Focus capacity-building on the weakest framework (often governance or infrastructure). • Pilot projects in strong frameworks while strengthening others.
Mid-range developing cities	<ul style="list-style-type: none"> • Achieve readiness in 18–24 months. • Pursue balanced development across frameworks. • Leverage unique local assets through strategic partnerships to overcome resource constraints.
Lower developing cities	<ul style="list-style-type: none"> • Require 24–36 months foundational development. • Prioritize highest-impact framework improvements. • Focus on nature-based solutions requiring less infrastructure.
Emerging cities	<ul style="list-style-type: none"> • Follow the "Learn-Pilot-Scale" approach over 3–5 years. • Years 1–2: Education, policy design, opportunity assessment. • Years 2–4: Pilot demos (nature-based and built environment). • Years 4–5: Systematic CDR deployment across sectors.

COMMON BARRIERS AND OPPORTUNITY PATHWAYS

Despite variation in context, cities face recurring challenges that constrain readiness. Each challenge can be turned into a corresponding opportunity pathway by leveraging sector-specific CDR options suited to urban environments.

CHALLENGE AREA	UNDERLYING ISSUE	OPPORTUNITY PATHWAY	ILLUSTRATIVE EXAMPLE
Policy-integration deficits	CDR not embedded in climate, waste, water or building policies.	Embed CDR into existing planning , waste (water) management, and building codes; develop cross-sector roadmaps with measurable targets.	Helsinki : building-code carbon-footprint limits creating lead markets for carbon-negative materials.
CDR-specific capacity gaps	Limited technical expertise and institutional coordination.	Establish municipal CDR offices and partnerships with universities or research centers; begin with low-infrastructure nature-based pilots .	Stockholm : urban forest management and soil-carbon projects supported by research institutions.
Fiscal autonomy	Cities often lack local carbon-tax or fiscal authority.	Use ancillary taxation to drive incentives, such as property taxes; use carbon-credit revenues, green bonds and PPPs to fund CDR; align with national incentives .	San Francisco : leveraging composting and biochar programs financed through waste-fee structures.
Infrastructure and siting constraints	Dense urban environments limit the feasibility of large-scale facilities.	Focus on distributed, modular, co-location , and CDR pathways embedded in urban systems and infrastructure .	Hamburg : integrating DAC with port industries and CO ₂ shipping routes.
Limited access to geological storage	No assessed city has direct onshore storage; most lack offshore access.	Form regional consortia for shared transport & storage infrastructure ; focus on land-based and chemical storage (e.g. mineralization; carbonation).	Zurich : sewage-sludge CCS with district-heating integration (20 000 t CO ₂ / yr by 2028).

CONCLUSIONS AND FUTURE DIRECTIONS

Urban CDR deployment is feasible within 1-5 years, depending on starting conditions. The diversity of city profiles demonstrates that CDR is not limited to specific types; it requires tailored strategies. The primary barriers are not technological but institutional – governance capacity and cross-level coordination remain the critical enablers.

KEY TAKEAWAYS FROM THE GLOBAL ASSESSMENT:

- 1. Readiness is achievable but varied:** Substantial capacity building is required for most cities. Four cities (31%) have already achieved CDR Ready status across diverse contexts, demonstrating that immediate CDR implementation is feasible.
- 2. No single path to readiness:** CDR Ready cities demonstrate different strengths. This indicates multiple pathways to readiness depending on local context and assets.
- 3. Governance is foundational:** Cities with exceptional governance demonstrate readiness even when infrastructure is constrained. Strong institutional capacity enables strategic deployment regardless of starting infrastructure.
- 4. Universal challenges require collaborative solutions:** Geological storage access, fiscal autonomy limitations and CDR-specific capacity gaps affect all cities. Regional partnerships, innovative financing and systematic capacity building are essential.
- 5. Nature-based solutions offer a universal entry point:** All assessed cities possess opportunities for urban forest, soil carbon and green infrastructure CDR regardless of industrial infrastructure. Nature-based approaches can remove carbon while building capacity for technological CDR, but should only be counted as balancing biological carbon cycle emissions (i.e. like-for-like principle) because of their lower durability and higher vulnerability to leakage or disturbance.
- 6. Legal mandates drive action:** Having a legally binding national net-zero target, complemented with net-negative or climate neutrality commitments at the city-level – codified in city charters, city codes or through local government mandate, legislation or policies – and active CDR projects locally demonstrates that legal frameworks accelerate deployment. Adopting an early net-zero or climate neutrality commitment (e.g. 2030 or 2035) similarly drives urgency.
- 7. Regional leadership opportunities:** CDR Ready cities should establish themselves as regional hubs. This creates knowledge exchange networks and shared infrastructure.

The pathway to CDR Readiness within 5 years is challenging but achievable. Success depends on rapid action, targeted capacity building, sustained political commitment and coordinated regional infrastructure development. The scale of the climate crisis demands this level of ambition – this assessment demonstrates it is within reach. The next chapters outline how cities can: build a supportive governance system; ensure transparency, accountability, equity and justice; craft a diversified funding strategy; assess the local suitability of CDR methods; and embed carbon removal objectives across departments and policy domains.



CHAPTER 2: **STRUCTURING LOCAL GOVERNANCE**

Cities are emerging as essential actors in the global effort to scale CDR. As centers of innovation, governance, public service delivery and infrastructure development, municipalities are uniquely positioned to shape both the supply and the demand for carbon removal. Cities are among the most proactive on environmental and climate policy implementation, often ahead of state and national governments. Yet the ability of cities to fulfill this role varies, as we have seen in the Need-Gap Analysis: municipal authority, resources and political alignment vary widely across jurisdictions.

To unlock the full potential of urban CDR, municipal administrations must be reorganized to act strategically, navigate complex legal and institutional constraints, and collaborate effectively between departments, across levels of government and with local stakeholders. This chapter examines how municipal governments can structure their roles, governance systems and partnerships to accelerate carbon removal deployment and contribute meaningfully to global climate goals and other urban priorities.

PATHWAYS FOR MUNICIPAL AGENCY

Municipal agency is always bounded by legal and political context. Depending on these constraints, cities can take on different roles within the carbon removal ecosystem, using the five levers described in Part 1 (technological, regulatory/policy, urban planning, financial, political-economy). These levers are available to varying degrees and shape the role of the city. The City CDR Initiative identifies six distinct roles for municipal governments, as first presented in the report [The Role of Cities in Advancing Carbon Removal](#) (2024).

- **Strategizer:** The city leads the CDR agenda by setting objectives, guiding local stakeholders, developing robust policy frameworks, providing financial incentives and advancing support infrastructure.¹
- **Regulator:** The city leverages its powers of regulation, to improve the operating environment for CDR developers and investors through targeted regulatory interventions, while securing public support and legitimacy
- **Service provider:** The city integrates CDR into urban planning, treating carbon sinks as a public service embedded in the design and management of the urban and peri-urban environment.
- **Innovator:** The city focuses on building a collaborative research, development and innovation (RD&I) ecosystem, with catalytic funding and the necessary soft infrastructure to accelerate new CDR technologies.
- **Funder:** The city drives demand for CDR through financial incentives, direct public procurement and catalytic early-stage investment that create markets and reduce risk for private actors.
- **Convener:** The city acts as an advocate and enabler of the local CDR ecosystem, fostering awareness and ensuring citizen participation in priority-setting and decision-making.

These roles are archetypes rather than rigid classifications. Cities often operate in multiple modes – acting as a strategizer in one domain while serving as convener in another. Still, establishing a primary role provides strategic coherence, shaping how the city advances CDR within and beyond its boundaries and determining which tools are most effectively deployed.

ORGANIZING THE CDR FUNCTION

Realizing municipal opportunity and agency requires supportive governance systems. A key consideration is whether the internal structure of municipal administration enables – or inhibits – a systemic approach to CDR and carbon sink development. More broadly, today’s global net-zero governance landscape may overlook or even discourage municipal engagement in CDR. Without effective intra-government coordination and multi-level governance, municipal action will fall short of unlocking urban CDR at scale.

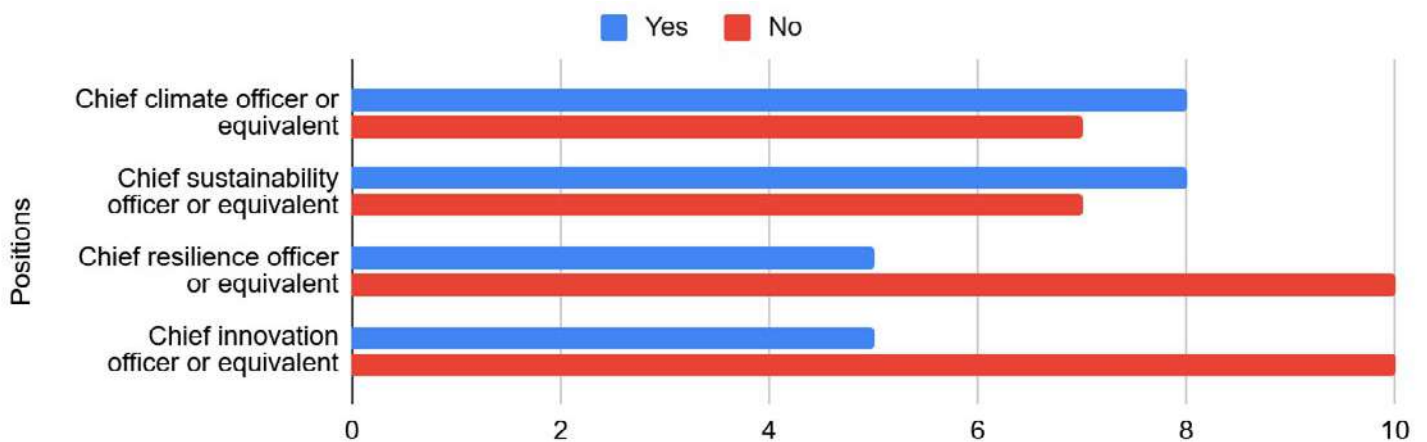
How a city organizes its CDR function depends on priorities, resources and administrative norms. Some cities place sustainability in a high-level standalone department agency or authority, such as a Department of Environmental

¹ Infrastructure is here understood as including both hard and soft infrastructure. Hard infrastructure typically consists of tangible, physical assets such as roads, bridges and power grids. Soft infrastructure includes the intangible systems and institutions that support societies, such as education, law enforcement and workforce development.

Protection. Another approach to elevating the capacity to act on climate and environmental issues is to place the responsibility in the mayor’s office, signaling strong political commitment and authority. These governance set-ups provide a natural structure that is well-aligned with CDR development needs. However, others situate sustainability within departments like public works, utilities or community development – an approach that may tilt the focus toward that department’s core mission. In many cases, sustainability has simply been added as a responsibility within existing teams.

Whichever the set-up, most cities have evolving leadership roles that can anchor CDR strategy, such as climate, sustainability, resilience and innovation officers. While resilience and innovation roles are newer and less widespread, all provide natural homes for key aspects of CDR strategy development, even when there is a central environmental department to coordinate efforts. A hybrid set-up that centralizes policy responsibility, while tactically decentralizing specific implementation responsibilities, enables a more systemic approach to carbon removal development. However, without clear targets, dedicated resources or incentives such as an internal CO₂ price, it may be difficult to leverage these roles for meaningful CDR action.

Figure 01: Presence of CDR relevant expert officials at management level



Source: City CDR Initiative’s 15-city data analysis

Given the range of integration opportunities, instruments and infrastructure dependencies, implementation will span multiple departments. Organizing cross-cutting issues is notoriously difficult in municipal administrations, organized around service delivery function. Yet climate action offers strong precedent: 14 of the interviewed cities already have cross-departmental climate teams. Such structures are vital for an effective organization of the CDR function.

Wherever sustainability leadership sits is where CDR planning and coordination should be concentrated. A hybrid model works best: centralized strategic leadership combined with implementation responsibility distributed across departments, connected through cross-departmental taskforces. Cities should assess governance innovation needs to foster collaboration, embed CDR responsibilities and key performance indicators (KPIs) across teams and strengthen their position in multi-level climate governance.

Raising sustainability to a higher level in the hierarchy increases authority, but siloed structures still limit impact if not addressed. Weak interdepartmental collaboration will continue to undermine integrated policies such as carbon removal. Mechanisms like cross-departmental taskforces, an explicit focus on co-benefits and embedded CDR, and support from elected leadership can enable more systemic action.

NAVIGATING MULTI-LEVEL GOVERNANCE

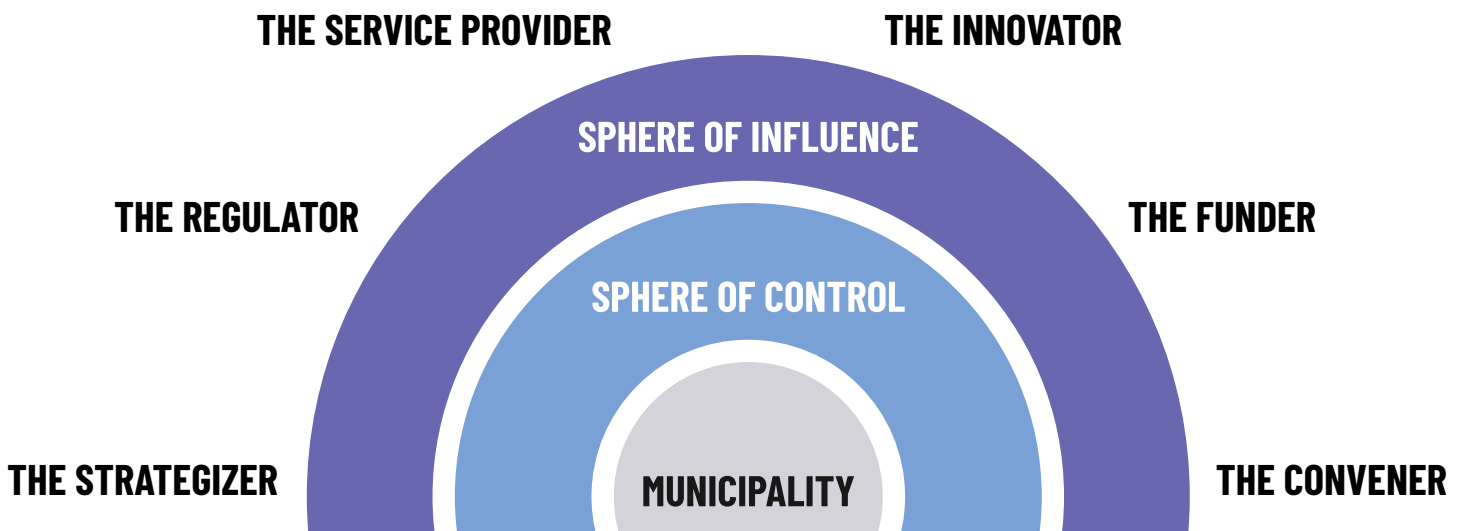
Building the cities of the future also requires coordinated action across levels of government. Municipalities can support carbon removal within and beyond their boundaries through multiple pathways, but their influence is shaped by domestic political and legal context. Relationships with national, regional and private actors can either constrain or unlock municipal agency. International networks increasingly allow cities to strengthen their domestic standing, particularly when higher-level governments lack political alignment on climate ambition. However, municipal governments in national political cultures that prioritize a hierarchical system of governance may find that the risk of perceived ‘overreach’ outweighs network power. As a general rule, cities cannot operate in isolation, but they are far from passive; the more actively they engage in this multi-level environment, the more leverage they gain.

As described in the Need-Gap Analysis, each city’s ability to support CDR varies due to differences in its authority and capacity to act. A local government’s authority to act derives from the mandate it has received from its citizens and the national or sub-national government for municipal action. Its capacity to act concerns the availability of resources, supporting networks, and supportive organizational systems and culture. The specific local circumstances place the local government in different functional roles in relation to the carbon removal ecosystem (as detailed earlier in this chapter): Strategizer, Regulator, Service Provider, Innovator, Funder and Convener. While cities often play different roles across policy areas, clarifying the primary role provides a coherent anchor for CDR policy and investment strategy. This starts by mapping the authority and capacity to act.

Some municipalities are positioned to take a more central role – setting strategy, shaping regulation, mobilizing finance and directly coordinating stakeholders. Others, constrained by limited authority or resources, may concentrate on core service delivery while convening and influencing external actors. Broadly, more political, legal and fiscal competencies expand the number of interventions a city can control directly rather than merely influence.

Understanding the boundary between a city’s sphere of control and its sphere of influence, based on an assessment of its authority and capacity to act, is essential for identifying where the local government can add the most value. It determines how the city can accelerate carbon removal – independently and in collaboration with partners – within and beyond its jurisdiction.

Figure 02: Illustration of a city’s capacity to act



Source: Pathways to Net-Zero Cities report

ADVOCACY AND COMMUNICATIONS

Advocacy and communications needs grow the more a local government operates in its sphere of influence, whichever role it assumes in relation to the CDR stakeholder ecosystem. In this section, we discuss a variety of ‘arenas’ in which city officials will need to advocate, communicate and recommend approaches to secure practical support, political buy-in and social legitimacy, while overcoming institutional and governance barriers to urban CDR at scale.

The chapter ‘Cities as Leaders and Testbeds’ in the preceding report [Pathways to Carbon Sink Cities: Need-Gap Analysis](#) showed that CDR developers expect more from local governments than introducing local policy, regulation and financial incentives. In fact, actions that help strengthen the political economy for local carbon removal were mentioned more frequently in the survey responses, including workforce development, public outreach and regional and national policy advocacy. This also includes local efforts, such as pilots deployed across the built environment – front yard projects – which can demonstrate progress, link CDR to residents’ everyday lives and build the societal case for carbon removal worldwide.

Embedding CDR in the local context is a condition for urban CDR at scale, but this requires that local governments strengthen their capacity to act. The 15-city analysis showed that education across administrations and city leaders is crucial to secure both political mandate and organizational capacity for deploying CDR and carbon sinks. The lack of internal awareness was the single most important impediment mentioned by the respondents. The lack of financial and technical capacity, expertise gaps, organizational siloes, competing priorities and the lack of political mandate were also cited as prominent barriers that local governments must navigate.

Beyond navigating, municipal advocacy is needed to remove barriers, enable multi-level collaboration and inter-departmental strategies, and turn local residents into ambassadors. Such advocacy also includes more direct regulatory lobbying by local governments at the national or regional level, if that is legally allowed in a given country. Many cities fall within a national urban policy framework making them an integral part of a national government’s coordinated strategy to guide the development of its cities toward certain economic, social and environmental goals. In addition, most cities must deal with regional entities with urban planning competencies. Some cities may benefit from a governance set-up defined by ‘home-rule’, giving them more autonomy and authority to act on climate change beyond their state or county. Whereas others may find less space to be ambitious due to a strictly hierarchical set-up.

By better understanding their roles and dependencies in the multi-level system that characterizes a country, local governments can influence the regulatory context and create a more enabling environment for city-led CDR.

ADVOCACY AND COMMUNICATIONS IMPERATIVES

At the end of the day, local governments are constrained by their borders, budgets and ballots. Generally, formal powers and public expectations of local governments revolve around quotidian, immediate, and practical issues (‘pothole fixing’, ‘trash collection’, ‘911’ issues) though this changes in line with the size and national or global exposure of the city and its residents. Most often, local governments also wield far less financial power than their state/province or national peers in terms of their tax base. The utilization of funds is highly contested, generally not spent on ‘nice-to-haves’, but rather quality of life fundamentals: schools, housing, infrastructure, police. Instead of seeing these constraints as a challenge, they are a signal of the unique opportunity cities have to turn the quotidian, immediate and practical into diversified platforms for decentralized CDR deployment and carbon sink ubiquity.

Having the right story is vitally important. The dominant pro-CDR messaging today revolves around arguing its salience: ‘it’s new, it’s separate, it’s urgent and it’s going to be big (expensive).’ This characterization can leave local decision makers and stakeholders without a clear sense of why CDR is relevant to their responsibilities, priorities

and capacities to act. Any city officials eager to engage on the topic should ask themselves: “Why is CDR relevant to us and why are we relevant to CDR?” To embed CDR into broader municipal narratives and attract new cities and funders, CDR messaging should be anchored in widely recognized political priorities and policy frameworks. These frameworks serve as entry points to communicate about CDR as they reflect the most prominent opportunities for embedding CDR objectives.

These features shape the approach to municipal advocacy and communications around CDR. Local governments can follow a set of principles to ensure an effective approach:

1. Embed CDR in the local context:

- a. Narrative** - align with stories that places tell about themselves, or aspire to.
- b. Economy** - focus on past, current and aspirational economic drivers.
- c. Policy** - leverage ‘what’s already on the books’ to incentivize CDR.
- d. Politics** - be tailored to constituencies that hold power and have influence.

2. Do the heavy lifting of education / awareness and baseline acceptance with an appetizer, not a main dish:

- a. Commission studies, conduct citizen surveys, ensure micro actions important to residents and deploy pilot projects as staging posts to demonstrate success and value.
- b. But keep the courses coming. The socialization process must be consistent and ongoing to build a critical mass of support.

3. Be a new solution to an identified challenge and pick a sectoral / political / ideological ‘host’ for your message and campaign to build a coalition around:

a. Adaptation and Resilience:

- i. Frame CDR as a co-benefit of green infrastructure, disaster risk infrastructure, coastal defense and soil health that also has the potential to add funding, such as through carbon credits.
- ii. Embed carbon removal and carbon sink strategies and measurement in adaptation and resilience frameworks and plans across city government departments.
- iii. Call for resilience officers and key municipal utilities (wastewater, drinking water, stormwater management) to integrate carbon sinks into their strategy documents and KPIs.

b. Energy Transition:

- i. Position CDR as a complement to clean energy by addressing unavoidable emissions from hard-to-abate sectors.
- ii. Pair carbon sink development with grid decarbonization, electrification and net-negative public infrastructure.
- iii. Call for energy departments or providers to structurally consider the synergies between emissions reduction interventions and carbon removal, such as shared infrastructure needs.

c. Clean Air and Public Health:

- i. Connect CDR to urban air quality improvements and particulate matter reduction, as well as mental health considerations.
- ii. Position CDR as a public health instrument with municipal health departments.

d. Embodied Carbon and Circular Materials:

- i. Connect CDR to tackling embodied emissions in the context of ambitious city climate goals and sustainable building certification programs.
- ii. Link CDR to building materials and their carbon storing capacity, local procurement policies and net-zero construction.

e. Equity and Poverty Reduction:

- i. Position CDR as an opportunity for environmental justice communities to advance equitable and just climate action.

- ii. Show how CDR-related industries can foster workforce development, job creation and inclusive urban planning.
- iii. Help position CDR as a tool for sustainable, equitable economic development and the revitalization of impoverished neighborhoods.

4. Act through a local coalition (not a single node) and mobilize constituents:

- a. Pursue triangulation to involve three distinct stakeholder nodes and cover gaps that two groups alone cannot address. Together, they cover a lot of ground politically, preempt biases, and suggest a more universal level of support.
- b. Secure grassroots support early on to decentralize and democratize advocacy, and improve the social legitimacy of policies and actual projects.
- c. Establish collaborative frameworks among various stakeholders to encourage broad integration of CDR.

5. Peer power: Spotlight positive outliers and early movers among other cities or local governments with similar constraints, existing connections, or close proximity.

6. Make it real: Make your arguments with tangible objects, projects and moments.

- a. Shovel activism.
- b. Charismatic projects.
- c. Don't be afraid to use the 'cool' factor, but avoid science fiction.

Based on these principles, local governments are advised to craft an advocacy and communications strategy with sustained actions in the following ‘arenas’:

	ARENA	CORE APPROACH
INTERNAL	Other departments/agencies: peers in other parts or relevant agencies whose support is needed for a whole-of-administration approach to urban CDR.	Show how CDR can help realize their priorities
	Political leadership: Mayor and members of the municipal council whose support is needed for a whole-of-administration approach to urban CDR.	Frame CDR leadership as a political asset
	Citizen engagement: residents and citizens within the city whose support is required for a whole-of-society approach to urban CDR.	Show how CDR can improve residents’ quality of life
	Community engagement: communities at or near project location that must be involved in project design and deployment.	Empower local leaders and create local ownership
EXTERNAL	State/Province/National level: governance entities that the local governments legally and/or politically depend on.	Frame cities as testbeds for systemic CDR planning
	Peers near municipalities: regional peers that may be relevant to project-specific value chains and regional advocacy needs.	Highlight shared interests to build regional coalitions
	City networks: knowledge gatekeepers and platforms for peer exchange, such as C40, Global Covenant of Mayors and ICLEI, as well as thematic networks such as the Resilient Cities Network.	Leverage political leaders to advocate for network action
	Quality standards: knowledge gatekeepers and platforms for the standardization of city climate action and reporting, such as GHG Protocol.	Leverage city networks to advocate for recognition
	International fora: leading international organizations, initiatives and campaigns for city climate action, such as UN-Habitat, UNEP, CHAMP and Race to Zero.	Leverage political leaders and city networks to advocate for recognition

RECOMMENDATIONS

Effective organization is the foundation of municipal CDR action. Cities need clear strategic ownership, coordinated delivery structures and strong political backing to unlock their full agency. The recommendations below highlight some core governance shifts that enable cities to move from ambition to execution.

POWERS AND GOVERNANCE:

1. **Clarify the city's primary role** in the CDR ecosystem and identify the most effective levers – regulatory, financial, urban planning, technological or political – to deploy.
2. **Embed CDR strategy development, planning, and deployment in the local context** and realize impact multiplier effects through integrated planning.
3. **Build on where the city is already doing CDR under another name** (e.g. NbS) to ensure ownership and accountability, and de-risk the politics.
4. **Embed CDR responsibilities within existing leadership roles**, especially sustainability and climate, but also resilience/adaptation and innovation functions.
5. **Adopt a hybrid governance model:** centralized strategic leadership paired with distributed implementation across relevant departments.
6. **Establish a cross-departmental CDR taskforce** linking teams that influence CDR opportunities and infrastructure dependencies.
7. **Assess governance innovations**, including shared KPIs, collaboration requirements and new coordination mechanisms, to overcome siloes.
8. **Secure sustained political support** and establish a direct reporting line to senior elected leadership to reinforce authority and continuity.

ADVOCACY AND COMMUNICATIONS:

9. **Anchor CDR messaging in local urban challenges**, widely recognized political priorities and policy frameworks.
10. **Leverage charismatic front-yard projects** to demonstrate progress, link CDR to residents' everyday lives and build the societal case for carbon removal worldwide.
11. **Prioritize municipal advocacy to remove barriers**, enable multi-level collaboration and inter-departmental strategies, and turn local residents into ambassadors.



CHAPTER 3: **PLANNING & TRACKING IMPACT**

As cities move from strategy to implementation, planning and tracking carbon removals become essential components of credible net-zero pathways. Carbon removal must be integrated into climate action in a way that is transparent, just and grounded in robust data. This requires cities to quantify residual emissions, follow clear accounting rules for removals and ensure that community benefits are prioritized in project design and deployment. The maturity of tracking and planning systems will determine whether CDR strengthens climate integrity or becomes a loophole that delays decarbonization. This chapter sets out the methodological, governance and justice considerations needed to embed CDR responsibly within urban climate plans and to ensure that city-level removals contribute meaningfully to national and global progress.

MEASURING RESIDUAL EMISSIONS

Determining what constitutes legitimate residual emissions is far from straightforward. While certain sectors are widely considered ‘hard-to-abate’, the feasibility of decarbonization is shaped by local conditions and technological progress. Carbon removal should therefore remain a complementary measure to emissions reduction, incorporated through iterative analysis, adaptive planning and dynamic target setting.

The EU Climate Neutral and Smart Cities Mission offers practical guidance to cities on how to achieve a state of climate neutrality by 2030. The [Guidance on target setting and emissions inventories](#) recommends that Mission Cities keep residual emissions below 20% of a recent baseline, defining residual emissions as those remaining after all technically and economically viable mitigation measures are exhausted. In the longer term, cities will need to go below 20% residuals to ensure that enough responsible and sustainable CDR capacity will be available for global net-zero and active climate restoration. Measuring residuals requires an ongoing process to:

1. Compare baseline emissions with expected reductions from identified actions to estimate remaining emissions;
2. Analyze residual sources, considering available and emerging solutions and identifying critical constraints; and
3. Continually refine the mitigation portfolio to minimise the need for CDR in reaching net zero, which implies in the longer term cutting residuals to a smaller fraction of baseline emissions.

Transparency is essential to safeguard the integrity of net-zero commitments, particularly given the absence of a standardized approach for defining residuals or assessing avoidability. A useful way is to determine whether obstacles to further mitigation are:

- **Tier 1:** potentially surmountable through additional action or investment; or
- **Tier 2:** beyond municipal control, such as measures requiring higher-level authority (provides a stronger justification for residual emissions).

In the absence of city-specific standards, municipal administrations can draw on the IPCC guidelines for national inventories. Specifically, the [2006 IPCC Guidelines for National Greenhouse Gas Inventories](#) and the [2019 Refinement](#) outline methods for calculating emissions and removals across five key sectors, while the [Paris Agreement's Enhanced Transparency Framework](#) requires national biennial transparency reports with consistent methodologies. These resources can help cities structure robust, credible and legally defensible residual emissions assessments that ensure social acceptance and are aligned with international expectations.

NAVIGATING GHG INVENTORY AND CLAIMS

Including CDR activities and carbon sinks in a municipal GHG inventory requires a structured and transparent approach. Cities making carbon-neutral, climate-neutral, net-zero or net-negative claims must ensure consistency with the national GHG inventory. Because cities are nested within national accounting systems, territorial claims must be aligned and adjusted if outcomes are transferred or traded internationally. Ongoing monitoring is necessary to prevent double-counting, maintain environmental integrity and build an increasingly granular estimate of the urban CDR potential.

Detailed below are the steps a city can take to integrate CDR into its GHG emissions inventory:

1. Establish the system boundary

A clear definition of the urban area and inventory scope is the foundation for accurate accounting. Because city emissions and removals extend beyond administrative borders, system boundaries should align with policy goals and reflect the city's functional footprint. Consumption-based accounting helps avoid burden-shifting outside the boundary and provides a fuller picture of a city's climate responsibility. Cities are recommended to maintain both territory-based inventory and a consumption-based emissions inventory (CBEI), with a progressive transition toward the latter.

2. Collect and analyze the data

With boundaries defined, emissions and removals must be quantified across all relevant sectors, such as the built environment, energy, industry, transport, waste and water, agriculture, forestry and land use, and household consumption. Data sources may include direct measurements, validated models and aggregated national datasets.

3. Report the data

Cities need to apply transparent methods consistent with IPCC guidelines.

a. Determine reporting approach.

Carbon removal can be reported either as a mitigation measure (subtracting removals from source sector emissions) or as a distinct negative emission. Cities are recommended to report negative emissions separately to track progress against dedicated CDR targets. New categories for capture, transport and storage should be established to accurately track removed amounts, including standardized sector-by-sector line items in inventory guidance.

b. Distinguish anthropogenic from natural fluxes.

Countries must differentiate between carbon fluxes caused by human interventions (anthropogenic) and those that are part of natural processes. For land-based sinks, the IPCC recommends using a 'managed land proxy' to report changes resulting solely from human activities.

c. Categorize carbon removal activities separately.

i. Direct CDR: City-led projects such as DAC or BECCS should use a life-cycle approach, reporting only net removals after subtracting emissions from capture and storage.

ii. Land Use, Land-Use Change and Forestry (LULUCF): Track emissions and removals separately within the system boundary for urban green spaces.

iii. Carbon credits: Credits purchased from projects within or outside the city must be accounted for transparently and cannot be subtracted from operational emissions.

d. Report net and gross emissions separately, with gross emissions including all relevant emissions within the systems boundary and excluding any purchased or sold carbon credits.

e. Express aggregate emissions and removals in carbon dioxide equivalent (CO₂e) and use the 100-year time-horizon Global Warming Potential values from IPCC assessment reports.

4. Verify the data

All reported data should be verified, preferably by an accredited third party, to ensure accuracy and prevent misreporting.

SUPPLY CHAINS, LOGISTICS AND INFRASTRUCTURE

Along the urban CDR supply chain, key decisions must be made to ensure cost-efficient, continuous and sustainable operations. Local governments have a role to play in several of these decisions where private sector entities are the project owners and even more when the local government itself leads the project development or has ownership over the public utility infrastructure in which the CDR method is integrated, such as with wastewater treatment plants (WWTPs), waste management or energy management infrastructure. In some cases, their decision-making power may be limited by national/federal or state/province laws; their local insights on the prerequisites and constraints of deploying CDR methods at the urban level then become a valuable contribution to shaping regional and national strategies and their supporting supply chains.

To build urban CDR supply chains and their logistics systems, several areas of decision-making around hard infrastructure are likely to involve city governments and to require their support:

- **Siting choices** – Where is it possible and efficient for the supply chain to locate its different stages? How can cities help mobilize land, repurpose areas and revise zoning codes in favor of urban CDR?
- **Infrastructure design** – What productive, energy, water and transport infrastructure is needed to embed new CDR supply chain activities into existing urban systems? How can local governments help mobilize the often diverse owners and operators, especially of energy and transport infrastructure to support these efforts?
- **Mode choices** – Which transport modes are available and accessible in and around the city, to connect the supply chain most efficiently? How can cities help develop access to transport services that are required for urban CDR to scale at minimal footprint?

As part of the survey sent to the 18 developers in the City CDR Initiative, they were asked about the expectations they have from local governments when it comes to their hard infrastructure needs. This mainly looked beyond the classic cases of having access to public infrastructure such as roads, railways, waterways and ports, with the survey prompts more oriented towards infrastructure assets related to production or processing.

Some did not require any further public support, though this was not reflected in terms of CDR methods or deployment pathways, but is likely the result of having more or less vertically integrated supply chains. Infrastructure components that were mentioned most often and could be considered catalytic enablers of urban CDR include:

1. Renewable energy plants and localized electricity grids.
2. Onshore specialized holding facilities for minerals or materials.
3. Temporary CO₂ storage facilities and biomass storage silos.

Overall, this indicates that the enabling role that local governments can take is heavily skewed towards soft infrastructure development and strengthening. This goes beyond ensuring fair access to traditional public infrastructure assets and maintaining adequate zoning and land-use rules. Developers do not have major expectations from local governments regarding the provision of hard infrastructure, beyond instances where they can provide critical supply chain assets that are beyond the developers' individual ability to secure or where the local government has explicit ownership rights, such as wastewater treatment plants (WWTPs), or is part of a shared ownership structure, such as public-private partnerships used for waste-to-energy plants.

SELECTION OF SUPPLY CHAIN ENABLING MUNICIPAL POWERS

For local governments, it is important to both understand how they can enable access to traditional public infrastructure (road, rail, water), what kind of 'specialized' infrastructure assets they maintain which can be leveraged

for CDR (WWTP, ports) and whether they can invest in additional forms of hard infrastructure that CDR developers can benefit from (special holding facilities, localized grids). In particular municipalities should consider the opportunities for development of CDR as a public utility, benefiting from synergies with existing public infrastructures.

In addition, local governments are called upon to improve the soft infrastructure for the CDR sector, ranging from leveraging policy and regulation, incentivizing research and pilot projects, introducing workforce development initiatives, altering construction and product standards, changing end-of-life rules and establishing green procurement policies.

In summary, local governments have significant agency to support the realization of effective, cost-efficient, sustainable urban CDR supply chains, in both hard and soft infrastructure. Below are some examples of municipal interventions to support urban CDR supply chains.

PREPARING:

- Mapping the availability and management requirements of (waste) materials, including their logistics, preexisting uses and departmental needs, for CDR projects to work.
- Overlay the materials mapping with CO₂ source and product use assessments to facilitate specific urban CDR value chains, such as 'mineralization corridors'.
- Evaluating the availability of residual and waste feedstocks suitable for sustainable biochar production and matchmake opportunities with project developers.

POLICYMAKING:

- Embedding carbon-storing construction materials in urban climate and planning strategies, using city-level inventories and CDR targets to drive uptake.
- Updating building codes, procurement standards and tender processes to explicitly recognize and prioritize carbon-storing materials.
- Introducing or leveraging renovation and demolition permits to enable tracking of embodied carbon or carbon leaving a building and discourage premature demolition through deconstruction requirements.
- Introducing performance-based standards to ensure that materials meet functional, structural, environmental and safety requirements when aiming for carbon storage.
- Examining and shaping transport regulations in collaboration with other jurisdictions that interact with the urban CDR supply chain, such as access codes, safety regulations and hazardous goods transport, to ensure safe and smooth operations.

ENABLING:

- Establishing dedicated collaboration platforms to matchmake CO₂ suppliers, waste material processors, construction product manufacturers and project developers.
- Capacity building and training for procurement officials to facilitate procurement of bio-based materials and bio-based concrete for public construction projects.
- Supporting 'lighthouse' projects that demonstrate technical feasibility, cost-effectiveness and social acceptance of carbon-storing materials.
- Investing in supply chain development, from sustainable forestry and fiber production to waste management, industrial processing and prefabrication of components.

PLANNING FOR ENVIRONMENTAL JUSTICE

Justice is a governance imperative for resilient climate action. Environmental justice aims to address current and historical pollution, toxic waste and other environmental hazards on marginalized communities. It includes issues such as industrial zoning, drinking water contamination, local air quality, local heat stress and access to green spaces. Climate justice is a type of environmental justice with a specific focus looking at the inequality in the impacts of climate change on communities around the world. Both are relevant to CDR in cities.

The environmental justice implications of CDR vary significantly by method, location and governance model. Poorly designed deployment can worsen social and economic inequities, undermine the transition to a circular economy or lock-in continued local pollution. Even well-managed CDR facilities in disadvantaged neighbourhoods may deepen existing environmental injustices, depending on local context. Meanwhile, policies that mandate low-carbon construction materials must be designed carefully to avoid driving up housing costs.

Justice concerns also extend beyond city boundaries. Technologies such as DACS, BECCS and biochar often depend on land, biomass or energy sourced from surrounding regions. Increased demand for biomass could reduce food security and raise prices, disproportionately impacting low-income households. Growing electricity demand to power DAC may raise energy costs and worsen energy poverty and cost burden if not paired with equitable energy access policies. These externalities must be mapped, monitored and eliminated through responsible design and governance.

Yet CDR can also generate justice benefits when intentionally planned. Urban forestry can provide shade, flood protection and slope stabilization – especially valuable for informal settlements or underserved areas. Fire-risk vegetation clearance paired with biochar application can improve resilience and soil health while reducing insurance exclusion risks for vulnerable communities. These examples highlight that governance determines outcomes: cities can shape CDR as part of a just transition through strong oversight and real community participation, ensuring a fair, inclusive and equitable shift to a low-carbon, sustainable economy where no one is left behind.

Environmental justice principles should inform both the ambition and delivery of urban climate strategies. CDR can advance justice across communities, generations and geographies – but if poorly implemented, it can exacerbate inequity just as easily. Cities therefore need clear and inclusive criteria to guide how CDR is funded, deployed and operated, including criteria to determine when to use a public utility model for CDR.

CITY CDR FUNDING TOOLS

A range of climate finance instruments can support urban CDR. While not exhaustive, the following list highlights key tools that cities can leverage in planning and advocacy, with examples of CDR methods for which they could be used. Although cities can establish their own carbon crediting programs for in-boundary carbon sinks such as urban forestry, a diversified funding strategy reduces risk and uncertainty. The funding tools listed below help cities move beyond dependence on volatile voluntary carbon market demand to fund urban CDR projects.

² The [17 Environmental Justice Principles](#) adopted by the Delegates to the First National People of Color Environmental Leadership Summit held on October 24-27, 1991, in Washington DC, serve as a core document in international environmental justice discussions. They can be used by cities to inform their local environmental justice strategy, including in relation to carbon removal deployment.

Figure 03: Overview of funding tools that could be used to support CDR development.

INSTRUMENT	DESCRIPTION	APPLICATION EXAMPLES
Blended finance structures	Combining concessional and commercial capital to improve project bankability.	Mixed CDR projects requiring upfront capital.
Public-private partnerships (PPP)	Collaborative agreements between public and private entities for project delivery.	Carbon curing projects for urban for infrastructure.
Leasing and asset finance models	Financing via leasing rather than outright purchase.	DACS/BECCS units and machinery, biochar reactors.
Aggregation models	Pooling smaller projects to access larger-scale finance.	Small-scale nature-based solutions.
Land value capture (LVC)	Financing projects via increased land value from climate improvements.	Green corridors or parks increasing property values, helping finance urban afforestation.
Carbon markets and emissions trading	Trading of CDR credits to generate revenue.	Verified carbon credits from various CDR solutions.
Municipal own-source revenue and policy Instruments	Local taxes, fees or policy-generated funds.	Local biochar / soil enhancement initiatives.
National government transfers	Funding from higher-level governments.	Broad application to municipal CDR initiatives.
International climate finance	Grants or concessional funding from multilateral bodies.	Targeted finance for CDR / just transition projects.
National, regional and municipal climate funds	Dedicated climate finance funds at various governance levels.	Capacity building, pilot CDR projects.
Payment for ecosystem services (PES)	Incentives for maintaining or enhancing ecosystem services.	Mangrove restoration, biochar and wildfire resiliency.
Viability gap funding	Grants or subsidies to make projects financially viable.	Early-stage or innovative CDR projects
Balance sheet financing (equity)	Direct capital investment by local governments or private investors.	Large-scale commercial projects.
Balance sheet financing (debt)	Loans or bonds issued by local governments or entities, repayable with interest.	Green infrastructure.
Project-level market rate financing (equity)	Equity investments directly into individual projects at market returns.	Municipal BECCS plant.

INSTRUMENT	DESCRIPTION	APPLICATION EXAMPLES
Project-level market rate financing (debt)	Project-specific loans at market interest rates.	Nonrecourse project finance for afforestation projects.
Concessional debt/equity	Favourable financing terms.	Capex-intensive engineered solutions (e.g. venture debt).
Grants	Non-repayable funds from governments or donors.	Nature-based solutions paired with co-benefits / biodiversity projects, e.g. Green Climate Fund grants for mangrove restoration.

Source: Own work

To secure financing for urban CDR, existing and future frameworks should explicitly incorporate CDR to i) ensure eligibility and ii) provide guidance for municipalities, corporates and developers raising finance for the first time. Without explicit inclusion, cities risk relying on indirect or hybrid classifications, undermining sustained funding efforts.

Cities do not have to start from scratch. Several financing models offer high CDR inclusion potential and impact.

- **Green/sustainability bonds:** Programmes like the UK's recent ReGenEarth³ Green Bond Programme provides an example of CDR financing. Local governments can expand existing frameworks – such as the [Green Bond Framework in Bern, Switzerland](#) – to explicitly include CDR, ensuring eligibility and access to capital.
- **Aggregation / pooling models:** Small-scale CDR projects often face both funding and capacity constraints. Pooling multiple projects, either across cities or within local institutions, reduces transaction costs and diversifies risk.
- **Blended finance / public-private co-investment:** Injecting public, philanthropic or national funds into local CDR projects lowers capital costs and attracts private investment.
- **Enabling mechanisms:** Guarantees or first-loss financing⁴ can make early-stage CDR projects more attractive to private investors. Municipalities may guarantee a portion of corporate or project-level debt, or provide first-loss capital in pooled urban CDR funds. Smaller municipalities can offer partial guarantees or partner with regional, national or multilateral development bodies (e.g. World Bank Green Guarantee programme).
- **Other pathways:** Cities can also leverage international or national climate funds, carbon markets, government transfers and philanthropic capital. Challenges at the city level include ticket-size mismatch, perceived subnational credit risk and incomplete project pipeline.⁵

From international finance to mechanisms like Land Value Capture (LVC)⁶, multiple pathways exist for city-level financing. Cities are advised to start by using the flexibility of existing financial instruments to demonstrate projects. They can focus initially on projects and programs that utilize existing and readily accessible financing with CDR outcomes aligned with tangible local benefits - job creation, housing, infrastructure and transit improvements, environmental quality enhancement, park and recreation expansion - while advocating for systemic inclusion of CDR in larger, high-impact financing pathways.

³ Launched a £100 million Green Bond Programme to integrate biochar production into UK anaerobic digestion and biomass sites.

⁴ In such a risk-sharing structure, an investor or entity agrees to absorb the initial portion of any losses in an investment or loan portfolio, protecting other, often more risk-averse, investors from immediate downside, thereby "catalyzing" their participation.

⁵ See [Urban Shift](#) for a further breakdown of these barriers;

⁶ Mechanism to finance projects by capturing increased land value from climate improvements – e.g. restoration works with carbon-storing concrete in sidewalks, public plazas, or municipal buildings.

RECOMMENDATIONS

Robust planning and transparent tracking ensure that CDR strengthens climate integrity rather than substitutes for mitigation and increases social resilience instead of exacerbating historical injustice. Cities must define credible residual emissions strategies, adopt consistent accounting frameworks, anticipate justice implications of both municipal and privately initiated CDR projects, and secure financing that supports responsible deployment.

The recommendations below outline some key steps to embed CDR into urban climate planning in a way that is science-aligned, socially grounded and finance-ready.

GHG ACCOUNTING AND INVENTORY MANAGEMENT:

1. **Limit reliance on CDR** by planning to minimize residual emissions such that the only remaining emissions are both technically hard to abate and socially necessary, with iterative refinement of emissions reduction interventions.
2. **Account removals separate from emission reductions** and make clear distinctions between durable and non-permanent removals.
3. **Use IPCC-aligned guidelines** to assess residual emissions and track CDR activities transparently across all relevant sectors.
4. **Align municipal claims with national accounting systems**, adjusting territorial claims where outcomes are transferred or traded internationally.
5. **Align analytic capabilities in inventory management** by conducting a dual greenhouse gas removal and residual emissions inventory.

SOCIAL LEGITIMACY AND ENVIRONMENTAL INTEGRITY:

6. **Conduct full social and environmental impact assessments**, covering land, energy, materials and potential indirect effects.
7. **Embed climate and environmental justice** through a formal framework that guides funding, siting, oversight and equitable benefits-sharing for all CDR projects.
8. **Require demonstrable and ongoing community engagement**, including affected groups beyond city borders, with evidence of broad support.
9. **Require meaningful community benefits plans** from developers, rooted in public engagement, that goes beyond employment to improve well-being and resilience.
10. **Ensure labor agreements** that guarantee fair wages, safe working conditions and skills development, supported by local institutions.

Public Infrastructure and Resilient Funding:

11. **Define when CDR should operate as public utility infrastructure**, particularly where equity, long-term stewardship or strategic control are priorities.
12. **Promote business models that do not rely indefinitely on credit revenues**, with limits on credit use – restricted to hard-to-abate and socially necessary emissions.

- 13. Advocate for inclusion of CDR in national and international funding frameworks** to ensure eligibility and guide municipalities raising funds for the first time.
- 14. Expand municipal financing options**, including green and sustainability bonds that explicitly include CDR; aggregation models for small-scale or distributed sinks; blended finance and guarantees to de-risk early projects; and land value capture and ecosystem service payment for nature-based solutions.
- 15. Harness public procurement instruments** to create lead markets for carbon storing materials and products and advance carbon sink integration in public works.
- 16. Develop a municipal CDR investment pipeline**, including pre-feasibility support and project standardization to accelerate access to capital.



CHAPTER 4: **ASSESSING SUITABILITY**

CDR needs cities, and cities need CDR. Cities can act as enablers of CDR through their governance structure, policy levers and financial tools. In return, CDR can contribute to broader city priorities, from improving air quality to generating new revenue streams to get new CDR projects off the ground through, for example, carbon credit sales and sustainable urban development. CDR should not compete with existing urban policies but instead enhance them. By leveraging synergies with other domains such as waste management, energy production and urban planning, cities can amplify their sustainability strategies and realize additional benefits, such as economic development, urban resilience and financial innovation.

Assessing project suitability is essential for:

- i. Aligning CDR with broader city priorities (net zero, resilience, justice);
- ii. Ensuring efficient use of municipal resources and capacities;
- iii. Strengthening community trust and legitimacy; and
- iv. Accelerating scalable and replicable CDR models.

A clear suitability framework enables proactive decision-making and strengthens accountability across city departments and stakeholders. The following principles should guide the evaluation of CDR project proposals:

Strategic alignment: Does the project advance the city's climate goals (e.g. net zero, resilience, NbS)?

Contextual relevance: Is the intervention suited to the city's environmental, social and economic landscape?

Long-term feasibility: Is the project technically viable and able to deliver durable CO₂ removals?

Social equity and inclusion: Does it promote fair outcomes and engage vulnerable populations meaningfully?
Institutional readiness: Are governance systems in place to oversee implementation, monitoring and evaluation?

The principles can be used as a checklist or to structure initial project scoping discussions. Building on these principles, this report proposes an **Urban CDR Suitability Assessment Framework** designed to help cities systematically evaluate project suitability across social, economic and technological dimensions. This multi-criteria tool is intended for practical use by cities at varying stages of CDR readiness – some criteria may be more relevant than others depending on local context.

URBAN CDR SUITABILITY ASSESSMENT FRAMEWORK		
SOCIAL CONSIDERATIONS	ECONOMIC CONSIDERATIONS	TECHNOLOGICAL CONSIDERATIONS
Awareness & trust	Total cost & funding pathways	Maturity & provenance
Equity & distribution	Local economic impact	Infrastructure & integration
Participation & governance	Financial resilience & risk sharing	Monitoring, Reporting and Verification (MRV)
Social license & legal acceptance	Alignment with economic strategy	Resource intensity & environmental externalities
Cultural fit & visibility	Opportunity cost & land-use trade-offs	Scalability and replicability

The framework supports cities in:

- **Evaluating feasibility and local fit** of different CDR approaches;
- **Screening projects** for early-stage alignment with city needs, capacities and priorities;
- **Identifying risks and readiness gaps** to inform further analysis;
- **Conducting comparative assessments** across multiple proposals;
- **Prioritizing investment, budgeting and engagement efforts**; and
- **Designing socially responsive and equitable interventions** through inclusive stakeholder processes.

SOCIAL, ECONOMIC AND TECHNOLOGICAL CONSIDERATIONS

The framework is structured across three primary assessment domains – social, economic and technological – each including multiple dimensions and evaluation prompts. While the framework distinguishes between social, economic and technological considerations for clarity, these dimensions are deeply interconnected. Social acceptance can influence funding and policy support; economic feasibility can shape which technologies are viable; and technological choices, in turn, affect local employment, equity outcomes and community trust. Cities should therefore assess these factors holistically, recognizing that progress or shortcomings in one domain may reverberate across the others. Across all three dimensions, co-benefits play a central role: they shape social acceptance, influence economic viability and interact with technological choices, so are therefore integrated throughout the framework rather than in any single dimension.

1. SOCIAL CONSIDERATIONS

Why it matters: Social dynamics – including visibility, land use and equity – can determine whether projects gain acceptance and endure.

DIMENSION	DESCRIPTOR	GUIDING QUESTIONS
Awareness & trust	Public familiarity with both CDR in general and the proposing organization	<ul style="list-style-type: none">• How well do residents understand the CDR method and its benefits and risks?• Have past pilot projects built or eroded trust?
Equity & distribution	Fair allocation of impacts, benefits and burdens	<ul style="list-style-type: none">• Which neighbourhoods or demographic groups gain value and which bear disruption (e.g. noise, land take)?• Are historically marginalized communities engaged early and meaningfully?
Participation & governance	Depth of two-way engagement and institutional capacity to act on feedback	<ul style="list-style-type: none">• Are stakeholders co-design partners or merely informed?• Does the city have clear decision-making channels to integrate community input?

DIMENSION	DESCRIPTOR	GUIDING QUESTIONS
Social license & legal acceptance	Ongoing political, regulatory and community permission to operate	<ul style="list-style-type: none"> Are there existing land-use or permit hurdles? Have local leaders or NGOs voiced support (or opposition)?
Cultural fit & visibility	Alignment with local identity, heritage and urban fabric	<ul style="list-style-type: none"> Does the siting or visual footprint complement (or clash with) neighbourhood character? Does it leverage sense of place (e.g. art, green space) to foster pride rather than resentment?

2. ECONOMIC CONSIDERATIONS

Why it matters: Cities face budget constraints and must prioritise investments with visible returns, co-benefits or alignment with development goals.

DIMENSION	WHAT TO ASSESS	SAMPLE PROMPTS
Total cost & funding pathways	Lifecycle CAPEX/OPEX versus realistic municipal budgets and external financing	<ul style="list-style-type: none"> What is the \$/t CO₂ removed, including maintenance over X years? Which grant, loan or PPP instruments can be tapped and on what terms? How does the cost compare with other mitigation/removal options?
Local economic impact	Net job creation, supply-chain multipliers and secondary revenue streams	<ul style="list-style-type: none"> How many local jobs will be sustained? Can by-products (e.g. biochar, renewable energy) be sold or reused city-wide?
Financial resilience & risk sharing	Allocation of cost overruns, performance guarantees and insurance mechanisms	<ul style="list-style-type: none"> Who bears downside risk if removal targets aren't met? Are there performance bonds or warranties in place?
Alignment with economic strategy	Fit with city's long-term visions	<ul style="list-style-type: none"> Does the project strengthen an existing green-tech ecosystem? Are there anchor institutions (universities, incubators) to partner with?
Opportunity cost & land-use trade-offs	Scarcity of space and competing urban priorities	<ul style="list-style-type: none"> What critical services or developments might be forgone by dedicating this land? Is there a higher-value alternative? Could this biomass, water or energy be used more effectively elsewhere?

3. TECHNOLOGICAL CONSIDERATIONS

Why it matters: Technological feasibility determines whether a CDR project can actually be implemented in a city, now or in the future.

DIMENSION	WHAT TO ASSESS	SAMPLE PROMPTS
Maturity & provenance	Technological readiness level (TRL), track record at city-scale, known failure modes	<ul style="list-style-type: none"> • Has the method been deployed at pilot or larger scale in a comparable climate or urban context? • What are documented operational challenges (e.g. downtime, safety incidents)?
Infrastructure & integration	Compatibility with existing urban systems (energy, waste, transport)	<ul style="list-style-type: none"> • Can the project be plugged into existing waste streams, energy grids or CO₂ networks? • Will new civil works (roads, storage tanks) require major permitting?
Monitoring, Reporting and Verification (MRV)	Robustness, cost and transparency of monitoring protocols	<ul style="list-style-type: none"> • Are there standardized MRV frameworks ready to apply? • How easily can third-party auditors verify removal claims?
Resource intensity & environmental externalities	Energy, water and material inputs versus local availability and grid carbon intensity	<ul style="list-style-type: none"> • What is the kWh/tCO₂ or m³/tCO₂ ratio and can it be supplied renewably / sustainably? • Does the process generate waste streams that require additional treatment?
Scalability and replicability	Potential to ramp up outputs and adapt to evolving policy or spatial conditions	<ul style="list-style-type: none"> • Can capacity be expanded modularly (e.g. add reactors, mobile units)? • How sensitive is the system to land-use changes, regulatory shifts or resource scarcity?

APPLYING THE URBAN CDR SUITABILITY ASSESSMENT FRAMEWORK

The social, economic and technological considerations for assessing project suitability are used as criteria for the Urban CDR Suitability Assessment Framework. Cities can apply the tool in a variety of ways, such as a scoring template (e.g. during procurement or funding decisions), a facilitated workshop exercise (e.g. with community groups or city departments), or an internal feasibility assessment protocol (e.g. within climate planning teams).

Each criterion could be scored on a simple 1-5 scale:

1 = Major barrier or low readiness

3 = Moderate alignment, with conditions or requires adaptation

5 = Strong alignment or high readiness

For each project:

Category	Dimension	Score (1-5)	Justification	Red flag? (Y/N)	Mitigation measures needed	Priority level (high/med/low)

Cities can use this scoring system to: i) identify red flags (scores 1-2) requiring mitigation measures; ii) map strengths and trade-offs visually (e.g. radar or spider chart); or iii) make decisions on whether to proceed, revise or defer projects.

Users may opt to adjust individual criteria in the social, economic and technological dimensions to align with local context and priorities. Depending on its application, the framework could further be adjusted with:

- **Weighted scoring** – to emphasize priority criteria;
- **Qualitative explanations** – to document assumptions and context for each score (e.g. under the “Justification” column); or
- **Traffic light classification** – to provide a quick-glance summary of project fit (green = good fit; yellow = conditional; red = not recommended).



CHAPTER 5: **EMBEDDED PLANNING**

CDR needs cities, and cities need CDR. Cities can act as enablers of CDR through their governance structure, policy levers and financial tools. In return, CDR can contribute to broader city priorities, from improving air quality, to sustainable urban development, to generating new revenue streams to get new CDR projects off the ground through, for example, carbon credit sales. CDR should not compete with existing urban policies but instead enhance them. By leveraging synergies other policy areas such as waste management, energy production and urban planning, cities can amplify their sustainability strategies and realize additional benefits, such as economic development, urban resilience and financial innovation.

SETTING THE STAGE

CDR can be integrated directly into the systems that shape urban life – planning, infrastructure and governance. Embedded CDR Policymaking offers cities a practical pathway to mainstream carbon removal by building it into existing regulatory and operational requirements. This approach delivers three major advantages.

Lower perceived costs: Instead of purchasing high-priced durable CDR credits (often hundreds of €/tCO₂), integration is experienced as a small incremental cost to ongoing activities – such as a modest (0-5%) increase in wastewater treatment costs – strengthening political durability.

Progressive cost distribution: Any cost of removal must be borne somewhere. By attaching costs to specific regulated activities (e.g. data center cooling, industrial wastewater treatment, commercial development), cities can distribute costs more progressively and maintain public support.

Reliable demand signals: Regulatory requirements provide stable, long-term demand that enables investment in retrofits and new projects.

Before cities can effectively implement cross-policy CDR strategies, they must take foundational, upfront actions. These can be categorized as follows:

- **Science:** Establish science-aligned targets to minimize and balance hard-to-abate and socially necessary residual emissions and report progress transparently.
- **Policy:** Define policy goals and assess their hierarchy of importance to ensure CDR aligns with existing strategies.

These preliminary steps provide the framework upon which cities can build a structured, ongoing approach to CDR integration. The development of CDR core policy also requires CDR support policy, such as Research, Development & Innovation and Finance & Investment. Incorporating CDR into urban policies will necessitate updates to GHG accounting frameworks, ensuring that all sources and sinks are tracked systematically and appropriately. Further work is needed in this regard, as discussed in Chapter 3.

To reach net zero, cities will have to go beyond individual mitigation strategies and embed CDR across urban infrastructure and governance structures. CDR must be integrated holistically into urban planning, recognizing that it is both a mitigation tool and a broader resilience and sustainability strategy. Cities function as complex systems where multiple sectors – such as energy, waste, land-use, food, wellbeing – intersect. By embedding CDR across these systems, cities can enhance co-benefits in urban policies, strengthen the financial viability of CDR projects by tying them to essential services and build social legitimacy by positioning CDR as part of broader urban sustainability and socio-economic initiatives.

This chapter introduces a **Framework for Embedded CDR Planning**, developed to guide cities in integrating carbon removal within their planning and governance processes. The framework outlines a continuous cycle of actions that enable cities to iteratively refine and expand CDR strategies while advancing broader urban priorities.

FRAMEWORK FOR EMBEDDED CDR PLANNING

CDR integration into city policies follows a structured framework built around a continuous cycle of action. This framework consists of six key steps, enabling cities to iteratively refine and expand their carbon removal strategies, while advancing other city priorities. It aims to be a process guide for city officials and practitioners to act strategically and practically to integrate CDR, with distinct actions to be taken.

1. IDENTIFY OPPORTUNITIES FOR POLICY SYNERGY

Assess policy areas to find intersections where CDR can enhance or complement ongoing initiatives.

2. MAP CO-BENEFITS & CONNECT TO CITY PRIORITIES

Identify economic, social, and environmental benefits of CDR to align projects with broader city objectives.

3. FRAME THE ROLE OF THE CITY

Define whether the city acts as a strategist, regulator, service provider, innovator, funder, or convener in CDR efforts.



4. COORDINATE ACROSS CITY DEPARTMENTS & STAKEHOLDERS

Ensure interdepartmental collaboration and external partnerships to streamline CDR implementation.

5. IMPLEMENT POLICY INSTRUMENTS & ADJUST REGULATIONS

Deploy regulatory frameworks, financial incentives, and procurement policies to integrate CDR into city planning.

6. TRACK PROGRESS & INTEGRATE INTO GHG ACCOUNTING

Establish MRV systems to measure CDR impact and align with climate targets.

1. IDENTIFY OPPORTUNITIES FOR POLICY SYNERGY

OBJECTIVE:

Ensure that CDR enhances existing city priorities rather than competing with them.

Cities assess how CDR aligns with current policy areas and regulatory frameworks. By identifying synergies, cities can achieve dual benefits from policies they would pursue regardless of CDR.

APPROACH:

1. **Map existing city priorities** across key sectors (e.g. waste management, energy, land use, economic development).
2. **Identify intersections and interdependencies** where CDR provides co-benefits, enhances primary objectives, or activates feedback loops.
3. **Evaluate opportunities for policy adjustments** that could facilitate CDR adoption without necessarily requiring major legislative changes.

POLICY AREA	CITY PRIORITY	CDR SYNERGY
Waste management	Reduce landfill waste	Convert organic waste to biochar for CDR
Urban forestry	Expand green spaces	Enhance tree planting for carbon sequestration
Building (codes)	Promote sustainable construction	Encourage use of carbon-negative building materials

OUTCOME:

A clear roadmap of which policy areas CDR can be embedded in without creating siloed or competing initiatives.

2. MAP CO-BENEFITS AND CONNECT TO CITY PRIORITIES

OBJECTIVE:

Position CDR as a tool that supports environmental, economic and social goals, maximizing its impact and securing broad support.

APPROACH:

1. **Identify core objectives** of urban policies where CDR could play a supporting role.
2. **Quantify co-benefits** of CDR projects (e.g. improving air quality, creating jobs, enhancing urban resilience).
3. **Develop targeted policy recommendations** that optimize both primary policy objectives and CDR-related benefits.

OUTCOME:

A well-structured case for CDR that secures broader political and public support by demonstrating its multi-sectoral value.

3. FRAME THE ROLE OF THE CITY

OBJECTIVE:

Define how the city can act within its spheres of control and influence to drive CDR deployment.

Cities can play multiple roles in climate action and their approach to CDR should reflect these roles. As previously defined, these include:

- **Strategizer** – setting the long-term visions for CDR in urban development.
- **Regulator** – implementing rules and incentives that shape the CDR landscape.
- **Service provider** – managing water, forestry and infrastructure in ways that support CDR.
- **Innovator** – fostering an environment conducive to research and industrial innovation.
- **Funder** – mobilizing public funds, leveraging procurement powers, facilitating private investment and exploring carbon market participation.
- **Convener** – engaging (local) stakeholders, industry and communities in CDR efforts.

APPROACH:

1. **Assess which policies fall under direct municipal control** versus those that require collaboration with regional or national entities.
2. **Match each city role with relevant policy levers** to advance CDR solutions.

OUTCOME:

A clear division of responsibilities that ensures each city department and stakeholder knows its role in implementing CDR.

4. COORDINATE ACROSS CITY DEPARTMENTS AND STAKEHOLDERS

OBJECTIVE:

Foster collaborative governance by ensuring alignment across departments and external partners.

Effective CDR integration requires breaking down policy silos and fostering interdepartmental collaboration and multi-stakeholder engagement.

APPROACH:

1. **Establish an internal CDR governance structure** (e.g. city-level task force or working group) to oversee integration efforts and ensure cross-departmental collaboration.
2. **Develop interdepartmental action plans** aligning climate, infrastructure and economic development strategies.
3. **Facilitate knowledge-sharing and training programs** to build institutional capacity.
4. **Engage external stakeholders** (e.g. private sector, academia, local communities) to contribute resources and expertise.

OUTCOME:

A governance structure that ensures all stakeholders are actively engaged in supporting CDR initiatives.

5. IMPLEMENT POLICY INSTRUMENTS AND ADJUST REGULATIONS

OBJECTIVE:

Provide cities with actionable tools to incentivize, regulate and enable CDR deployment.

Cities can integrate CDR through a mix of regulations, incentives, procurement policies and financial mechanisms.

APPROACH:

1. **Regulatory tools** – update zoning laws, air quality regulations and waste policies to accommodate CDR projects.
2. **Incentives** – offer tax credits, grants and subsidies for CDR initiatives.
3. **Market mechanisms** – support carbon credit trading, PPPs and municipal bonds for CDR funding.
4. **Public procurement** – prioritize carbon-negative materials in city projects and leverage tendering systems to reward companies with strong carbon performance.
5. **R&D and innovation support** – partner with research institutions to advance urban-scale CDR solutions.

OUTCOME:

Cities have a flexible toolkit to drive CDR integration through policy interventions tailored to their specific context.

⁶ For example, the [CO₂ Performance Ladder](#) in the Netherlands used by public contractors.

6. TRACK PROGRESS AND INTEGRATE INTO GHG ACCOUNTING

OBJECTIVE:

Ensure that CDR efforts are measured, reported and aligned with climate targets.

For CDR to be fully embedded in urban climate planning, it must be incorporated into GHG accounting frameworks. This requires:

- **Adapting city-level GHG inventories** to account for both reductions and removals.
- **Ensuring transparency** in how CDR is reported and verified.
- **Aligning with global standards** (e.g. IPCC, GHG Protocol) to maintain credibility.

APPROACH:

1. **Integrate removal metrics into climate reporting tools.**
2. **Regularly update policies** based on monitoring and evaluation of results.

OUTCOME:

A transparent and accountable system that enables cities to measure progress towards net zero and adjust strategies accordingly.

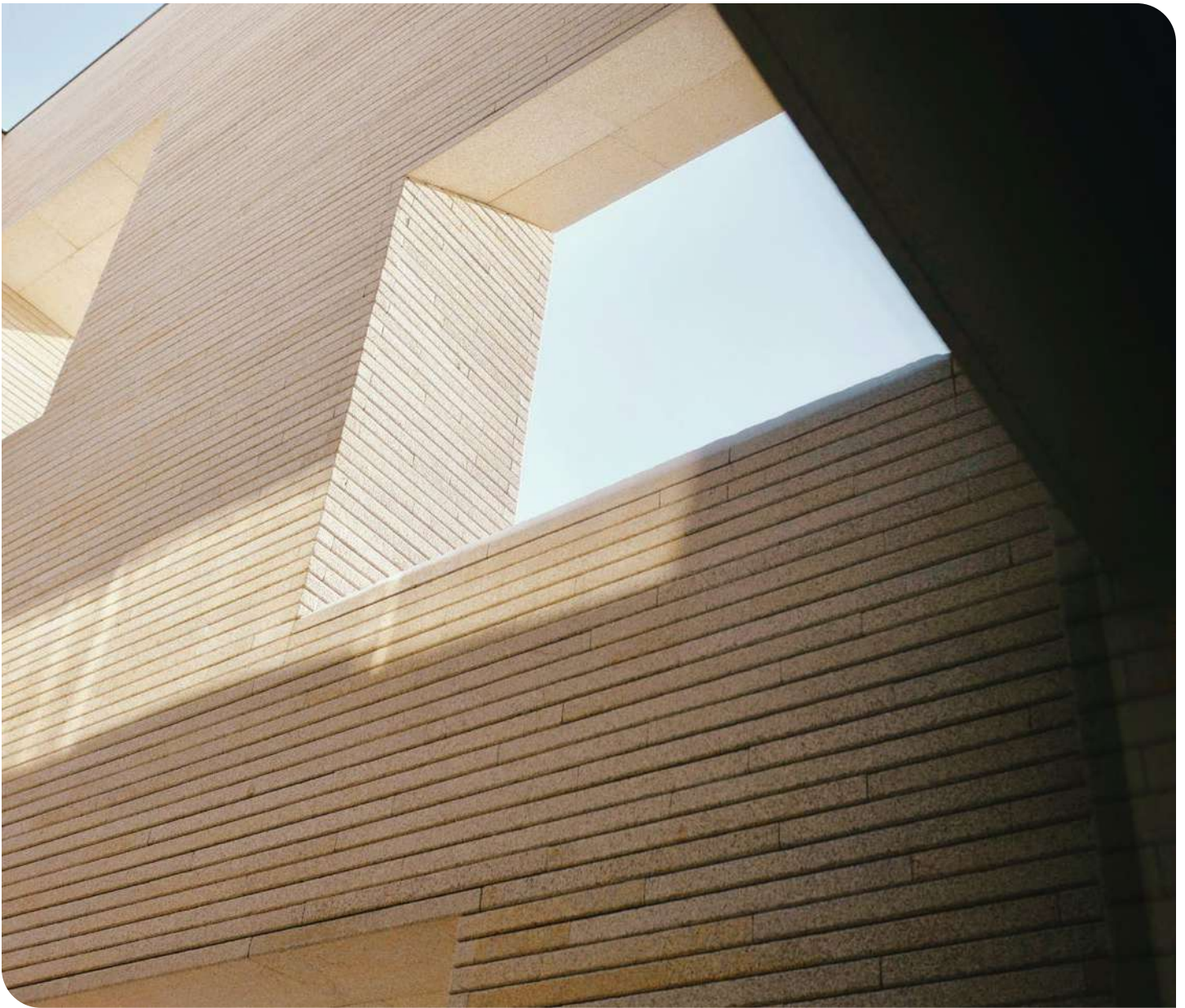
KEY CITY CDR POLICY INTERSECTIONS

The framework for cross-policy integration provides a strategic and practical approach to embedding CDR across urban policies. The first step is to focus on specific policy areas where CDR can have the greatest impact.

A number of key policy verticals have been identified, in which CDR policy and City policy intersect and can strengthen each other. Ten policy intersection factsheets have been developed and can be found in the Annex. The policy factsheets help operationalize this framework by offering insights for city officials on how to implement CDR solutions in different sectors, leveraging synergies and maximizing co-benefits. While they are not exhaustive, they provide initial deep dives into key relevant topic areas.

THE FOLLOWING POLICY AREAS ARE COVERED IN THE FACTSHEETS:

- Land use planning and zoning
- Urban design and infrastructure
- Waste management
- Energy management
- Water management
- Agriculture and food systems
- Economic development
- Biodiversity and ecosystem services
- Adaptation and resilience
- Public education and community engagement



CONCLUSION & ACKNOWLEDGEMENTS

Cities stand at the centre of the transition toward a net-zero and, eventually, net-negative world. This Implementation Guide shows that while CDR approaches are developing quickly, the ability of cities to advance them depends far more on governance clarity, internal coordination, planning processes and the confidence to take early steps. Becoming a “carbon sink city” is not a technological project alone – it is an institutional, social and economic one.

THROUGHOUT THIS GUIDE, SEVERAL THEMES HAVE EMERGED:

- First, readiness is something local governments can deliberately cultivate by: strengthening governance systems, aligning infrastructure policy and operational capacity, they create the conditions for meaningful, high-quality CDR deployed systematically across the urban environment.
- Second, local governments benefit from establishing clear internal ownership of CDR across departments: identifying responsible teams, enabling cross-departmental coordination, establishing supportive internal policies and collaborative frameworks among departments, engaging residents and stakeholders early to build trust, and addressing the logistical needs of particular urban CDR value chains from the outset.
- Third, integrating CDR into planning and tracking systems strengthens the governance and effectiveness of local climate strategies, clarifies the scale of residual emissions and helps understand how removal can complement emissions reduction, climate adaptation and equity goals. It also brings transparency and accountability, vital conditions for social legitimacy.

A further insight is that good CDR decisions require holistic assessment. The Urban CDR Suitability Assessment Framework introduced in this Guide allows cities to evaluate potential projects across interconnected, social, economic and technological dimensions. It highlights that technical feasibility alone is insufficient: co-benefits, community alignment, economic resilience, MRV robustness and long-term responsibility matter just as much. Finally, embedding CDR into existing municipal systems – waste, energy, buildings, land use, procurement, education and more – ensures that CDR strengthens core urban functions rather than sitting apart from them, contributing to the long-term objective of integrating CDR and carbon sinks into the very fabric of our cities.

Taken together, the tools and processes presented here form an implementation pathway that cities can adapt to their own context, capacity and ambition. This pathway is iterative rather than linear: cities may move back and forth between organising, planning, building readiness, assessing options and embedding CDR as learning accumulates and opportunities evolve. This conclusion also aligns with the other components of the Pathways to Carbon Sink Cities series. The **Vision Paper** establishes why cities matter to global CDR and what a carbon-sink future could look like. The **Need-Gap Analysis** identifies the barriers cities face and the system changes required to overcome them. This **Implementation Guide** provides the practical tools to act: frameworks, processes and methods that cities can use immediately, even at early stages of readiness.

Together, the Carbon Sink Cities series offer a clear narrative and a practical roadmap to local governments wanting to increase the ambition of their climate action efforts: from high-level vision, to understanding system needs, to taking concrete steps toward responsible, equitable and durable carbon removal. By applying and iterating on these tools – and by learning collectively – cities can bring about a future in which CDR supports local development goals, fosters regenerative models, strengthens resilience and contributes meaningfully to global climate stability.

The path to Carbon Sink Cities is emerging, collaborative and adaptive. Cities do not need to wait for perfect information or mature markets to begin; they can start where they are today, build capacity gradually and lead by example. With thoughtful planning and deliberate action, urban areas can become catalysts of high-quality carbon removal, turning cities into agents of climate restoration – helping shape a climate-secure, socially just and economically vibrant future.

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ANNEX

ANNEX 1: CITY CDR READINESS METHODOLOGICAL FRAMEWORK

Cities, as major contributors to global carbon emissions and centers of innovation, are uniquely positioned to implement CDR solutions at scale. However, the successful integration of CDR technologies and nature-based solutions requires a comprehensive assessment of urban readiness across multiple dimensions. This chapter presents a systematic framework for evaluating city-level CDR readiness, developed through the assessment of 13 cities across diverse geographic and developmental contexts.

The City CDR Readiness Assessment provides a standardized methodology for measuring and comparing urban capacity to implement carbon removal strategies. By synthesizing governance structures, policy frameworks and infrastructural capabilities into a composite index, this assessment tool enables cities to identify strengths, diagnose gaps and prioritize interventions for CDR implementation.

1. PURPOSE AND SCOPE OF THE ASSESSMENT

The City CDR Readiness Assessment serves multiple strategic purposes in advancing urban carbon removal initiatives:

1.1 CORE OBJECTIVES

- **Diagnostic function:** To provide cities with a comprehensive evaluation of their current capacity to implement CDR solutions, identifying both enabling factors and critical barriers across governance, policy and infrastructure domains.
- **Benchmarking tool:** To establish a standardized framework that allows for meaningful comparison of CDR readiness across cities with different developmental contexts, climate zones and governance structures.
- **Strategic planning resource:** To inform targeted capacity-building interventions by quantifying the relative importance of different readiness dimensions and highlighting priority areas for improvement.
- **Progress monitoring:** To enable longitudinal assessment of city readiness evolution, tracking improvements over time and measuring the effectiveness of capacity-building initiatives.
- **Knowledge exchange platform:** To facilitate peer learning by identifying CDR-ready cities that can serve as models and mentors for developing cities.

1.2 ASSESSMENT SCOPE

The assessment framework encompasses the full spectrum of CDR modalities relevant to urban contexts, including:

- Nature-based solutions (urban forestry, green infrastructure, soil carbon sequestration)
- Technological CDR approaches (direct air capture, bioenergy with carbon capture and storage)
- Hybrid solutions (biochar production and application, enhanced weathering)
- Policy and market-based mechanisms (carbon credit systems, procurement frameworks)

The framework assesses readiness for both pilot-scale demonstrations and scaled implementation, recognizing that cities exist along a developmental continuum from emerging interest to advanced deployment.

2. ASSESSMENT FRAMEWORK ARCHITECTURE

The City CDR Readiness Assessment employs a three-framework architecture, each examining a critical dimension of urban readiness through a two-axis evaluation matrix. This multi-dimensional approach recognizes that CDR readiness emerges from the complex interplay of political will, institutional capacity, policy sophistication and physical infrastructure.

2.1 FRAMEWORK 1: GOVERNANCE & ACCOUNTABILITY

This framework evaluates the political and institutional foundations necessary for sustained CDR implementation.

Political resonance axis: Measures the degree to which CDR aligns with city political priorities, leadership commitment and stakeholder engagement. This axis assesses whether CDR has secured political champions, features in strategic planning documents and enjoys cross-party or multi-stakeholder support. High political resonance indicates that CDR transcends electoral cycles and bureaucratic silos.

System capacity axis: Evaluates the institutional infrastructure required to implement CDR programs, including dedicated staff, technical expertise, inter-departmental coordination mechanisms and monitoring capabilities. This axis examines whether the city possesses the organizational architecture to translate political commitment into operational programs.

The intersection of these axes creates four quadrants representing different readiness profiles: cities with high political resonance and high system capacity are "CDR Champions"; those with strong political will but limited institutional capacity are "Ambitious Aspirers"; cities with capable systems but limited political prioritization are "Sleeping Giants"; and those low on both dimensions are "Emerging Contexts."

2.2 FRAMEWORK 2: POLICY & REGULATION

This framework examines the regulatory and policy architecture that enables or constrains CDR implementation.

Policy innovation axis: Assesses the presence and sophistication of policies specifically designed to promote CDR, including carbon removal targets, financial incentives, procurement frameworks and integration with broader climate action plans. This axis evaluates whether the city has moved beyond general climate commitments to develop CDR-specific policy instruments.

Regulatory coherence axis: Measures the degree to which existing regulations facilitate or impede CDR deployment. This includes land-use regulations that affect nature-based solutions, permitting frameworks for technological CDR, environmental safeguards and alignment between city, regional and national regulatory frameworks. High regulatory coherence indicates that regulations across different domains are aligned and streamlined for CDR implementation.

Cities scoring high on both axes have established clear policy frameworks that actively promote CDR while ensuring regulatory pathways are navigable and coherent.

2.3 FRAMEWORK 3: SYSTEM & INFRASTRUCTURE

This framework evaluates the physical and technical foundations for CDR implementation.

Infrastructure readiness axis: Assesses the availability of essential physical infrastructure, including land availability for nature-based solutions, energy infrastructure for technological CDR, water systems, transportation networks

for biomass or captured carbon and monitoring infrastructure. This axis evaluates whether the city possesses the fundamental assets required for CDR deployment.

Integration potential axis: Measures opportunities to integrate CDR into existing urban systems and development pipelines. This includes synergies with waste management, water treatment, urban planning, energy systems and economic development initiatives. High integration potential indicates that CDR can be embedded within ongoing urban processes rather than requiring entirely parallel infrastructure.

The interplay between these axes reveals whether cities have the physical foundations for CDR and whether implementation can leverage existing systems or requires new standalone infrastructure.

3. DIMENSIONAL SCORING SYSTEM

Each of the six axes across the three frameworks is evaluated using a standardized four-point scale, converting qualitative assessments into quantitative scores that enable comparison and aggregation.

3.1 SCORING RUBRIC

The four-point scale reflects distinct levels of capability and readiness:

Score 4 (Excellent: Leading practice): The city demonstrates comprehensive capability with minimal gaps. Systems, policies, or infrastructure are at or beyond international best practice. The city is ready for immediate advanced CDR implementation and can serve as a model for others. Evidence includes: dedicated CDR programs with allocated budgets, specialized staff, established implementation protocols and demonstrated results from pilot or operational programs.

Score 3 (Good: Strong foundation): The city has developed strong foundational capabilities with minor gaps that do not significantly impede implementation. Most elements are in place and functioning effectively. The city can proceed with CDR implementation with limited additional support or capacity building (typically addressable within 3-6 months). Evidence includes: relevant policies or infrastructure in place, cross-functional coordination mechanisms established and preliminary studies or plans completed.

Score 2 (Developing: Basic capability): Basic capability is present but significant gaps exist that require targeted development before full CDR implementation. The city has initiated relevant processes but lacks maturity or comprehensiveness. Implementation requires 12-24 months of focused capacity building. Evidence includes: general climate commitments that could encompass CDR, some relevant infrastructure or policies but not specifically tailored to CDR and awareness of CDR opportunities but limited concrete action.

Score 1 (Emerging: Limited capability): Limited or nascent capability with major gaps across multiple dimensions. The city requires foundational capacity building before CDR implementation can commence. Development requires 2-5 years of systematic investment in governance, policy, or infrastructure. Evidence includes: absence of CDR-specific frameworks, limited technical knowledge and CDR not integrated into strategic planning.

3.2 FRAMEWORK-LEVEL AGGREGATION

Individual axis scores are aggregated to produce framework-level scores, representing overall readiness in each of the three dimensions:

- Governance & Accountability Score (GAS) = (Political Resonance Score + System Capacity Score) ÷ 2
- Policy & Regulation Score (PRS) = (Policy Innovation Score + Regulatory Coherence Score) ÷ 2
- System & Infrastructure Score (SIS) = (Infrastructure Readiness Score + Integration Potential Score) ÷ 2

These framework-level scores (ranging from 1.0 to 4.0) provide intermediate assessments that identify whether governance, policy, or infrastructure represents the primary constraint or enabler for a given city.

4. THE COMPOSITE READINESS INDEX (CRI)

4.1 CRI CALCULATION METHODOLOGY

The Composite Readiness Index synthesizes the three framework-level scores into a single metric that captures overall city readiness for CDR implementation. The index employs differential weighting to reflect the relative importance of each framework dimension:

$$CRI = (0.35 \times GAS) + (0.35 \times PRS) + (0.30 \times SIS)$$

The resulting CRI ranges from 1.0 (minimal readiness across all dimensions) to 4.0 (comprehensive readiness), providing a standardized metric for comparing cities and tracking progress over time.

4.2 WEIGHTING RATIONALE

The differential weighting reflects strategic insights about the relative importance and modifiability of different readiness dimensions:

Governance & Accountability (35%): Governance receives the highest weight alongside policy because political commitment and institutional capacity are foundational prerequisites. Without political resonance and system capacity, even excellent policies and infrastructure will fail to translate into effective CDR programs. Governance also represents the dimension most resistant to rapid change—building political consensus and institutional capacity typically requires extended time horizons, making early attention critical. The 35% weight reflects that governance simultaneously acts as both enabler and constraint for all other dimensions.

Policy & Regulation (35%): Policy frameworks share top weighting with governance because they determine the long-term scalability and sustainability of CDR initiatives. Well-designed policies create enduring structures that persist beyond individual political cycles, champion programs, or pilot projects. Policy innovation and regulatory coherence shape market conditions, mobilize private investment and align diverse stakeholders toward common objectives. The equal weighting with governance reflects that robust policies can sometimes partially compensate for governance limitations and vice versa, but both are essential for sustained success.

System & Infrastructure (30%): Infrastructure receives slightly lower weighting because it represents the most readily modifiable dimension. While physical infrastructure is necessary for implementation, it can be developed relatively quickly when governance support and policy frameworks are in place. Cities can build monitoring systems, retrofit facilities, or adapt existing infrastructure within 6–18 months given appropriate resources and authorization. The 30% weight acknowledges infrastructure's importance while recognizing it is derivative of governance and policy commitment rather than determinative of them.

This weighting structure embodies a strategic insight: cities seeking to improve their CRI most efficiently should prioritize governance and policy development in early stages, building infrastructure in parallel but not in advance of political and regulatory foundations.

4.3 FRAMEWORK CONTRIBUTION ANALYSIS

The weighted calculation enables analysis of how each framework contributes to the overall CRI. For any city, the contribution of each framework is calculated as:

Framework Contribution = Framework Score × Weight

This contribution analysis serves multiple analytical purposes. First, it identifies relative impact—revealing which frameworks are driving overall readiness versus constraining it. Second, it highlights priority areas for improvement by showing where marginal investments will yield the greatest CRI increases. Third, it enables strategic scenario planning, allowing cities to model how improvements in specific frameworks would affect overall readiness.

For example, a city with high policy and infrastructure scores but low governance scores might have a moderate CRI, but contribution analysis would reveal that governance represents the binding constraint. Conversely, a city with moderate scores across all frameworks might achieve similar overall CRI, but the contribution analysis would indicate more balanced development requirements across all dimensions.

5. READINESS CLASSIFICATIONS AND IMPLEMENTATION IMPLICATIONS

Cities are classified into three readiness tiers based on their CRI scores. These classifications carry specific implications for implementation strategy, capacity-building requirements and expected timelines.

5.1 CDR READY CITIES (CRI 3.0 - 4.0)

Definition: Cities scoring between 3.0 and 4.0 demonstrate comprehensive readiness across governance, policy and infrastructure dimensions. These cities exhibit strong performance on multiple axes within each framework, with few critical gaps.

Characteristics:

- CDR is explicitly prioritized in city climate strategies with dedicated targets and timelines
- Specialized staff or units assigned to CDR program development and implementation
- Clear policy frameworks including incentive mechanisms, procurement guidelines, or regulatory pathways
- Essential infrastructure either in place or readily adaptable to CDR applications
- Established monitoring, reporting and verification capabilities

Implementation Capacity: These cities can launch comprehensive CDR programs within 6-12 months. Implementation can proceed immediately from strategic planning to operational deployment. These cities are positioned to serve as early adopters, demonstration sites and models for peer cities.

Strategic Focus: Priorities include scaling proven interventions, advancing technical innovation, establishing monitoring protocols and sharing lessons learned with developing cities.

5.2 CDR DEVELOPING CITIES (CRI 2.0 - 2.9)

Definition: Cities in this range demonstrate moderate readiness with significant capability in some dimensions but notable gaps in others. These cities have initiated CDR-relevant processes but require targeted strengthening before comprehensive implementation.

Characteristics:

- General climate commitments that could encompass CDR but lack CDR-specific frameworks
- Nascent political support or institutional interest in CDR
- Some relevant policies or infrastructure but not comprehensively tailored to CDR
- Technical awareness of CDR opportunities but limited operational experience
- Capacity constraints in one or more critical areas (typically governance or specialized infrastructure)

Implementation Capacity: These cities require 12-24 months of targeted capacity building before comprehensive CDR implementation. During this period, cities should focus on pilot projects, policy development, stakeholder engagement and infrastructure planning.

Strategic Focus: Priorities include strengthening the weakest frameworks identified through contribution analysis, building technical capacity through partnerships with CDR-ready cities, developing CDR-specific policy instruments and establishing dedicated governance structures.

5.3 CDR EMERGING CITIES (CRI 1.0 - 1.9)

Definition: Cities scoring below 2.0 are in early stages of CDR readiness development. These cities typically exhibit limited capability across multiple frameworks and require foundational capacity building.

Characteristics:

- CDR is not explicitly addressed in city planning or policy documents
- Limited awareness or understanding of CDR opportunities among decision-makers
- Absence of dedicated governance structures or policy frameworks for CDR
- Infrastructure constraints or competing priorities that limit near-term CDR focus
- Potential for CDR integration but requiring substantial groundwork

Implementation Capacity: These cities require 2-5 years of foundational development before comprehensive CDR implementation. This period focuses on awareness building, governance establishment and strategic planning rather than operational deployment.

Strategic Focus: Priorities include building political awareness and support for CDR, conducting baseline assessments and feasibility studies, integrating CDR into broader climate action planning, developing partnerships with technical experts and CDR-ready cities and identifying "quick win" opportunities that build momentum and demonstrate value.

6. APPLICATION AND LIMITATIONS

6.1 ASSESSMENT PROCESS

The CDR Readiness Assessment is conducted through a structured multi-stage process:

Desktop Review: Analysis of publicly available documents including climate action plans, policy frameworks, strategic plans and infrastructure inventories.

Stakeholder Consultation: Structured interviews with city officials, technical staff, policy makers and relevant external stakeholders to validate documentary findings and assess operational realities.

Expert Scoring: Application of the scoring rubric by trained assessors with expertise in urban climate policy, CDR technologies and governance systems.

Validation Workshop: Review of preliminary assessments with city representatives to ensure accuracy, address information gaps and refine scores based on additional evidence.

Comparative Calibration: Cross-city comparison to ensure consistency in scoring standards and interpretation of rubrics.

6.2 METHODOLOGICAL LIMITATIONS AND CONSIDERATIONS

While the CRI provides a robust framework for assessing readiness, users should be aware of several important limitations:

Temporal Snapshot: The assessment captures readiness at a specific point in time. Cities evolve rapidly; assessments should be refreshed periodically (recommended every 18-24 months) to track progress and reflect changing conditions.

Qualitative Judgment: Despite standardized rubrics, axis scoring involves expert interpretation. While validation processes minimize inconsistency, some subjectivity is inherent in converting complex qualitative realities into numerical scores.

Context Dependency: The framework applies universal criteria, but local context affects how readiness translates to implementation success. Cultural factors, political systems and economic conditions not fully captured in the index may significantly influence outcomes.

Technology Neutrality: The assessment evaluates general CDR readiness rather than readiness for specific technologies. A city may be well-prepared for nature-based solutions but less ready for direct air capture, yet receive a single composite score.

Linear Aggregation: The mathematical averaging of scores assumes substitutability between dimensions. In reality, severe deficiency in one area may not be fully compensated by excellence in another. The framework partially addresses this through weighting, but threshold effects may exist.

Data Availability: Assessment quality depends on information availability. Cities with comprehensive documentation and transparent governance may score higher partly due to better information rather than solely superior capability.

6.3 RESPONSIBLE APPLICATION

The CRI should be interpreted as a diagnostic and planning tool rather than a prescriptive judgment. Lower scores do not indicate city failure, but rather identify development priorities and realistic timelines. Higher scores do not guarantee implementation success without sustained commitment and resources. The framework is most valuable when used to:

- Guide strategic planning and resource allocation for CDR capacity building;
- Facilitate peer learning by connecting cities at different readiness stages;
- Track progress over time through repeated assessments;
- Inform tailored support programs that address specific framework gaps; and
- Build political will by demonstrating concrete readiness improvements.

CONCLUSION

The City CDR Readiness Assessment Framework enables a comprehensive, systematic approach to evaluating urban capacity to implement CDR strategies. By disaggregating readiness into governance, policy and infrastructure dimensions and by quantifying capability along standardized axes, the framework enables cities to move from aspirational climate commitments to strategy development and concrete implementation planning.

The assessment of 15 cities reveals substantial variation in readiness, confirming that successful CDR implementation requires intentional capacity building tailored to each city's specific constraints and opportunities. A Composite Readiness Index with the underlying framework scores is provided to each city to give them diagnostic clarity about their current state and strategic guidance about priority interventions. While this is currently not shared publicly, it is intended to feed into a publicly available City CDR Readiness Index.

As CDR transitions from niche demonstration projects to essential climate infrastructure, standardized readiness assessment becomes increasingly critical. This framework offers cities a practical tool for self-evaluation, a benchmark for comparing progress against peers and a roadmap for building the multi-dimensional capabilities required for effective carbon removal at urban scale. By making readiness transparent and measurable, the assessment accelerates the journey from climate ambition to carbon removal action.

ANNEX 2: CITY CDR CROSS-POLICY FACTSHEETS

STANDARD STRUCTURE

Brief overview of policy area	Description of the policy area and its main objectives within the urban context. Explaining why it is important for city development, sustainability or community well-being
	Introducing how CDR solutions can align with, enhance or transform this policy area. Focusing on co-benefits. Highlighting the potential synergies between CDR initiative and existing city priorities, showing how integrating CDR can advance both climate and non-climate goals.
Key strategies for integration	Tools: Policy adjustment or enhancement – ways the policies can be adjusted or enhanced to incorporate CDR (e.g. creating incentives, updating regulations, integrating CDR requirements within existing frameworks).
	Support actions: Programme development – proposing the creation of new initiatives that leverage CDR (e.g. pilot projects, community engagement programmes or partnerships).
	Collaborations: Collaboration and partnerships – identifying potential stakeholders or stakeholder groups who could collaborate to implement CDR-enhanced policies. Outlining ways cities can foster these partnerships to share resources, expertise and benefits.
Challenges and solutions	Barriers – discussing potential challenges that may arise when integrating CDR in the policy area (e.g. regulatory hurdles, financial limitation, tech gaps, social resistance, trade-offs).
	Solutions – recommending actionable solutions to overcome barriers (e.g. changes in policy, funding mechanisms, community engagement, tech advancements).
	Enabling conditions – highlighting key conditions that need to be in place for successful integration (e.g. regulatory frameworks, funding availability, public awareness campaigns)
Future opportunities	Scaling & replicating – offering insights on larger-scale implementation or adaptation in various settings.
	Innovation & research – identifying opportunities for further research/ development with relevant stakeholders
Link to other policy areas – linkages to other factsheets	

LAND USE PLANNING AND ZONING

Standard structure		Land use planning and zoning
Brief overview of policy area	Description	Land-use planning and zoning shape how cities grow, balancing competing demands for housing, commerce, infrastructure and green space. Inclusive planning helps manage urban growth, reduce sprawl and enhance public health. Strategic development allows cities to accommodate growing populations (55% urban today, possibly 66% by 2050) while limiting emissions. Well-designed land use supports UN SDGs (e.g. SDG11 for sustainable cities) and improves quality of life through green infrastructure, housing and transport choices.
	How CDR aligns	CDR solutions align with land-use planning by embedding carbon removal directly into zoning and development policies. Cities can allocate space for urban forests, DAC hubs or parks enhanced with biochar and ERW. These interventions improve air quality, expand green infrastructure and support biodiversity. For example, urban vegetation has been shown to naturally remove 2–7% of a city’s CO ₂ emissions. Integrating CDR into planning frameworks enables cities to protect existing carbon sinks (trees, soils) and design new ones, advancing both climate goals and broader priorities like health, resilience and livability.
Key strategies for integration	Tools	<p>Update zoning codes to designate areas for high-carbon sequestration uses (e.g. urban forests, ERW corridors).</p> <p>Mandate green infrastructure (e.g. green roofs, urban forests, community gardens) in specific zones.</p> <p>Include carbon sequestration goals in environmental impact assessments and master planning processes.</p> <p>Offer developer incentives (e.g. expedited permitting, tax abatements) for exceeding carbon-storage benchmarks.</p>
	Support actions	<p>Launch urban greening initiatives retrofitting underutilized land (e.g. medians, vacant lots) with CDR-focused vegetation.</p> <p>Develop grants and technical assistance for neighborhood-based carbon farming and tree planting.</p> <p>Engage in GIS mapping of urban carbon stocks to guide zoning and development.</p>
	Collaborations	<p>Partner with planning departments, zoning boards, developers and legal experts to integrate CDR-supportive land use codes (e.g. for biochar facilities or green buffers).</p> <p>Coordinate regionally with neighboring jurisdictions to establish shared carbon sink projects, like reforestation corridors or carbon farming zones.</p> <p>Collaborate with academic institutions for scenario modeling and CDR land-use assessments.</p>

Standard structure		Land use planning and zoning
Challenges and solutions	Barriers	<ol style="list-style-type: none"> 1. Financial constraints limit implementation of CDR-friendly projects. 2. Social resistance to zoning changes. 3. Regulatory gaps for novel CDR technologies. 4. Limited land availability due to competing urban priorities.
	Solutions	<ol style="list-style-type: none"> 1. Establish municipal green bonds and tax incentives to finance multi-benefit green infrastructure. 2. Launch public engagement campaigns emphasizing tangible benefits (e.g. reduced heat, cleaner air). 3. Pilot regulatory 'sandboxes' to test and refine zoning policies for urban DAC or biochar production. 4. Integrate CDR into redevelopment plans incrementally to minimize pushback and maximize co-benefits.
	Enabling conditions	<p>Zoning flexibility to accommodate carbon-focused land uses and innovative pilot projects.</p> <p>Standardized metrics for measuring and certifying carbon removals across land types.</p> <p>Integration of CDR targets into comprehensive plans, climate strategies and land-use frameworks.</p>
Future opportunities	Scaling & replicating	Cities can scale urban reforestation and conservation into regional greenway networks and peri-urban 'nature parks'. Citywide initiatives (e.g. large-scale tree planting or mixed-use carbon parks) can become templates for replication. As data on land-use carbon impacts improves, planning frameworks can evolve to support zoning overlays or green infrastructure incentives that are deployable across diverse metropolitan regions.
	Innovation & research	Future research could enhance urban carbon mapping (e.g. satellite-based monitoring of tree growth) and explore shared CDR infrastructure (e.g. regional DAC hubs in industrial zones). Research into the land-value tradeoffs between green space and development can inform cost-benefit analyses. Ultimately, robust, localized data on how much CO ₂ is sequestered by various land uses will improve planning decisions and strengthen public buy-in.
Link to other policy areas		<ul style="list-style-type: none"> • Biodiversity • Urban design and infrastructure • Climate change adaptation and resilience

URBAN DESIGN AND INFRASTRUCTURE

Standard structure		Urban design and infrastructure
Brief overview of policy area	Description	Urban design and infrastructure policies govern the physical fabric of cities – buildings, transportation systems and public spaces. These policies influence energy consumption (through building codes), mobility patterns and overall city resilience. Sustainable design approaches, such as green building standards and transit-oriented development, aim to reduce emissions, enhance energy efficiency and improve urban quality of life.
	How CDR aligns	Urban infrastructure offers a unique opportunity to embed carbon removal. Cities can mandate the use of carbon-storing materials (e.g. wood, biochar-blended concrete) in public projects and incentivize carbon-negative procurement. Green roofs, biochar-enhanced soils and urban forests in public spaces not only sequester carbon but also provide urban cooling, improve air quality and enhance biodiversity. By integrating CDR into architecture and streetscapes, cities make carbon removal visible and functional, aligning infrastructure development with both climate and community goals.
Key strategies for integration	Tools	Update building codes and procurement policies to require or prioritize carbon-storing materials (e.g. biochar asphalt, CO ₂ -storing concrete).
		Mandate carbon-sequestering green infrastructure (e.g. roofs/walls) in new developments and retrofits. Create streamlined permitting for DAC-integrated buildings and infrastructure.
	Support actions	Pilot municipal infrastructure projects using carbon-storing materials. Develop city-led green building certification schemes that reward CDR integration. Offer grants or tax credits for developers incorporating DAC systems or carbon-storing designs.
Collaborations	Develop partnerships with architects, construction firms, civil engineers and materials scientists to incorporate carbon-smart design and materials. Collaborate with tech developers and utilities to integrate energy-efficient, CDR-enabled systems (e.g. DAC integrated into infrastructure). Engage regional networks to promote green procurement coalitions and standardize carbon-performance metrics in design.	

Standard structure		Urban design and infrastructure
Challenges and solutions	Barriers	<ol style="list-style-type: none"> 1. High costs and limited availability of carbon-negative materials. 2. Limited supplier readiness and contractor expertise. 3. Regulatory hurdles in updating procurement and building codes. 4. Public perception or aesthetic concerns about CDR installations.
	Solutions	<ol style="list-style-type: none"> 1. Provide subsidies and green bonds to offset upfront costs. 2. Incentivize local production and certification of sustainable materials. 3. Offer training programs for architects and city staff on CDR-aligned design. 4. Use pilot projects in non-sensitive areas and share data widely to build confidence.
	Enabling conditions	<p>Regulatory mandates for carbon-negative procurement and construction materials.</p> <p>Public incentives and funding for sustainable, carbon-aligned urban development.</p> <p>Certification systems to verify carbon performance of building materials and urban designs.</p> <p>Public education campaigns to build awareness and demand for climate-positive infrastructure.</p>
Future opportunities	Scaling & replicating	As CDR materials mature, cities can lead widescale urban retrofits (e.g. citywide adoption of carbon-sequestering pavements or building materials). Procurement policies can be expanded to include carbon-negative construction materials across regional infrastructure projects, leveraging economies of scale. DAC-ready building guidelines could be standardized for broader implementation, enabling integration across new developments and retrofits alike.
	Innovation & research	Research is needed on the long-term durability and carbon performance of CDR-integrated construction materials. Future building codes could establish explicit carbon-content limits. Cities may eventually host localized DAC systems that power on-site utilities or transit infrastructure. Innovations such as self-healing concrete that gradually absorbs CO ₂ are emerging. ERW in urban environments also deserves attention for its dual benefits: carbon removal and improved soil health.
Link to other policy areas		<ul style="list-style-type: none"> • Energy generation • Land use planning and zoning

WASTE MANAGEMENT

Standard structure		Waste Management
Brief overview of policy area	Description	Waste management policies oversee how cities handle municipal waste, including collection, recycling, composting and disposal. The primary goals are to minimize landfill use, reduce methane emissions, manage hazardous waste and promote a circular economy. Effective systems protect public health, reduce pollution and recover valuable materials. Cities increasingly focus on diverting organic waste and promoting sustainable waste streams.
	How CDR aligns	CDR can be embedded in waste systems through biochar production, composting and BECCS. Organic waste streams that would emit methane in landfills can instead become carbon sinks. For example , diverting organics to compost or biochar production captures carbon in soil instead of letting it rot in landfills. Biogas from wastewater and digesters can be captured and used as renewable energy, with additional carbon capture. This supports both climate goals and waste reduction targets, positioning waste as a feedstock for carbon removal in a circular economy.
Key strategies for integration	Tools	<p>Require waste-to-energy plants to implement CCS for biogenic CO₂.</p> <p>Mandate organic waste diversion to support biochar and compost production.</p> <p>Adjust procurement policies to prefer biochar-based compost and recycled construction materials.</p> <p>Adopt zero-waste plans that track carbon flows.</p> <p>Explore end-user responsibility in overall waste management linking CDR requirements to generators of waste.</p>
	Support actions	<p>Launch pilot BECCS retrofits in waste facilities.</p> <p>Establish neighborhood composting and biochar hubs.</p> <p>Partner with local schools and businesses to co-develop waste-to-soil initiatives.</p>
	Collaborations	<p>Collaborate with waste haulers, composting firms, utilities and farmers to scale organic waste systems that produce biochar or biogas for CDR.</p> <p>Partner with research centers and clean-tech startups to pilot carbon-removing waste infrastructure.</p> <p>Coordinate with regional governments on landfill caps, bio-CCS and methane mitigation.</p>

Standard structure		Waste Management
Challenges and solutions	Barriers	<ol style="list-style-type: none"> 1. High capital costs for carbon removal technologies like carbon capture or anaerobic digestion. 2. Limited public awareness of waste-related CDR benefits. 3. Workforce and skills gaps in emerging CDR tech.
	Solutions	<ol style="list-style-type: none"> 1. Use municipal green bonds or carbon credits to fund infrastructure retrofits. 2. Educate the public on waste-to-value strategies (e.g. compost = cleaner air + better soil). 3. Partner with local institutions to develop training programs for CDR jobs in waste sectors.
	Enabling conditions	<p>Strong stakeholder engagement across waste, utilities and environmental sectors.</p> <p>Clear business models that justify investment in carbon capture from waste streams.</p> <p>Access to verified, safe and cost-effective carbon storage options for captured emissions.</p>
Future opportunities	Scaling & replicating	<p>Cities could scale municipal WtE-CCS systems by linking multiple facilities into shared CO₂ storage hubs. Successful pilots could evolve into district-level carbon hubs that combine biogas, biochar and DAC. Municipal procurement targets for carbon-neutral products derived from waste (e.g. biochar for soil) can create steady demand. Over time, industrial symbiosis parks – where one facility’s waste becomes another’s carbon input – could proliferate. Financing models may emerge in which cities fund new carbon removal projects through revenue from verified carbon credits (e.g. from methane capture, avoided emissions, or those from carbon removal itself).</p>
	Innovation & research	<p>Research opportunities include optimizing mixed-waste biochar feedstocks and capturing biogenic CO₂ at landfills. Over time, cities could export compost and biochar products to peri-urban farms, closing nutrient loops. Scaling technologies like urban biochar and biogas capture remains a key challenge. Cities can trial emerging waste-to-carbon systems (e.g. digesters that yield carbon-neutral bioplastics or modular pyrolysis units for neighborhood use). Comprehensive data on waste stream carbon content and emissions reductions will refine future policy. Academic partnerships can help quantify climate impacts of specific interventions (e.g. methane reductions from organics diversion).</p>
Link to other policy areas		<ul style="list-style-type: none"> • Agriculture and food systems • Energy generation • Climate change adaptation and resilience

ENERGY MANAGEMENT

Standard structure		Energy Management
Brief overview of policy area	Description	Urban energy policies regulate the generation and distribution of power and heating, with goals of ensuring reliability, affordability and sustainability. Cities often influence energy systems through procurement standards, incentives for renewables and support for grid modernization. Cleaner energy systems reduce greenhouse gas emissions, improve air quality and enhance energy resilience.
	How CDR aligns	CDR technologies can both support and benefit from clean energy systems. Cities can integrate BECCS and DAC into local energy infrastructure, pairing carbon removal with renewable generation. Wastewater, biomass incineration or waste-to-energy plants capture, store and sell their biogenic CO ₂ . Energy policies that support renewables can be expanded to include 'renewables-plus-CDR' packages. These synergies improve air quality, generate green jobs and build climate resilience, while helping cities meet carbon neutrality targets.
Key strategies for integration	Tools	Require new biomass and biogas plants to integrate BECCS; incentivize retrofits. Prioritize carbon-negative energy in city procurement. Offer fast-track permitting for RE-CDR hybrid projects.
	Support actions	Launch green bond programs to finance BECCS and DAC integration. Establish education and outreach programs for carbon-negative energy awareness. Support demonstration zones for CDR-energy integration (e.g. BECCS industrial clusters).
	Collaborations	Work with energy providers, utilities and academic institutions to develop credible and sustainable business cases for BECCS and DAC powered by renewables. Partner with regional and national agencies for infrastructure funding and clean energy incentives. Engage community stakeholders to build support and local benefit-sharing models (e.g. job creation).

Standard structure		Energy Management
Challenges and solutions	Barriers	<ol style="list-style-type: none"> 1. High costs of BECCS and DAC deployment. 2. Public resistance to new infrastructure (e.g. bioenergy plants). 3. Uncertainty around how CDR fits into urban energy strategies.
	Solutions	<ol style="list-style-type: none"> 1. Implement carbon pricing and targeted subsidies to de-risk investment. 2. Highlight local co-benefits (jobs, clean air) through public campaigns. 3. Develop clear policies integrating CDR into energy planning and siting decisions.
	Enabling conditions	<p>Supportive policies that prioritize carbon-negative energy technologies.</p> <p>Long-term funding mechanisms for BECCS, DAC and hybrid energy-CDR projects.</p> <p>Cross-sector collaboration between cities, utilities and technology developers.</p>
Future opportunities	Scaling & replicating	<p>Cities could evolve into regional energy innovation hubs. Large-scale BECCS 'energy parks' combining biogas, biofuel and CCS could become common. DAC may be modularized and distributed (e.g. neighborhood-scale DAC kiosks powered by rooftop solar). Inter-city collaborations could emerge around shared geologic storage infrastructure. At larger scales, municipal investment in regional BECCS or underground CO₂ storage could become standard, drawing lessons from pioneers like Stockholm's waste-to-energy BECCS plant, which accelerated the city's net-zero target by a decade.</p>
	Innovation & research	<p>Future research can explore novel pairings of CDR and clean energy systems. Cities can serve as testbeds for next-generation energy-CDR integration. Potential R&D areas include: dynamic grid management to accommodate CDR loads, lower-energy DAC processes and sustainable biomass sourcing for BECCS. Collaborations with national labs could support microscale experiments (e.g. DAC retrofits on urban buildings) to improve real-world feasibility. Studying co-benefits (e.g. district heating systems coupled with CO₂ capture) can reveal synergies. Data from pilot installations (e.g. biogas plants with integrated carbon capture) should directly inform evolving policy frameworks.</p>
Link to other policy areas		<ul style="list-style-type: none"> • Waste management

WATER MANAGEMENT

Standard structure		Water Management
Brief overview of policy area	Description	Water policies ensure safe and sustainable supply, manage wastewater and stormwater and protect aquatic ecosystems. They play a crucial role in public health, flood control and climate resilience. Infrastructure for clean drinking water, efficient sewage treatment and stormwater retention are central to urban sustainability.
	How CDR aligns	Nature-based water solutions such as wetlands, bioswales and riparian buffers sequester carbon while managing water flows and improving quality. Urban water systems can also support CDR by processing wastewater into biochar or biogas. Blue carbon ecosystems like mangroves or urban marshes store CO ₂ and enhance biodiversity. Ocean alkalinity enhancement can be implemented in wastewater treatment with high carbon storage potential. These systems offer co-benefits including storm protection , water purification and urban cooling, making water policy a key vector for integrating CDR with resilience strategies.
Key strategies for integration	Tools	Require integration of blue carbon and wetland restoration in water management plans.
		Update regulations to encourage biochar-based stormwater filtration and ERW in treatment facilities.
	Support actions	Provide subsidies for water systems incorporating carbon-positive technologies.
Restore wetlands, mangroves and riverbanks as part of climate resilience and carbon removal strategy.		
Collaborations	Support actions	Deploy algae-based wastewater systems and pilot ERW-enhanced filtration.
		Create grant programs for biochar and algal sequestration in urban water projects.
Collaborations	Collaborations	Team up with water utilities, environmental agencies and engineering firms to restore wetlands and design multifunctional water systems.
		Collaborate with NGOs and researchers to monitor blue carbon sequestration in urban aquatic environments.
Collaborations	Collaborations	Promote public education through community stewardship programs and public engagement campaigns.

Standard structure		Water Management
Challenges and solutions	Barriers	<ol style="list-style-type: none"> 1. Limited public and policymaker awareness of water-based CDR. 2. Competing land uses in dense urban areas. 3. Potential ecological trade-offs in engineered interventions.
	Solutions	<ol style="list-style-type: none"> 1. Frame water-C solutions as triple-benefit infrastructure (flood control + water treatment + carbon). 2. Use vertical or hybrid systems in underused spaces (e.g. parking lots, rooftops). 3. Implement safeguards based on appropriate sector guidance to avoid ecological harm.
	Enabling conditions	<p>Robust regulatory frameworks that align water management with carbon goals.</p> <p>Dedicated funding streams for blue-green infrastructure with CDR potential.</p> <p>Integrated planning processes that embed water-based CDR into urban design and climate resilience.</p>
Future opportunities	Scaling & replicating	Cities can scale up carbon-positive green infrastructure (e.g. large wetland parks, reforested floodplains or restored river corridors). Regional strategies could connect wetlands along river systems to enhance both carbon sequestration and climate resilience. Over time, municipalities might adopt carbon targets for water infrastructure – embedding sequestration goals into flood control, stormwater systems and urban watersheds – supported by standardized design frameworks and long-term monitoring tools.
	Innovation & research	Quantifying urban blue carbon and designing multifunctional water infrastructure for CDR are key research frontiers. Technological concepts like artificial mangrove structures or carbon-storing water treatment systems may emerge. Over time, managing urban water holistically – with explicit carbon objectives – can restore watershed function while contributing to climate mitigation. “Carbon-smart” stormwater culverts that double as wetlands could be envisaged, or green roofs that capture rainwater and sequester carbon. Innovations might include biochar filters in drainage systems or carbon-absorbing linings in water mains. As cities tackle growing climate stresses like flooding and heat, embedding carbon targets into water projects can unlock co-benefits. For example, expanding a floodplain park could be quantified for its carbon value and credited toward climate goals.
Link to other policy areas		<ul style="list-style-type: none"> • Climate change adaptation and resilience • Land use planning and zoning • Agriculture and food systems

AGRICULTURE AND FOOD SYSTEMS

Standard structure		Agriculture and food systems
Brief overview of policy area	Description	Urban and peri-urban agriculture policies aim to ensure food security, nutrition and sustainable land use. They encompass community gardens, farmers' markets, rooftop farms and peri-urban farming. Challenges include soil degradation, food waste and emissions from food production. Regenerative practices are gaining attention (composting, organic farming, agroforestry). Well-planned food systems can reduce 'food miles' and create green spaces, contributing to a city's sustainability.
	How CDR aligns	CDR-enhancing practices like regenerative agriculture, composting and biochar application, improve soil carbon storage and boost productivity. City-led initiatives can support agroforestry or urban farming that builds soil health while sequestering carbon. Diverting food waste into compost or biochar aligns waste, agriculture and climate policies. These practices enhance biodiversity, water retention and local food resilience while contributing to emissions reduction and removal.
Key strategies for integration	Tools	Develop city guidelines for biochar, ERW and regenerative practices in urban and peri-urban farming. Mandate composting with biochar in public food waste programs. Integrate carbon farming metrics into land use strategies for green spaces.
	Support actions	Fund urban agriculture pilots that use CDR methods (e.g. agroforestry, biochar, ERW). Create circular programs to redirect food waste to local soil amendment producers. Establish urban farming hubs with training in CDR practices.
	Collaborations	Partner with urban and peri-urban farmers, agricultural extension services and food waste innovators to scale regenerative practices. Engage with universities and agri-tech startups for soil carbon monitoring and demonstration projects. Coordinate with rural regions for shared CDR strategies across urban-rural food supply chains.
Challenges and solutions	Barriers	1. Urban space constraints limit scaling of carbon farming. 2. Lack of knowledge about biochar, ERW and soil-based CDR. 3. High costs of new amendments and measurement challenges.
	Solutions	1. Use vacant lots and public land (e.g. parks, school grounds) for demonstration plots. 2. Educate communities on food security and climate co-benefits. 3. Provide tax breaks or grants to farms using verified carbon-sequestering practices.
	Enabling conditions	Municipal policies that support regenerative and climate-smart agriculture. Affordable access to biochar, enhanced rock weathering materials and composting tools. Clear verification standards for tracking soil carbon and emissions reductions in urban agriculture.

Standard structure		Agriculture and food systems
Future opportunities	Scaling & replicating	Urban agriculture can scale through regional partnerships that integrate regenerative practices, such as biochar application and compost reuse, into broader food systems. Cross-city programs could develop certification and trading platforms for urban-farmed carbon credits. Future plans might include city-supported 'carbon farms' (e.g. alleyway orchards or park-edge agroforestry buffers enhanced with carbon-rich soils). Policies could incentivize local sourcing and closed-loop waste recovery from restaurants and grocers. Over time, greenbelts and agroforestry corridors may be embedded in regional planning.
	Innovation & research	Ongoing research (e.g. optimizing crop types and rotations for urban soils) will improve urban food-based carbon removal strategies. Cities can experiment with 'carbon-smart' neighborhood planning that integrates food production with recreation and habitat, creating layered benefits. Promising research areas include: low-cost soil carbon field tests, biochar production from urban green waste and crop selection for high carbon uptake in compact spaces. Pilot anaerobic digestion systems could process food scraps into biofertilizer. Hosting innovation challenges or grants for startups working on urban agri-CDR can link local food systems with emerging tech solutions. Over time, sensors and data tools for tracking soil carbon will enable ongoing monitoring and accountability.
Link to other policy areas		<ul style="list-style-type: none"> • Waste management • Climate change adaptation and resilience

ECONOMIC DEVELOPMENT

Standard structure		Economic development
Brief overview of policy area	Description	Economic development policies aim to create jobs, attract investment and build resilient economies. Cities often focus on sustainable industries, innovation hubs and infrastructure to boost competitiveness. Goals include diversifying the economy, supporting small businesses and ensuring long-term prosperity. Climate and sustainability initiatives (green buildings, smart tech) are increasingly part of economic planning.
	How CDR aligns	CDR projects can drive economic growth by creating green jobs and attracting clean-tech investment. From biochar producers to DAC technology startups, carbon removal offers opportunities for economic diversification. Cities that position themselves as CDR leaders can tap into emerging global markets and stimulate local innovation ecosystems. Supporting workforce development and financing tools for CDR-aligned industries ensures long-term prosperity alongside climate benefits.
Key strategies for integration	Tools	Provide tax incentives and grants for CDR-related businesses and tech developers. Include CDR in innovation incubators and startup support programs. Update procurement rules to prioritize carbon-negative goods and services.
	Support actions	Develop CDR workforce training and placement programs. Create pilot zones for CDR-integrated industry demonstration. Facilitate partnerships with finance institutions to expand access to green funds and credit.
	Collaborations	Collaborate with innovation hubs, industry clusters, economic development boards and venture capital to fund and deploy CDR startups. Work with chambers of commerce and business associations to integrate CDR into green job strategies. Partner with universities and incubators to commercialize academic research and accelerate CDR solutions.
Challenges and solutions	Barriers	1. High upfront costs and uncertain revenue models. 2. Lack of regulatory clarity and incentives for CDR investment. 3. Low public and policymaker awareness of CDR's economic potential.
	Solutions	1. Leverage CDR revenues to offer subsidies, tax incentives and public-private grants. 2. Revise green economy criteria to explicitly include CDR. 3. Promote case studies linking CDR to job creation and revitalization.
	Enabling conditions	Regulatory frameworks that incentivize investment in carbon removal industries. Access to diverse funding sources (e.g. green bonds, PPPs, innovation grants). Alignment of CDR initiatives with broader economic development and job creation strategies.

Standard structure		Economic development
Future opportunities	Scaling & replicating	Cities at the forefront of CDR implementation could become exporters of carbon solutions and technologies. Municipal CDR initiatives could expand into regional or national platforms, fostering a larger carbon economy. Cross-city partnerships can replicate successful incubators and innovation clusters, stimulating sector-wide growth. Over time, standardized tools for measuring job creation, local value-add and credit trading could support cities in scaling climate innovation as an economic development strategy.
	Innovation & research	Expanding research into viable CDR business models – especially those rooted in circular economy principles – will unlock economic potential. As the CDR industry matures, job opportunities will span sectors: from DAC operators and carbon foresters to agronomists and infrastructure engineers. Cities can accelerate this transition by funding feasibility studies (e.g. sizing biochar facilities or DAC modules) and supporting applied research in partnership with local industries. Hosting hackathons or CDR innovation accelerators can stimulate fresh ideas tailored to urban constraints. Tracking and publicizing green job growth within the carbon economy will help justify workforce development programs and attract investment.
Link to other policy areas		<ul style="list-style-type: none"> • Energy generation • Waste management • Water management • Agriculture and food systems

BIODIVERSITY AND ECOSYSTEM SERVICES

Standard structure		Biodiversity and ecosystem services
Brief overview of policy area	Description	Biodiversity and ecosystem policies aim to protect natural habitats, green spaces and ecological services. In cities, this includes urban forests, parks, wetlands and green corridors. Healthy ecosystems provide food, pollination, flood control and temperature regulation. Urban biodiversity enhances residents' well-being and resilience to climate impacts.
	How CDR aligns	Nature-based CDR approaches (e.g. including reforestation, wetland restoration and soil carbon enhancement) offer dual benefits for carbon removal and habitat conservation. Urban woodlands and green corridors can be designed to sequester carbon while supporting wildlife. Embedding ecosystem health indicators in climate plans ensures CDR efforts also advance ecological integrity, equity and quality of life. For example, urban forests of native trees sequester CO ₂ while providing habitat – research shows urban woodlands with native species yield 'robust synergies between carbon storage and biodiversity'. Protecting and enhancing natural ecosystems is inherently a carbon removal strategy as well as a conservation goal.
Key strategies for integration	Tools	Mandate biodiversity corridors and high-carbon-sequestration species in urban greening plans.
		Strengthen protections for urban wetlands and other carbon-rich ecosystems.
	Support actions	Align zoning with ecosystem-based CDR goals.
Collaborations	Support actions	Expand tree planting programs focusing on high-carbon native species.
	Collaborations	Launch grants for community-led restoration projects.
		Support biochar and ERW use in parks and public lands.
		Coordinate with conservation NGOs, land trusts, academic ecologists and community organizations to restore habitats with high carbon value.
		Engage businesses and developers in offsite carbon offset and ecosystem enhancement projects.
		Leverage citizen science programs to monitor both biodiversity and carbon metrics.

Standard structure		Biodiversity and ecosystem services
Challenges and solutions	Barriers	<ol style="list-style-type: none"> 1. Urban expansion pressures limit space for ecological CDR. 2. Long-term ecosystem restoration is underfunded. 3. Trade-offs between biodiversity and carbon (e.g. monocultures vs native habitat).
	Solutions	<ol style="list-style-type: none"> 1. Promote multifunctional land use. 2. Use biodiversity bonds and carbon credits to finance restoration. 3. Align planning processes to balance ecosystem integrity and carbon goals.
	Enabling conditions	<p>Legal protections for carbon-rich ecosystems, including forests and wetlands.</p> <p>Municipal and private sector investment in ecosystem restoration and conservation.</p> <p>Public engagement strategies to foster community participation in biodiversity-based CDR.</p>
Future opportunities	Scaling & replicating	Cities could join or lead multi-city rewilding initiatives (e.g. linking parks, urban forests and restored grasslands into regional carbon and biodiversity corridors). These landscape-scale efforts could increase ecological connectivity while scaling CDR. Over time, cooperative urban forestry or habitat restoration pacts could facilitate pooled investment, shared data and policy alignment across jurisdictions. Biodiversity-CDR pilot zones could become models for integrated ecological planning at the regional level.
	Innovation & research	Research should explore how multi-functional green spaces can deliver both biodiversity and carbon removal benefits. Technologies like AI-assisted biodiversity monitoring can help verify CDR performance. Innovative financing tools (e.g. biodiversity-carbon credit markets) could mobilize private capital. Key questions include how to quantify and credit urban biodiversity-linked CDR (e.g. carbon stored in green roofs or community forests). Pilot projects might focus on measuring carbon capture in restored grasslands or wetlands within city limits. Selecting or breeding native species that are more resilient and carbon-dense could enhance outcomes. Local universities can map biodiversity-carbon hotspots to inform urban conservation strategies.
Link to other policy areas		<ul style="list-style-type: none"> • Climate change adaptation and resilience • Land use planning and zoning • Water management

ADAPTATION AND RESILIENCE

Standard structure		Adaptation and resilience
Brief overview of policy area	Description	Adaptation policies prepare cities for climate impacts (heat waves, floods, storms). They include urban heat-island reduction (tree planting, cool pavements), flood defenses, emergency planning and social resilience programs. The goal is to protect lives and infrastructure as climate stressors grow. Well-crafted plans safeguard public health and minimize damage, especially for vulnerable populations.
	How CDR aligns	Many adaptation measures (e.g. urban tree planting , green roofs and wetland restoration) also capture carbon. Framing CDR as a resilience tool enhances its relevance and equity. Biochar in urban soils can reduce drought impacts while storing carbon. Shade trees improve public health during heatwaves and sequester CO ₂ . Coordinated adaptation-CDR planning ensures climate strategies deliver both mitigation and community resilience.
Key strategies for integration	Tools	<p>Integrate CDR into adaptation strategies (e.g. green infrastructure for heat and flood resilience).</p> <p>Require impact assessments of development projects to include CDR potential.</p> <p>Use resilience bonds to fund dual-benefit (adaptation + CDR) projects.</p>
	Support actions	<p>Pilot green infrastructure projects with co-benefits for resilience and carbon removal.</p> <p>Support biochar-enhanced urban farming for food and climate resilience.</p> <p>Create post-disaster restoration programs incorporating carbon-sequestering vegetation.</p>
	Collaborations	<p>Align planning, public health, emergency response and infrastructure teams to embed CDR into resilience strategies (e.g. cooling forests, stormwater wetlands).</p> <p>Collaborate with universities and NGOs to model co-benefits and identify priority adaptation-CDR intersections.</p> <p>Empower local communities to co-design and implement neighborhood-level climate solutions.</p>

Standard structure		Adaptation and resilience
Challenges and solutions	Barriers	<ol style="list-style-type: none"> 1. Zoning and planning codes often exclude CDR. 2. Budget silos limit joint planning between adaptation and mitigation. 3. Public resistance to unfamiliar technologies. 4. Lack of knowledge on CDR-adaptation integration.
	Solutions	<ol style="list-style-type: none"> 1. Revise zoning codes to allow for nature-based and CDR-integrated development. 2. Create joint funding mechanisms (e.g. nature-based resilience funds). 3. Engage the public through community-based design processes. 4. Advocate for national policy reforms to enable blended green-gray infrastructure.
	Enabling conditions	<p>Regulatory integration of CDR into resilience and disaster planning policies.</p> <p>Public and private investment in nature-based and infrastructure-linked CDR.</p> <p>Ongoing urban research to develop and validate scalable adaptation-CDR solutions.</p>
Future opportunities	Scaling & replicating	Regional collaboration can unlock larger-scale adaptation-CDR solutions, such as flood-resilient carbon removal parks or coastal green buffers that store carbon while protecting infrastructure. Future city plans may normalize features like rooftop farms with drought-resistant, carbon-rich soils or networks of rain gardens designed for both stormwater management and carbon sequestration. Nature-based solutions could be mandated in city codes, with climate adaptation bonds funding carbon-rich landscape interventions. Satellite tracking and drone monitoring of biomass may provide the oversight needed to scale such systems.
	Innovation & research	Research is needed on how adaptation infrastructure (e.g. bioswales, levees and urban tree canopies) can double as carbon sinks. Integrated approaches (e.g. flood parks enhanced with biochar-rich soils) offer resilience and removal in tandem. Cities can pilot systems that combine environmental sensors (e.g. moisture probes, heat monitors) with carbon tracking for real-time feedback. Collaborations with research institutions could lead to resilience metrics that include carbon storage (e.g. neighborhood-level resilience scores factoring in soil carbon and canopy cover). Cross-sector projects blending climate science, urban ecology and planning will be essential for designing solutions that address both risk and emissions.
Link to other policy areas		<ul style="list-style-type: none"> • Economic development • Agriculture and food systems • Water management • Energy generation • Water management • Biodiversity

PUBLIC EDUCATION AND COMMUNITY ENGAGEMENT

Standard structure		Public education and community engagement
Brief overview of policy area	Description	Public education policies aim to inform and involve citizens in climate action. This includes school education, public awareness campaigns and participatory planning processes. Engaged communities adopt sustainable behaviors (recycling, energy savings) and support policy measures. Education and outreach build climate literacy, social cohesion and stewardship.
	How CDR aligns	Awareness of CDR is still low, so public education is critical. Outreach programs that explain how local trees, soils and emerging technologies capture carbon can inspire community support. Engaging residents in tree planting, composting, or urban farming helps demystify CDR and promote stewardship. Inclusive education ensures all communities understand and benefit from climate solutions, making public engagement a cornerstone of responsible CDR governance.
Key strategies for integration	Tools	Embed CDR education in school curricula and public communications. Require community consultation and participatory design in CDR strategy development. Mandate teacher training on climate and CDR science.
	Support actions	Launch citizen science and volunteer programs for urban carbon tracking. Fund school- and neighborhood-led CDR projects (e.g. tree planting, composting). Create living labs and public demonstration sites for biochar, DAC and other technologies.
	Collaborations	Work with schools, libraries, museums and cultural organizations to integrate CDR into educational programming. Partner with NGOs and media to promote accessible, multilingual CDR messaging. Use digital platforms (apps, maps, signage) to connect residents with local carbon sinks and empower participation in carbon-smart behaviors.
Challenges and solutions	Barriers	1. Low public understanding of CDR. 2. Mistrust of new technologies or government-led projects. 3. Limited funding for outreach and education. 4. Coordination challenges among stakeholders.
	Solutions	1. Allocate funding for education campaigns, curricula and community grants. 2. Collaborate with local groups, schools and businesses on visible CDR projects. 3. Use relatable messaging and reward participation. 4. Empower communities to lead CDR efforts with municipal support.
	Enabling conditions	Strong grassroots support for integrating CDR into city policies and programs. Resources for schools, universities and community centers to deliver CDR education. Effective messaging that emphasizes co-benefits and relevance of CDR to daily life.

Standard structure		Public education and community engagement
Future opportunities	Scaling & replicating	Cities can scale outreach by embedding CDR into public education systems, cultural programs and digital infrastructure. Future initiatives might include virtual reality tours of carbon removal sites or live carbon dashboards in public parks. Schools could integrate carbon monitoring into science curricula, using portable sensors to track soil or plant-based carbon. Resident advisory councils could shape CDR implementation to reflect community values. Long term, embedding carbon literacy into civic life – via museums, media, festivals and curriculum – can normalize public participation and turn carbon removal into a shared cultural goal.
	Innovation & research	Cities can study which teaching methods and materials most effectively raise awareness of CDR and explore strategies for sustaining engagement over time. Research into climate messaging – conducted in partnership with social scientists – can test which approaches resonate across demographics. Community co-design of tools (e.g. a ‘my carbon’ calculator) can turn abstract data into meaningful action. Hackathons or civic tech events can invite residents to co-create dashboards, apps or campaigns. Studying public attitudes over time (e.g. through longitudinal surveys) can guide ongoing outreach and help normalize participation in CDR initiatives.
Link to other policy areas		<ul style="list-style-type: none"> All