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THE CITY-INDUSTRY-CLIMATE NEXUS

Cities as engines of global net-zero transitions in a shifting world

UNIDO white paper on decarbonizing cities and urban communities

Disclaimer

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FOREWORD

Two thirds of the world's population will live in urban areas by 2050. This is not only a challenge, but an opportunity. Cities, particularly in low and middle-income countries, are central to decarbonization and creating the next wave of sustainable industrialization.

Increasing urbanization is a defining development challenge of our times, but the solutions exist – from AI and digitalization, e-mobility and renewable energy, better waste and water management, and more.

This UNIDO white paper on city-driven, industry-led and human-focused global net-zero transitions reflects this evolving framework for how we live. Cities concentrate people, infrastructure and businesses. They are where new industries rise, where markets shift and where most jobs are created. Decarbonizing cities is not only essential for climate action, but also the path forward for building the industries and economies of the future which ensure sustainability and prosperity for the generations to come.

We can and must decouple growth from emissions, and urban decarbonization is a part of this. It is a great chance to shape low-carbon value chains, deploy innovative technologies, reduce poverty, increase food security, and create growth and decent jobs directly where transformation happens – in factories, transit hubs and neighbourhoods.

This white paper is also a call to reframe how we think about industrial transformation – while national strategies are necessary and UNIDO is a proud partner in helping to shape them, we must always also remember the local level where delivery on such strategies truly happens. Impact on the ground is what matters most.

Urban decarbonization is a core pillar of inclusive and sustainable industrial development. From advancing municipal green public procurement to preparing bankable climate-smart projects across various industrial sectors, UNIDO works with local and national actors to increase ambitions and translate them into concrete results. Creating net-zero economies very much depends on how we develop our growing cities, and how people live and work in them. This white paper provides the outline for making that transformation a reality.

Gerd Müller
Director General, UNIDO

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VISION STATEMENT

In an era marked by structural global transitions, cities, particularly in low- and middle-income countries (LMICs), are poised to become the critical arenas for climate action and socio-economic progress. The decarbonization of cities and urban communities is not merely a climate imperative. It is an industrial development strategy for an inclusive and sustainable future. Decarbonizing cities creates markets for clean industries, reduces environmental, social and economic risks, and builds resilient economies. It is not just about solar rooftops and electric buses. It is also about transforming the urban-industrial systems that power urban life, from the production of cement, steel, textiles and food, to the organization of logistics, the development and application of cleantech, and the management of waste. This white paper sets forth a vision for a city-driven, industry-led and human-focused global transition, where the path to net zero takes shape in the daily workings of urban neighbourhoods, local companies and municipal governments.

CHALLENGES

The evolving global context presents distinct challenges that demand strategic responses:

Geopolitical realignments and the rise of subnational actors are highlighting the increasing influence of cities as key players in the sustainability transition amid shifting power dynamics. Cities are becoming pivotal arenas where decarbonized futures are being forged and the next wave of industrialization is taking shape. However, although urban areas are both major emitters of greenhouse gas (GHG) and frontline implementers of climate change solutions, the Paris Agreement remains centred on national governments.

Climate and environmental pressures on cities, especially those in LMICs, are intensifying. Climate change is creating critical threats, including rising sea levels, extreme heat, storms and droughts. These increasingly frequent and severe events are endangering human health, livelihoods and urban economies. As city populations swell, the growing demand for energy and resources, as well as the increase in municipal and industrial waste, are becoming key pressure points significantly contributing to climate change. There is an urgent need to transform economic and industrial models towards resilience and net-zero pathways.

The transformation of economic and industrial models requires systemic approaches that reconcile growth with planetary boundaries and social inclusion. Urbanization in LMICs is reshaping economic and consumption patterns, often at the cost of land degradation, food system vulnerability and reliance on carbon-intensive supply chains. While cities in LMICs are powerful drivers of Gross Domestic Product growth and innovation, they face deepening inequality, with informal settlements and job losses threatening social stability. Meanwhile, the potential of cleantech and green industries to deliver inclusive economic benefits is limited by structural weaknesses. The micro, small and medium-sized enterprises (MSMEs) that dominate urban employment are key to local climate solutions but they need targeted support.

Home-grown MSMEs and start-ups create context-specific and local innovative solutions to urban problems, and this is vital for climate action. However, **underdeveloped innovation and entrepreneurship ecosystems** are hindering the deployment and scale-up of these solutions. To achieve scalable impact, conducive ecosystems are needed to connect local problem-solvers, including MSMEs and start-ups, with policymakers, research and development institutions, investors and other private sector companies.

Cities in LMICs face numerous **implementation barriers,** starting with financing challenges, with low creditworthiness and complex eligibility requirements restricting access to capital markets and climate finance instruments. Structural and institutional obstacles, such as regulatory misalignment, limited technical capacity and political economy dynamics, further constrain the ability of local governments to design and sustain long-term initiatives. Urban decarbonization and sustainable industrial development are mutually reinforcing processes that advance many of the Sustainable Development Goals (SDGs), but global progress toward these Goals is lagging. Many SDG targets are stalled or regressing amid multiple crises, declining aid and geopolitical tensions. A critical gap also exists in workforce preparedness, as training systems are poorly aligned with the needs of emerging green industries. Building inclusive skills strategies to equip youth and women workers with future-facing competencies is essential to ensure fair, resilient and effective urban transitions.

SOLUTIONS

Decarbonization of cities as industrial policy

Decarbonizing cities is not simply an environmental objective. It is the next frontier of industrial development. Urban areas are where climate ambition materializes into tangible action, through the transformation of, among others, mobility patterns, infrastructure and industrial value chains. The convergence of urbanization, industrialization and decarbonization offers a unique pathway for systemic change, particularly in LMICs. By engaging with cities, UNIDO can help align national industrial and climate policies with local implementation, enabling integrated, net-zero development pathways that reflect regional priorities and global goals. Bold urban initiatives, when strategically integrated, can drive the emergence of net-zero industries, green jobs and new forms of localized economic competitiveness.

Holistic strategies and key levers

UNIDO's mandate to advance inclusive and sustainable industrial development places it at the forefront of moves enabling cities to leverage their potential to act as dynamic hubs of industrial innovation, integrating economic growth, social inclusion and environmental impact to drive systemic change. UNIDO champions pioneering technologies, business models and financing mechanisms, and fosters collaborative processes. It promotes holistic strategies that transcend sectoral boundaries and employ a broad range of technical cooperation levers. To support cities, UNIDO activates key levers: policy and governance; technology, innovation and entrepreneurship; finance; knowledge sharing, partnerships and capacity building; and digitalization and data. These levers are applied across critical urban-industrial sectors: energy; resources, materials and solid waste; water; buildings and facilities; and transport.

Strengthening municipal finance systems

Access to capital is a prerequisite for sustainable urban transformation. However, many LMIC municipalities face constraints such as limited fiscal autonomy, weak creditworthiness and a lack of bankable projects. This white paper underscores the urgency of strengthening municipal finance systems so that cities can shift from grant dependence to credit-backed infrastructure investment, creating conditions for long-term, scalable financing. Cities need tailored strategies which, when aligned with local infrastructure needs and risk profiles, enhance project bankability, especially when anchored in site-specific value propositions such as industrial parks or economic zones. Cities grow not as they are planned, but as they are financed.

Investment planning and market shaping

Local governments have substantial power to shape markets through capital investment planning, design regulations and public procurement. Capital investment planning involves systematic processes, such as annual capital budgeting and asset management planning, to allocate resources toward priority interventions that advance urban sustainability, resilience and service delivery. Design regulations can set requirements for urban development inside municipal boundaries while Green Public Procurement (GPP) leverages local government purchasing power to promote low-carbon goods and services, thereby incentivizing cleaner production practices. When supported by strong regulatory frameworks and aligned with national climate goals, design regulations and GPP can be powerful mechanisms for market transformation, helping cities de-risk innovation, scale up sustainable technologies and drive systemic change across urban-industrial systems.

From local implementation to shared governance

While national governments articulate climate targets, cities are the primary implementers of these ambitions. However, the current institutional architecture of climate policy governance often leaves subnational actors underrepresented in decision-making processes. Actively involving cities in shaping Nationally Determined Contributions strengthens bottom-up climate ambition and enhances the coherence of national and global commitments. Once established, implementation can be steered through a coordinated suite of instruments at the municipal level, including policy frameworks, strategic plans, roadmaps and spatial planning, to guide long-term, cross-level action and ensure measurable progress toward national and global sustainability targets.

Innovation ecosystems and green skills as catalysts

Cities can stimulate innovation by aligning policy imperatives, market dynamics and entrepreneurship support to address urgent sustainability challenges and shape long-term, net-zero transition trajectories. By activating indigenous innovation potential through cleantech accelerators, cities can drive the development and scale-up of locally tailored solutions built on viable business models. In addition, structured technology transfer partnerships, reinforced by comprehensive capacity building, enable the adaptation and adoption of advanced technologies, fostering context-specific approaches, strengthening technical capabilities, and generating new employment opportunities. UNIDO's targeted green skills development, through modernized curricula and industry-linked vocational training for youth and women, aligns workforce capabilities with emerging net-zero sectors. By integrating these pathways – innovation mechanisms, entrepreneurship support, technology transfer and tailored skills training – cities can accelerate decarbonization. They can also drive inclusive and sustainable industrialization and build resilient net-zero urban-industrial systems.

Ignite the change: Rallying cities for industrial and climate leadership

Achieving global net-zero ambitions requires a paradigm shift: recognizing cities as economic agents, not just sites of implementation, but co-leaders of transformation. Governments, city leaders, private sector actors and development institutions must work together to unlock the economic, industrial, demographic and innovation potential of cities. This calls for a coordinated approach that places cities at the heart of industrial strategy and climate governance. We must invest in cities, not only as engines of growth but as the blueprint for sustainable industrialization. UNIDO stands ready to convene, support and scale these efforts, uniting stakeholders to make cities the vanguard of a just, resilient, net-zero world.

THE CITY-INDUSTRY-CLIMATE NEXUS:

Cities as engines of global net-zero transitions in a shifting world

INTRODUCTION

Cities are at the forefront of today's structural global transitions. In low- and middle-income countries (LMICs), urban areas are not only expanding rapidly, they are becoming pivotal arenas for climate action, and inclusive and sustainable industrial development. This white paper explores how urban decarbonization can help build resilient economies, create markets for cleantech and green industries, and reconfigure the systems that underpin urban life. From cement and steel to logistics and waste management, the decarbonization of urban-industrial ecosystems, grounded in local innovation, private sector engagement and municipal leadership, offers a viable and inclusive pathway to net zero.

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CHALLENGES

- A shifting world: Geopolitical realignment and the rise of subnational actors
- Climate and environmental pressures
- Transformation of economic and industrial models
- Underdeveloped innovation and entrepreneurship ecosystems
- Implementation barriers

A shifting world: Geopolitical realignment and the rise of subnational actors

The global development landscape is undergoing profound structural shifts, reshaping how, where and by whom progress is defined. The world is witnessing a systemic reconfiguration of political, environmental, economic, demographic and technological dynamics. In this rapidly changing world, cities, defined as complex socio-economic and spatial systems distinguished by their dense populations, concentrated economic activity, infrastructure networks and governance structures, are becoming pivotal arenas where decarbonized futures are forged and the next wave of industrialization is taking shape. UNIDO's framing of a city-driven, industry-led and human-focused global net-zero transition reflects this reality.

As the international order becomes more fragmented and multilateral frameworks come under strain, cities and subnational actors are gaining strategic relevance, especially for climate action (UN-Habitat, 2024a). Urban areas account for approximately 70 per cent of global greenhouse gas (GHG) emissions, mainly due to energy use in buildings, transport and industry (UN-Habitat, 2024b). At the same time, nearly 70 per cent of climate-related public investment is made by subnational governments, highlighting their critical role in delivering climate solutions on the ground (OECD, 2022). Despite this dual role, as both major emitters and frontline implementers, the architecture of the Paris Agreement remains centred on national governments through Nationally Determined Contributions (NDCs).

Climate and environmental pressures

The impacts of climate change converge most intensely in cities. This is manifested through increasingly frequent and severe stressors, such as extreme heat and water scarcity. These pressures are especially acute in LMICs, where informal settlements, overstretched services and weak institutional capacity leave urban populations particularly vulnerable. By 2040, more than two billion urban residents could face an additional temperature rise of at least 0.5°C, and 36 per cent of the global urban population may endure annual mean temperatures of 29°C or higher (UN, 2025). Rising demand for cooling is compounding energy burdens, often in regions where power systems are already fragile. By 2050, it is expected that 1.8 billion people will experience absolute water scarcity (WEF, 2024a). Urban water demand is projected to increase by 80 per cent by 2050, putting severe stress on already deficient water supplies (UNESCO, 2023). Urban decarbonization strategies must increasingly contend with mounting resource constraints – including not only water but also critical minerals and land – which, as factors of production, shape the feasibility, equity and pace of the net-zero transition.

"Urban decarbonization strategies must increasingly contend with mounting resource constraints – including not only water but also critical minerals and land."

Cities also face escalating environmental pressures from waste generation and resource-intensive consumption patterns, which further compound their GHG emissions profiles and undermine resilience. Municipal solid waste generation is predicted to grow from 2.1 billion tonnes in 2023 to 3.8 billion tonnes by 2050 (UNEP, 2024). Demolition and construction debris and electronic waste (e-waste, also known as WEEE) aggravate this challenge, both as pollutants and as missed opportunities for resource recovery. Rapidly expanding cities in LMICs are also experiencing escalating challenges from plastic waste, driven by rising plastic use and insufficient plastic waste management infrastructure. Inadequate municipal waste collection, as low as seven per cent in some LMIC urban areas, leads to significant methane and black carbon emissions (Reuters, 2024). The result is severe environmental degradation, public health concerns and major contributions to climate breakdown.

Urban sprawl and reliance on private vehicles exacerbate these impacts, also resulting in longer commute times and worsening air quality. How cities are built and expanded in the coming decades will be pivotal in shaping a sustainable global future. The world's population is expected to continue growing over the coming 50 or 60 years – from 8.2 billion in 2024 to a peak of around 10.3 billion people in the mid-2080s (UNDESA, 2023). Half the global population currently resides in cities and this proportion is projected to increase to 70 per cent by 2050 (UN, 2025). These trends necessitate the construction of entirely new urban areas and the rapid expansion of existing ones.

The continued expansion of cities requires extensive construction, which in turn drives demand for carbon-intensive materials, such as steel, cement and aluminium. These industry sectors contribute significantly to climate change. The steel sector alone accounts for approximately seven per cent of global energy-related CO_2 emissions, highlighting its significant role in

industrial decarbonization efforts (IEA, 2023a). Moreover, beyond direct emissions, cities are significant contributors to Scope 3 emissions through embedded carbon in materials, goods and services consumed. This rapid expansion presents a dual imperative: to deliver essential infrastructure and economic opportunities, while managing environmental issues. However, it also offers a significant potential turning point for LMICs, which can bypass legacy industrial pathways by integrating decarbonization from the outset through new economic and industrial models.

Transformation of economic and industrial models

Urbanization in LMICs is reshaping economic structures and consumption dynamics, with a rising cohort of young, urban consumers generating growing demand for diversified goods and services. In parallel, rapid and often unregulated urban expansion is contributing to the degradation of productive land and encroachment on peri-urban agricultural zones. This spatial transformation exacerbates vulnerabilities in local food systems and deepens dependence on extended, carbon-intensive supply chains. Moreover, the persistence of informal labour across food, waste and materials sectors reflects structural deficiencies in urban-industrial models. This underscores the need for integrated strategies that formalize value chains, enhance productivity and align urban and rural development with equitable and sustainable economic transformation.

Despite demonstrated benefits, eco-industrial parks and industrial symbiosis remain underutilized in industrial transitions in many countries. Yet these models offer opportunities to accelerate urban decarbonization by linking industry with municipal systems. Similarly, while urban economies are beginning to host cleantech sectors, including the manufacturing, assembly and servicing of electric vehicles (EVs), energy-efficient appliances and renewable energy components, the full economic potential of these value chains remains largely untapped. The expansion of green industries can catalyze broader economic development by creating demand for auxiliary services. However, structural gaps in skills development, limited access to finance and inadequate alignment of industrial, climate and urban policies continue to impede cities from capturing the employment and value-added opportunities these sectors offer. Without targeted investment in technical education, inclusive workforce strategies and entrepreneurship support, urban green transitions risk reinforcing inequality rather than mitigating it.

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Micro, small and medium-sized enterprises (MSMEs) form the backbone of urban economies, accounting for more than 90 per cent of all businesses worldwide, and for over 90 per cent of employment in 13 LMICs in Africa (UNDESA, 2020). Their role in industrial decarbonization is often overlooked, despite their presence across high-emission sectors such as construction, mobility and waste management. These enterprises are uniquely positioned to deliver climate solutions at the community level. Urban decarbonization strategies must embed targeted support for MSMEs to upgrade production practices, comply with environmental standards and access sustainable finance. This includes developing inclusive business models and creating viable pathways for their participation in rapidly evolving sectors, such as the circular economy or sustainable mobility.

Cities generate over 80 per cent of global Gross Domestic Product (GDP) through concentrated production, consumption and innovation, with urban areas in LMICs contributing an increasingly significant share (UN, 2022). For example, Sub-Saharan Africa's cities already generate more than 50 per cent of national GDP, and this share is expected to rise, with GDP in Sub-Saharan cities projected to increase at an annual average rate of 2.9 per cent during 2024-50, outpacing all other parts of the world. (CSIS, 2018, Oxford Economics, 2024). Cities are "real economy" hubs where labour, capital, infrastructure and policy interact to drive economic activity and societal transformation. As such, cities are active agents shaping local, national and global development trajectories.

However, urbanization is often accompanied by an increase in social inequality. More than one billion people currently reside in informal settlements, lacking access to essential services such as clean water and sanitation (UN-Habitat, 2020). Industrialization, when inclusive, can play a critical role in poverty reduction and have a positive spillover effect on cities. Urban poverty rates remain high, with 24 per cent of city residents globally living in informal settlements lacking access to adequate services and infrastructure (UN-Habitat, 2020). These communities are disproportionately affected by limited economic opportunities. The shift to automation and

digitalization is reshaping economies and labour markets, offering opportunities for innovation and requiring new skills and roles while underscoring the importance of supporting workers during the transition to ensure that no one is left behind.

Influential megatrends, including the shift to net zero, rapid advances in artificial intelligence (AI) and digitalization, the reorganization of global value chains, and significant demographic changes, are reshaping the global industrial landscape. These trends pose a challenge but also create new opportunities for cities in LMICs to accelerate economic diversification, job creation and climate action. A forward-looking and coordinated urban policy is essential for cities in LMICs to capitalize on these opportunities, strengthen their strategic positioning and play a more influential role within the evolving global economic and political landscape.

Underdeveloped innovation and entrepreneurship ecosystems

Urbanization creates fertile ground for economic transformation driven by innovation. New industries, such as renewable energy services, circular construction and manufacturing, green logistics, sustainable mobility and digital infrastructure, are emerging to meet urban demands while aligning with climate and development goals. Innovation is accelerating the transformation of urban-industrial systems by reconfiguring how cities function. However, in LMICs, access to emerging global technologies and the capacity to deploy them remain limited.

Many LMIC cities are hubs of grassroots innovation and entrepreneurship, and MSMEs and start-ups are developing solutions for context-specific energy, housing, mobility and food systems. These actors are vital to climate change mitigation and adaptation, yet their efforts often remain isolated due to limited institutional support. Scalable impact depends on innovation and entrepreneurship ecosystems that connect local problem-solvers with public authorities, investors and technical institutions. Urban strategies that nurture such ecosystems, through targeted financing, regulatory flexibility and cross-sector partnerships, will be better equipped to accelerate sustainable transitions.

Implementation barriers

No transformation can materialize without appropriate financing. Cities do not grow as they are planned. They grow as they are financed. In many LMICs, urban authorities struggle to access capital markets or climate finance due to low creditworthiness, lack of bankable projects and complex eligibility requirements. Beyond financing, implementation faces a range of structural and institutional barriers. Regulatory misalignment across governance levels can stall project approval and integration, while limited technical and administrative capacities constrain the ability of local governments to design, execute and maintain decarbonization initiatives. Political economy dynamics, including entrenched interests and short-term policy cycles, can further undermine long-term transition efforts. Addressing these multifaceted barriers requires not only resources but sustained institutional coordination and capacity at all governance levels.

The drive for urban decarbonization and inclusive and sustainable industrial development are mutually reinforcing processes that intersect across multiple dimensions of the Sustainable Development Goals (SDGs). Cities' role as hubs of industrial activity directly ties urban transitions to SDG 9 (Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation), while the promotion of clean energy technologies and green industrial processes contributes to SDG 7 (affordable and clean energy), SDG 12 (responsible consumption and production) and SDG 13 (climate action). Urban decarbonization, in turn, creates demand for sustainable industrial solutions, such as low-carbon materials and circular economy practices, reinforcing SDG 11 (sustainable cities and communities). However, while work on the SDGs has improved millions of lives in the past decade, progress remains uneven and faces significant challenges. With the 2030 deadline only five years away, nearly half of the SDG targets are moving too slowly or making only marginal progress, while nearly a fifth of them have regressed. The SDGs face severe setbacks from cascading global crises and escalating climate disasters. Official development assistance declined by 7.1 per cent in 2024, with further cuts anticipated in 2025. Geopolitical tensions, widening inequalities and insufficient multilateral support are hindering equitable implementation, particularly for SDGs 11 and 13 (UN, 2025).

Another critical challenge for urban decarbonization is the persistent gap in workforce preparedness. While cities are advancing ambitious climate policies and low-carbon infrastructure, the human capital needed to sustain these transformations is often missing. Technical and vocational education, and training systems in many LMICs remain poorly aligned with the requirements of emerging green industries. For instance, the

transition to electric mobility demands new skills in battery management, charging infrastructure installation and EV maintenance; renewable energy expansion requires technicians in solar, wind and grid integration; and circular urban systems call for expertise in, for example, product design and end-of-life treatment. These competencies are rarely embedded in mainstream training pathways. The absence of inclusive and forward-looking skills strategies risks locking cities into dependence on external expertise, slowing the uptake of technology and reinforcing inequality by excluding youth and women from the green economy. Building a new generation of urban workers, policymakers and planners, equipped with future-facing skills, is thus indispensable for achieving decarbonization while ensuring fair and resilient urban development.

"The absence of inclusive and forward-looking skills strategies risks locking cities into dependence on external expertise, slowing the uptake of technology and reinforcing inequality by excluding youth and women from the green economy."

02

SOLUTIONS

- Decarbonization of cities as industrial policy
- Holistic strategies and key levers
- Strengthening municipal finance systems
- Investment planning and market shaping
- From local implementation to shared governance
- Innovation ecosystems and green skills as catalysts

Decarbonization of cities as industrial policy

While UNIDO primarily operates at the global, regional and national levels, the profound structural shifts reshaping today's world demand a rethinking of where transformative change occurs. Cities in LMICs are emerging as critical arenas where climate action and industrial transitions converge. In this shifting landscape of power and responsibility, cities are not only implementing national commitments but actively shaping them, creating a strategic opportunity for UNIDO to embed its mandate to promote, dynamize and accelerate industrial development within urban systems. By engaging with cities, UNIDO can help align national industrial and climate policy with local leadership and implementation, enabling integrated, net-zero development pathways that reflect regional priorities and global goals. Cities, particularly in LMICs, are where economic growth, environmental stress and human development intersect most tangibly. They are also where systemic solutions can be deployed most effectively.

"Cities in LMICs are emerging as critical arenas where climate action and industrial transitions converge. In this shifting landscape of power and responsibility, cities are not only implementing national commitments but actively shaping them."

UNIDO is committed to driving urban decarbonization as a strategic entry point to tackle three priorities: clean energy and climate action; ending hunger through innovation and local value addition; and promoting fair and sustainable supply chains. Rather than approaching these as separate or parallel agendas, UNIDO considers them as intrinsically linked levers of industrial transformation within urban systems. Climate change both shapes and is shaped by how cities source, move and consume energy, food and materials. In turn, food systems influence land use, resource flows and urban resilience, while supply chains determine the carbon intensity, inclusivity and competitiveness of local economies. By working at the intersection of these three domains, UNIDO advances solutions that reduce GHG emissions, localize value and enhance socio-economic resilience simultaneously. This approach enables cities to address the root causes rather than just the symptoms. At the same time, the transformation of urban-industrial systems is closely interdependent with rural development, as supply chains, resource flows and labour dynamics connect cities with their hinterlands. This makes it essential to align urban transitions with rural conditions and opportunities.

The private sector plays a multifaceted role in urban-industrial decarbonization, as a major contributor to GHG emissions, as a vital source of technological and financial solutions, and as an actor increasingly exposed to the physical and transition risks of climate change. Net-zero transitions have profound implications for businesses, including entrepreneurs. On one hand, the transitions may threaten existing strategies, necessitating adaptive measures. On the other hand, businesses can proactively shape these transitions, steering them toward desired outcomes. Business models play a significant role in addressing both aspects. Effective alignment of private sector incentives with climate objectives requires the creation of predictable policy environments, performance-based market instruments and regulatory frameworks that reward emission reductions and resilience investments.

By embedding climate objectives into inclusive industrial pathways, UNIDO helps cities become contributors to global goals and active architects of a paradigm shift in the way development is conceived. UNIDO's distinct contribution is facilitating sustainability transitions where complexity and opportunity are most significant: at the nexus of urbanization, industrialization and decarbonization.

Holistic strategies and key levers

UNIDO's mission is to advance inclusive and sustainable industrial development through technical cooperation by equipping local and national governments with the tools needed to turn urban-industrial transitions into drivers of climate action and economic opportunity. At the core of this mission lie four interdependent pillars:

1. Innovation-powered transformation: UNIDO champions pioneering technologies, business models and financing mechanisms that catalyze accelerated and effective net-zero transitions, ensuring that urban-industrial advancement aligns with environmental imperatives and social objectives.

2. Inclusive and equitable engagement: UNIDO fosters collaborative processes that engage local communities, marginalized groups, public and private sectors, and international stakeholders. This inclusive approach ensures that urban-industrial decarbonization contributes to social equity and leaves no one behind.

3. Systemic and integrated action organized around missions: UNIDO promotes holistic strategies that transcend sectoral boundaries and employ a broad range of technical cooperation levers. This systemic approach enhances coherence and maximizes impact in tackling the multifaceted challenges of urban-industrial transformation and climate change, without compromising other critical environmental dimensions, such as biodiversity, air and water quality, pollution and land degradation. In its technical cooperation, **UNIDO activates key levers to support cities:**

- Policy and governance
- Technology, innovation and entrepreneurship
- Finance
- Knowledge sharing, partnerships and capacity building,
- Digitalization and data

These levers are applied across critical **urban-industrial sectors,** including:

- Energy
- Resources, materials and solid waste
- Water
- Buildings and facilities
- Transport

while also integrating nature-based solutions. A more detailed description of these technical cooperation levers and urban-industrial sectors in focus is provided in Appendix A, followed by selected UNIDO project examples in Appendix B. Although the levers and sectors are outlined separately for clarity, their interconnections must be recognized, and interventions should be organized around integrated, mission-oriented solutions that capture the systemic nature of urban-industrial transformation.

4. Resilience and climate adaptation: UNIDO grounds its efforts in building adaptive capacity and resilience within urban-industrial systems, ensuring that infrastructure, institutions and communities not only withstand climate-related shocks and stresses but are empowered to thrive amid uncertainty, securing long-term sustainability.

While the focus is on cities, it is essential to consider the broader economic and social effects of urban-industrial transitions, ensuring that advances in cities deliver net positive outcomes at the national and regional levels.

Strengthening municipal finance systems

Financing is a cornerstone of the urban-industrial transition. Cities that strengthen their financial performance and adopt sound financing solutions can mobilize the scale of investment needed to advance industrial decarbonization and climate-aligned growth. Targeted technical support enables cities to improve budgeting practices, enhance revenue administration, strengthen debt management and modernize financial reporting. These improvements form the basis of creditworthiness action plans that guide municipalities toward measurable progress and, ultimately, investment-grade ratings. Higher credit ratings expand the range of instruments available, from pooled municipal bonds and blended finance solutions to guarantee mechanisms. With stronger fiscal positions, cities can transition from a dependence on grants, particularly from the central government, to commercial-based infrastructure financing, creating the conditions for scalable and sustained investments. Long-term fiscal discipline, transparent reporting and predictable planning frameworks increase the confidence of financiers and create stable environments for private capital engagement.

"Financing is a cornerstone of the urban-industrial transition. Cities that strengthen their financial performance and adopt sound financing solutions can mobilize the scale of investment needed to advance industrial decarbonization and climate-aligned growth."

Creditworthiness is most effective when paired with the capacity to identify and implement tailored financing strategies. Cities require advisory support to evaluate instruments ranging from municipal bonds and commercial-based loans to public-private partnerships, land value-capture mechanisms and blended finance structures. The design of these strategies must be aligned with specific infrastructure needs and risk profiles, ensuring that the financing mix reflects local priorities as well as investors' expectations.

By combining strengthened fiscal performance with structured financing strategies, cities can move from fragmented, project-by-project transactions to systematic and replicable financing models. Coupled with upstream project preparation and transaction advisory services, cities can build credible investment pipelines, improve market access and lower the costs of capital. This integrated approach positions cities as proactive market participants, capable of leveraging blended finance, attracting institutional investors and securing the resources required to drive industrial decarbonization through financially sustainable urban development pathways. Over time, they evolve from grant-dependent entities into financially autonomous actors, leading the urban-industrial transition with stable and scalable financing solutions.

Investment planning and market shaping

Cities can deploy comprehensive planning tools that align urban development with long-term sustainability and industrial decarbonization goals set at the local and national levels. One crucial operational practice that bridges long-term strategic objectives with on-the-ground delivery is capital investment planning. It comprises systematic processes, including annual capital budgeting and asset management planning, to allocate resources to meet urban priorities and service objectives.

Cities hold significant leverage to drive upstream supply chain decarbonization by setting design regulations (also known as development and building regulations) and procurement standards that prioritize low-carbon and sustainable products. Design regulations are rules and standards that govern how buildings, infrastructure and public spaces are planned, constructed and maintained within a city or municipality. They ensure that urban development is safe, functional, sustainable and aligned with broader urban planning goals. Green Public Procurement (GPP) is the process by which public sector entities acquire goods, services and infrastructure with reduced environmental impacts across their life cycle, compared to conventional alternatives. At the local level, GPP serves as a key implementation tool, enabling cities to leverage their significant purchasing power to accelerate net-zero transitions. Through design regulations, GPP, and collaboration with suppliers, urban governments can incentivize cleaner production practices beyond their immediate boundaries. Additionally, cities can foster transparency and accountability in supply chains by promoting carbon footprint reporting and supporting supplier capacity-building for emissions reduction.

From local implementation to shared governance

Strategic planning and policy alignment for sustainable urban development depend on an integrated toolkit that steers coordinated action across all governance tiers. Policy frameworks establish the legal and institutional foundations for eco-friendly practices, allowing local and regional authorities to operate in a coherent regulatory context. Strategies articulate medium- to long-term goals for sustainable urban transitions, while roadmaps convert policies into detailed schedules with timelines, milestones, assigned roles and success metrics. Spatial planning shapes land use and urban form to boost resource efficiency and liveability, driving climate and environmental gains over time.

Central to the success of these tools is multi-level governance, which ensures vertical coordination - linking urban planning with energy, transport and environmental policies - and horizontal alignment among local, regional, national and global actors. Coordinating municipal actions with NDCs is crucial, especially given that the Paris Agreement's limited enforcement powers have highlighted the value of integrating bottom-up initiatives (UN-Habitat, 2024b). A well-functioning multi-level governance system merges national direction with city-level ambition, recognizing municipalities as partners in setting targets and piloting solutions. This unity enhances the credibility of national pledges, unlocks climate finance and speeds up the delivery of impactful, city-led sustainability programmes.

Innovation ecosystems and green skills as catalysts

Urban innovation is a key enabler of systemic transformation. Two complementary dynamics underpin progress toward net-zero cities. Bottom-up, supply-led innovation emerges from citizens, communities, and local business founders who experiment with new ways of addressing environmental and socio-economic challenges. The cultivation of indigenous entrepreneurship is essential in urban-industrial contexts. It ensures the development and deployment of technologies that are not only contextually appropriate but also scalable within local urban milieus through appropriate business models. Strategic support mechanisms, such as cleantech accelerators and innovation funds, play a crucial role in nurturing start-ups that develop innovative solutions tailored to specific urban conditions.

"Strategic support mechanisms, such as cleantech accelerators and innovation funds, play a crucial role in nurturing start-ups that develop innovative solutions tailored to specific urban conditions."

Demand-driven innovation, on the other hand, is stimulated through policy incentives, regulatory frameworks, or innovation challenges that create explicit demand for new technologies, services and business models. The interaction between these dynamics is essential, for while demand can steer innovation toward strategic sustainability goals, bottom-up experimentation broadens the solution space and enhances societal ownership of change. Together, they accelerate the transition toward resilient, net-zero and inclusive urban futures.

Complementing domestic innovation efforts, technology transfer serves as a vital conduit for the international dissemination and contextual adaptation of sustainable technologies. This process is characterized by collaborative partnerships that extend beyond mere technology deployment to encompass comprehensive capacity building, equipping local stakeholders with the skills and knowledge required for effective operation, maintenance and incremental innovation. Illustrative examples include the introduction of state-of-the-art cooling technologies for urban housing, coupled with robust technician training programmes and knowledge exchange frameworks. By aligning technology transfer with capacity development, these initiatives simultaneously advance decarbonization and industrialization objectives, generate employment opportunities, and reinforce the resilience and economic vitality of urban systems.

UNIDO strengthens urban innovation ecosystems by advancing green skills development tailored to emerging industries. Through partnerships with governments, enterprises and training institutions, it promotes curricula modernization, industry-linked vocational training and targeted capacity building, including vulnerable groups such as youth and women. By aligning workforce development with the demands of electric mobility, renewable energy, circular construction and other sectors, UNIDO ensures that cities can mobilize the human capital needed to accelerate decarbonization while fostering inclusive and resilient growth.

03

CALL TO ACTION

- Ignite the change: Rallying cities for industrial and climate leadership
- UNIDO calls upon its partners to act with purpose and coordination

Ignite the change: Rallying cities for industrial and climate leadership

The imperative to achieve a net-zero global economy must be matched by an equally ambitious shift in how and where transformation is driven. Cities and urban communities, particularly in LMICs, are emerging not merely as sites of implementation, but as decisive arenas where economic growth and climate action intersect. Recognizing and enabling this urban-industrial nexus is essential to delivering the scale and pace of decarbonization efforts required.

UNIDO envisions a future where cities function as strategic platforms for inclusive and sustainable industrial development, acting as demand aggregators, technological accelerators and enablers of resilient, net-zero infrastructure. This vision demands a reconfiguration of traditional governance and financing models, moving beyond top-down approaches toward city-driven, industry-led and human-focused solutions.

To operationalize this vision, **UNIDO calls upon its partners to act with purpose and coordination:**

- **Donor governments** are requested to channel development finance to support urban-industrial transformation, prioritizing municipal creditworthiness, institutional capacity for capital investment planning and green public procurement, as well as innovation and entrepreneurship across integrated urban-industrial sectors, including energy; resources, materials and solid waste; water; buildings and facilities; and transport.

- **Beneficiary national governments** are encouraged to integrate urban systems into national industrial and climate policy, enable multi-level governance and create decision-making mechanisms that empower cities to act.

- **Beneficiary city governments** are urged to establish investable project pipelines and build institutional arrangements that enable effective coordination across public, private and community actors, and urban-industrial sectors, including energy; resources, materials and solid waste; water; buildings and facilities; and transport.

- **Private sector actors** are invited to engage as co-investors, technology partners and solution providers, supporting the development and deployment of context-appropriate innovations that drive decarbonization and competitiveness within urban economies.

- **International organizations,** including UNIDO, have a critical role to play in bridging policy and practice, offering integrated technical assistance, fostering multi-stakeholder platforms and enabling the transfer of knowledge and technology across regions.

UNIDO stands ready to convene, support, and scale these efforts, leveraging its technical mandate, global reach and cross-sectoral expertise to ensure cities are positioned as co-leaders in the global net-zero transitions. This is not a call for incremental adjustment. It is an invitation to co-create a new development paradigm, one that aligns industrial progress with planetary boundaries, and urban vitality with economic and environmental resilience.

The road ahead is complex, but the opportunity is historic. By investing in cities as engines of sustainable industrialization, we can forge a pathway that is not only net-zero but also just, inclusive and future-fit. Let this be the moment where ambition meets action, and where urban-industrial development becomes the cornerstone of a global net-zero transition.

APPENDIX A

UNIDO's technical cooperation levers and urban-industrial sectors in focus

In its technical cooperation, UNIDO activates key levers:

1. policy and governance
2. technology, innovation, and entrepreneurship
3. finance
4. knowledge sharing and partnerships
5. digitalization and data

To support cities in progressing from implementation to leadership. These levers are applied across critical **urban-industrial sectors,** including:

1. energy
2. resources, materials, and solid waste
3. water
4. buildings and facilities
5. transport, while also integrating
6. nature-based solutions

The technical cooperation levers and urban-industrial sectors are described below. This Appendix A presents a broad spectrum of potential interventions that offer flexibility in their application, allowing stakeholders to select and adapt measures to specific urban contexts and priorities, rather than prescribing a rigid, one-size-fits-all sequence of interventions. This approach acknowledges the diverse needs of cities and promotes a tailored mix-and-match strategy to maximize impact. While the levers and sectors are presented as distinct areas for clarity, **it is crucial to recognize their interconnections and to organize interventions around integrated, mission-oriented solutions that reflect the systemic nature of urban transformation.**

TECHNICAL COOPERATION LEVERS

1. Policy and governance

Strategic planning and policy alignment

Objective: Establish structured, long-term direction and coordinated action across governance levels (global, regional, national, subnational and local) to guide sustainable urban-industrial development that is environmentally sound, socially inclusive and economically resilient.

Vertical policy alignment for sustainable urban development aims to guide long-term, coordinated action across global, regional, national, subnational and local governance levels, also referred to as multi-level governance. National policy frameworks establish legal and institutional foundations for sustainable practices, enabling subnational and local actors to act within a coherent context, for example, through national climate policies mandating the integration of green infrastructure. Strategies in turn articulate the approaches and priorities for achieving medium- to long-term goals and targets for sustainable urban transitions, such as a city's strategy to expand green space coverage by a specific date. Roadmaps provide step-by-step implementation plans with defined timelines, milestones, responsibilities and performance indicators, translating policies and strategies into actionable steps.

Aligning city-level actions with NDCs is essential, as the Paris Agreement's limitations in enforcing a top-down global response have underscored the importance of stronger integration of bottom-up initiatives. A well-functioning multi-level governance system combines top-down policy direction with bottom-up ambition, acknowledging that cities are not only implementers of climate measures but also proactive in setting targets and advancing innovative solutions. Another dimension of multi-level governance is horizontal coordination, which refers to the integration across administrative silos at the same governance level (e.g. various ministries) that are responsible for distinct urban-industrial domains, such as energy, transportation, or waste. An integrated strategic planning should account for the development of

surrounding rural and peri-urban areas, given cities' reliance on these regions for critical resources and ecosystem services. This holistic approach reinforces the credibility of national commitments, facilitates access to climate finance, and accelerates the delivery of high-impact, city-led climate and sustainability outcomes.

Regulatory and market-based instruments

Objective: Establish enforceable rules to shift urban systems toward net-zero practices.

Regulatory and market-based instruments play a critical role in shaping the structural conditions necessary for sustainable urban-industrial transitions. Unlike strategic planning or public procurement, which focus on design and implementation, these instruments directly alter the "rules of the game". Codes and regulations set mandatory performance thresholds, such as national building energy codes or design regulations, ensuring baseline compliance across sectors and creating a level playing field for net-zero practices. Market-based instruments create incentives and disincentives, thereby steering behaviour by influencing costs and benefits, for example, through tax credits for industrial energy efficiency upgrades or congestion charges to curb urban GHG emissions.

Regulatory and market-based instruments are most effective when embedded within an integrated policy mix, reinforcing innovation, accelerating the adoption of cleantech, and supporting industries in aligning with net-zero pathways. Moreover, their effectiveness is enhanced and coherence is ensured through horizontal coordination across ministries, such as finance, energy, industry and urban development, and vertical alignment across governance levels. When well-designed, regulatory and market-based instruments can unlock investment, reduce transition risks and create stable conditions for cities and industries to co-evolve toward a decarbonized future.

Implementation through Green Public Procurement

Objective: Leverage government purchasing power to accelerate demand for sustainable solutions.

Green Public Procurement (GPP) refers to the process by which public sector entities acquire goods and services with reduced environmental impacts across their life cycle, compared to conventional alternatives. GPP functions primarily as a demand-side mechanism, creating market pull. At the same time, it exerts supply-side effects by encouraging producers to innovate and align their production processes with high environmental performance standards. It plays a catalytic role in de-risking and scaling up innovative technologies - such as electric mobility and circular or low-carbon construction materials - by creating stable, early demand that lowers market and production risks, fosters economies of scale, and helps these solutions become cost-competitive. Particularly in sectors where industrial decarbonization is complex or capital-intensive, GPP can stimulate the adoption of cleaner processes and practices along supply chains. Its effectiveness depends on supportive regulatory frameworks, technical capacity within procurement agencies, and coordination across ministries and governance levels (national, subnational and local). When integrated into broader policy frameworks and aligned with national decarbonization and industrial development goals, GPP becomes a strategic lever for driving both market development and systemic transformation.

Capital investment planning

Objective: Guide annual, project-specific investments at the city level to optimize land use, mobility, energy and infrastructure systems for sustainability, resilience and economic vitality.

Capital investment planning is a critical practice that focuses on prioritizing capital investments to meet policy goals and service delivery targets. Distinct from high-level policy or strategy, it involves systematic processes, such as annual capital budgeting and asset management planning, to allocate resources for priority interventions that advance urban sustainability, resilience and service delivery. This includes coordinating multi-functional upgrades, such as integrated street retrofits that combine resurfacing, pedestrian safety, green infrastructure and low-carbon mobility within a single investment cycle. It also enables targeted investments in public facilities based on audit data, performance criteria, and available financing, ensuring that decarbonization and efficiency measures are rooted in everyday decision-making. When institutionalized within municipal governance, capital investment planning develops into a significant mechanism for sequencing infrastructure delivery, managing trade-offs and aligning limited budgets with climate and industrialization goals. Its effectiveness depends on robust data systems, transparent prioritization processes and the capacity to integrate technical, financial, and sustainability considerations into project selection and design.

Building quality infrastructure

Objective: Ensure that urban-industrial transitions are supported by reliable, safe and high-performing products, services and processes through robust quality infrastructure systems.

Quality infrastructure (QI) refers to the institutional system that ensures the reliability, safety and credibility of products and services through standardization, metrology, accreditation and conformity assessment. A robust QI system is essential for enabling urban–industrial decarbonization by providing a foundation for verifying performance, enforcing compliance and ensuring that sustainability claims are credible and measurable. It underpins the effective deployment of innovative cleantech across key sectors, including energy, construction, mobility and waste management. In rapidly growing urban areas, QI helps reduce risks to consumers, workers and the environment, while enabling the scalability and integration of net-zero solutions. For MSMEs, it is vital as it facilitates regulatory compliance and supports integration in regional and global value chains.

2. Technology, innovation, and entrepreneurship

National technology emergence and mainstreaming

Objective: Support the emergence, diffusion and scaling of net-zero solutions through national cleantech innovation and entrepreneurship ecosystems and international cooperation.

It is crucial to foster home-grown entrepreneurship by supporting local innovators with the development of contextually relevant and scalable technologies and business models that address urban-industrial challenges. Targeted interventions, such as incubators, green start-up accelerators, microfinance and blended finance instruments, and mentorship programmes, help lower entry barriers for youth and women, who are often excluded from formal markets. By embedding entrepreneurship training within vocational and higher education systems, cities can nurture a new generation of innovators who respond to local needs while integrating into global value chains. For example, a national cleantech accelerator and innovation fund may support start-ups developing electric rickshaws tailored for congested city environments, combining local knowledge with technological advancement and business training.

Regional cooperation among national cleantech innovation and entrepreneurship ecosystems is equally critical. Given the global concentration of cleantech manufacturing and the strategic importance of metals and minerals value chains, regional collaboration can strengthen collective resilience and competitiveness. By identifying comparative advantages and building complementary capacities across countries, regions can advance joint research, technology transfer, value chain development and market creation initiatives that benefit all participants. Such cooperation not only mitigates supply chain and security risks but also promotes more balanced participation in the global cleantech economy, enabling developing regions to design, produce and scale cleantech suited to their shared urban–industrial contexts.

Technology transfer

Objective: Facilitate the international movement and adaptation of sustainable technologies, particularly from more advanced contexts to LMICs, while building local capacity for practical use, repair and maintenance.

Technology transfer involves collaborative partnerships, often between governments or institutions, that enable the deployment of sustainable technologies in urban contexts. An example is the deployment of decentralized solar mini-grids in peri-urban neighbourhoods, paired with local entrepreneurship training and maintenance services. Such initiatives demonstrate how technology transfer facilitates the decarbonization of urban communities by integrating technology deployment with capacity development. By building local technical skills and expertise, these efforts contribute to job creation and strengthen the local workforce, fostering economic resilience alongside sustainable infrastructure modernization and climate action.

3. Finance

Enhancing subnational creditworthiness

Objective: Improve cities' financial performance, transparency and institutional capacity to achieve investment-grade creditworthiness and access sustainable infrastructure financing.

This involves providing technical support and capacity building to improve cities' financial performance indicators and help them secure an investment-grade credit rating. By strengthening local public financial management, cities can become more attractive to financiers and better positioned to leverage public and private capital. This is a precondition for scalable urban investment, enabling cities to shift from grant dependence to self-sustaining, credit-backed infrastructure financing. Examples of technical cooperation include assessing financial management performance to evaluate budgeting practices, revenue administration, debt management, and financial reporting. This is complemented by the elaboration and implementation of creditworthiness action plans that address identified weaknesses and guide cities toward measurable improvements.

Additionally, institutional capacity building ensures sustainable enhancements in fiscal discipline, transparency and long-term financial planning. In parallel, investment promotion is becoming increasingly localized and site-specific, with cities acting as first-mile conveners for bankable, climate-aligned projects at distinct sites and districts. Global city networks and partner coalitions, supported by international financial institutions, enable cities to progress from plans to investment-ready projects through upstream project preparation and transaction advisory services, anchored in a stronger fiscal performance. Stronger credit profiles give cities access to advanced financing options such as pooled municipal bonds, blended finance funds, and guarantee facilities supported by international financial institutions and donors. These tools expand their financing choices and help attract private investors.

Identifying financing options for capital investments

Objective: Equip cities with the knowledge and tools to evaluate, design and implement financing strategies tailored to their infrastructure needs and risk profiles.

This involves providing cities with capacity building and advisory support to explore, evaluate, and structure a range of financing instruments tailored to their specific infrastructure needs and risk profiles. Examples include municipal bonds, concessional loans, public-private partnerships (PPPs), land-based financing mechanisms such as value capture, credit guarantees and blended finance tools. These efforts enable cities to diversify their funding sources and develop sustainable investment strategies that align with their industrial development and climate action priorities.

As investment promotion shifts to the city scale, financing strategies should be anchored in site-specific value propositions, linking instruments and risk mitigation (for example, guarantees, revenue-backed structures and offtake arrangements) to the performance of particular urban districts, industrial parks and special economic zones embedded in the urban fabric. Cities can leverage international networks, multi-partner gap-funding windows, and advisory platforms led by international financial institutions to progress from planning to transactions, thereby crowding in institutional capital alongside national and multilateral facilities.

To overcome the mismatch between city needs and investor requirements, projects must be structured to offer adequate ticket sizes, acceptable returns, and manageable risks. Approaches include pooling projects to create diversified portfolios, deploying catalytic capital and first-loss layers from international financial institutions to de-risk investments, and using instruments such as political risk insurance or sovereign guarantees to mitigate perceived risks. Export credit agencies and guarantee facilities can further reduce exposure for investors, while green and sustainability bonds provide standardized and recognized channels to attract institutional investors. These mechanisms help cities transition from isolated, high-cost transactions to scalable, replicable models that can systematically attract private capital.

4. Knowledge sharing and partnerships

Training and workforce development

Objective: Strengthen the skills and competencies of urban stakeholders, including policymakers, technicians, planners, job seekers and citizens at large, to design and effectively implement sustainable urban-industrial initiatives.

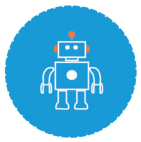
Training and capacity building are essential for equipping urban stakeholders with the competencies required to design, implement, apply, and sustain effective urban-industrial development initiatives. Efforts typically address multiple dimensions: fostering behavioural change to encourage sustainable practices at both individual and institutional levels; delivering technical skills development through training on tools, methods, and technologies relevant to urban-industrial development and climate action; and supporting institutional strengthening to enhance organizational structures, processes, and coordination for effective policy design and implementation.

A key priority is workforce development to prepare for emerging types of urban employment, such as green construction, electric mobility services, circular economy business models and digital solutions. The International Finance Corporation (IFC, 2019) estimates, for example, that over 230 million jobs in Sub-Saharan Africa will require digital skills by 2030, highlighting a significant opportunity for digital skills development. Embedding these skills into technical and vocational education, higher education and lifelong learning systems ensures that workers can adapt to evolving technologies while creating pathways for innovation and self-employment. These efforts ensure that sustainability objectives are embedded not only in strategies and infrastructure, but also in the human capital needed to drive and maintain systemic transformation.

Collaborative platforms and international fora

Objective: Host multi-stakeholder collaboration platforms and fora, including governments, academia, civil society, industries, and international organizations, to co-create, adapt, and scale sustainable urban solutions.

Collaborative platforms and international fora are essential mechanisms for accelerating sustainable urban-industrial net-zero transitions. They enable dialogue, knowledge exchange and collective action among diverse stakeholders, aligning policies, technologies, and investments toward shared development objectives. The Bridge for Cities initiative is UNIDO's flagship convening platform for cities, empowering urban stakeholders to advance industrial transformation in support of the 2030 Agenda. Through global fora, capacity-building workshops, youth dialogues and an online knowledge hub, Bridge for Cities brings together national and local governments, industries, international organizations, financiers, academia and civil society to foster know-how transfer, technology exchange, project matchmaking and network building. The initiative focuses on key areas such as green industry, the circular economy, low-carbon infrastructure, clean mobility and social equity, while also forging partnerships with UN-Habitat, UCLG, C40 Cities and other global actors. By linking policy, technology and finance, and by offering year-round opportunities for engagement, Bridge for Cities strategically connects urbanization, industrialization and decarbonization, helping cities to attract investment in climate-smart development solutions.



5. Digitalization and data

Smart maturity – local governance

Objective: Leverage digital technologies to enhance public participation, transparency and accessibility in urban planning and service delivery.

Smart maturity at the local governance level focuses on how cities utilize digital tools to actively engage citizens in decision-making and enhance their interaction with public services. From interactive urban simulations to streamlined digital platforms, these tools foster co-creation, build trust and make governance

more responsive and inclusive. Examples of digital innovation in urban governance include the use of interactive planning through digital twins, where cities employ simulation models to visualize development scenarios and engage the public in decision-making. For instance, in Pune, digital platforms enable participatory budgeting, and in Belo Horizonte, digital twin simulations allow citizens to visualize and debate planning scenarios. Another application is the use of e-governance platforms, which allow citizens to access public services, submit applications, pay taxes and receive information online. Examples include Davao City's digital business permit portal and Kerala's digitized local government services, both of which enhance administrative efficiency and improve service accessibility for residents.

Smart maturity – infrastructure

Objective: Deploy advanced digital technologies to monitor, manage and optimize urban infrastructure systems, enhancing sustainability, resilience and operational efficiency.

Smart infrastructure maturity refers to the integration of digital technologies, such as Internet of Things (IoT) sensors, big data analytics and AI, into core urban systems, including energy, water, mobility and waste management. These tools support data-driven decision-making by experts, enabling real-time monitoring, predictive maintenance, resource optimization and more responsive infrastructure services. For example, Pretoria has implemented GPS tracking and route optimization software to streamline waste collection, lowering fuel consumption and GHG emissions. In Tangier, the implementation of an AI- and IoT-enabled waste collection system resulted in a 24 percent reduction in travel distance (Belhiah et al., 2023). Hangzhou's AI-based traffic management system, known as City Brain, has demonstrated the potential to reduce commute times significantly. According to CNN (2019), cities adopting similar systems could see average commute durations decrease by 15 to 20 per cent by 2025, contributing to a reduction in GHG emissions from urban transport. Overall, the global market size for smart city systems and solutions was valued at $648.36bn in 2020 and is estimated to reach six trillion dollars by 2030 (Allied Market Research, 2022).

URBAN-INDUSTRIAL SECTORS

1. Energy

Renewable energy generation

Objective: Produce clean, sustainable energy from renewable natural resources to reduce GHG emissions and dependency on fossil fuels, as well as to increase energy security.

Renewable energy technologies provide critical pathways for decarbonizing urban-industrial energy systems. Solar technologies encompass utility- and prosumer-scale photovoltaic (PV) installations, concentrated solar power and solar thermal applications, including water heating and cooling, deployed in residential, commercial and industrial settings. Wind energy encompasses both onshore and offshore wind farms, providing substantial grid-scale capacity. Biomass-based generation leverages solid biomass, biogas and liquid biofuels sourced sustainably from waste and fuelwood, supporting power, heat and combined heat and power (CHP) production. These technologies enable integrated energy systems that align renewable energy generation with urbanization patterns and industrial demand profiles, facilitating decarbonization while maintaining system reliability and supporting economic growth. Moreover, emerging attention to the life-cycle management, including design, manufacturing of renewable energy technologies and end-of-life considerations, underscores the importance of circular approaches in sustaining their environmental and economic benefits.

Energy transmission and distribution

Objective: Deliver energy reliably from generation sources to end-users through robust, resilient and modernized infrastructure.

Energy transmission and distribution systems are essential for efficiently and reliably delivering electricity or thermal energy from generation sources to end users. This requires expanding and modernizing transmission and distribution infrastructure, which includes, for example, enhancing grid efficiency, reliability and minimizing energy waste to support stable power delivery in complex urban environments. Integrated district

heating and cooling networks complement electrical grids by providing centralized thermal energy solutions optimized for urban contexts.

Waste heat generated by factories, data centres, or wastewater treatment facilities, can be used as input to energy districts supplying residential heating through energy-sharing systems, especially where proximity and infrastructure allow for integration. This approach reduces GHG emissions and cuts energy costs. Low-temperature thermal grids, heat pumps, and thermal storage enable flexible distribution of this recovered heat. Separately, modern district heating/cooling systems provide centralized, low-carbon heating/cooling to urban neighbourhoods by combining diverse sources, such as waste heat, renewables and CHP. When strategically deployed, district heating/cooling enhances system-wide efficiency and resilience in the transition to clean energy. Infrastructure expansion and modernization are crucial for enabling sustainable energy flows that align with rapid urbanization and industrialization, ensuring an effective integration of renewable generation and demand-side management, and facilitating resilience and security.

Energy access

Objective: Ensure affordable, reliable and inclusive access to modern energy services, particularly for underserved urban and peri-urban populations.

Electrification efforts focus on informal settlements and peri-urban areas through the deployment of mini-grids and micro-grids, supported by battery storage systems that enable off-grid and backup power solutions. Innovative financial models, such as pay-as-you-go systems and energy-as-a-service platforms, enhance affordability and consumer flexibility. Clean cooking technologies, such as electric stoves, liquefied petroleum gas and biogas, mitigate health impacts and reduce GHG emissions. Furthermore, the active participation of prosumers and energy communities fosters decentralized energy access, enhancing local ownership and resilience within the broader energy transition framework. These approaches collectively contribute to just energy transitions, aligning with the dynamics of urbanization and industrialization.

Energy efficiency and optimization

Objective: Reduce energy consumption and losses across systems and sectors through best practices and innovative technologies.

Key measures include the deployment of energy management systems to monitor and control consumption, as well as energy efficiency improvements for buildings such as retrofits, enhanced insulation and the adoption of high-efficiency appliances. Additionally, smart meters and digital demand-side management tools enable real-time monitoring and adaptive energy use, offering opportunities for further dynamic optimization and balancing of energy supply and demand.

2. Resources, materials and solid waste

Narrowing resource loops

Objective: Reduce the input of raw materials and energy by increasing resource efficiency throughout production and consumption processes.

This approach emphasizes optimizing material flows to minimize waste and maximize resource productivity, thereby lowering both raw material and energy demands. While energy efficiency and optimization are addressed in the dedicated section focused on energy, narrowing resource loops complements these efforts by targeting a broader array of inputs, including resources, materials and water, across industrial-urban systems. Enhancing resource efficiency reduces production costs, thus enhancing profitability and competitiveness, mitigates supply chain risks linked to material scarcity and price volatility, and supports environmental compliance by minimizing GHG emissions and waste.

Slowing resource loops

Objective: Extend the lifespan of products and materials through reuse, repair, refurbishment and design, thereby delaying waste generation.

This includes product upgrading and fostering reuse through second-hand markets, sharing models and redistribution networks. Designing products for durability, modularity, and easy disassembly supports circularity. Industrial practices, such as servitization, leasing, energy-as-a-service, transport-as-a-service, and maintenance contracts, further enable prolonged use in the urban context.

Closing resource loops

Objective: Recover materials, nutrients, and energy from waste streams to minimize resource loss, reduce environmental impact, and reintegrate valuable resources into production systems.

Selective waste collection, material recycling, nutrient recovery, and composting are essential processes for closing resource loops. They reduce the need for primary raw materials, lower GHG emissions and limit methane generation from landfills, contributing directly to decarbonization targets. Industrial symbiosis - where one firm's by-product becomes another's input - reduces disposal costs and creates value from waste. Urban mining is the process of recovering valuable metals and minerals from electronic waste, discarded appliances, infrastructure (including construction and demolition waste, and end-of-life renewable energy infrastructure), and other materials already present in urban environments. Rather than extracting raw materials from natural ore deposits, urban mining focuses on reclaiming resources from the existing "urban stock" of materials. It does not mean building traditional mines within cities but instead emphasizes resource recovery to feed circular material flows and reduce dependency on primary mining. Urban mining is an essential source of critical raw materials for just energy transitions and high-tech industries.

Sector focus: food

Objective: End hunger, achieve food security and improve nutrition in urban settings.

More than half of the global food production is destined for consumption in urban areas. While cities are functionally open systems, depending on a constant supply of food from increasingly distant sources, food systems are often treated as external to the mainly service- or industry-driven urban economies. Enlarging the scope of analysis (and responsibility) beyond a narrow territorial definition to systematically include the peri-urban and rural supply-sheds that feed the cities leverages the transformative power of current urbanization dynamics and the resilience of their food supply. Food is an essential component of the urban metabolism. In the urban context, food markets and agro-processors generate large volumes of organic residues (peels, husks, spoiled food). Those residues need safe, sanitary disposal or valorization. Simultaneous analysis of urban impacts at various scales (local-regional-global, including, for example, Scope 3 emissions) is essential to understand the interconnections.

While inequality in food security is often particularly pronounced in urban areas, and threatens social stability if not addressed, high prices in cities also provide opportunities for innovative, capital-intensive production systems such as controlled environment and vertical farming, hydro and aeroponics. The short distance to the consumer and the intrinsic resilience of local supply have been recognized as a distinct value amid recent disruptions caused by global pandemics or price spikes in global grain shipments due to armed conflict in supply regions.

Food safety and supply chain integrity are particularly relevant in the high-density settings of urban contexts, and a one-health approach is imperative. From improved storage and integrated cooling chains to extended producer responsibility and supply chain transparency (for example, the development of premium markets for commodities credibly labelled as fairly produced, deforestation-free, or net-zero in their climate impact), urban areas have unique responsibilities and opportunities.

Sector focus: plastics

Objective: Reduce environmental and climate impacts of plastics through sustainable production, consumption and end-of-life management, while supporting circular economy practices in urban- industrial contexts.

Sustainable plastics management provides critical pathways for reducing the climate and environmental footprint of urban-industrial systems. This includes the use of bio-based and biodegradable polymers, improved plastics design for recyclability and the adoption of mechanical, chemical and feedstock recycling in industrial and municipal settings. Collection, sorting and recovery systems help divert plastics from landfills and natural ecosystems, lowering GHG emissions. These approaches enable circular plastics

systems that align material flows with urban consumption patterns and industrial demand, supporting climate mitigation, resource efficiency and economic resilience. A growing focus on life-cycle considerations, design innovation and end-of-life treatment underscores the potential of circular strategies to enhance environmental performance and sustain economic value in the plastics sector.

3. Water

Water supply

Objective: Ensure access to safe, reliable and resilient water supply in urban and industrial settings.

Upgrading and expanding infrastructure, such as treatment plants, pipelines, and pump stations, ensures stable water access while limiting energy use and GHG emissions. Reducing non-revenue water through improved distribution systems increases efficiency and lowers operational costs. Integrating rainwater harvesting can reduce dependency on grid-supplied water and enhance resilience to climate risks. These infrastructure investments directly support decarbonized industrial growth and more sustainable urban systems. For example, AI-powered systems can optimize water usage, detect leaks and improve distribution efficiency.

Wastewater treatment

Objective: Treat and manage urban liquid waste to protect health and water bodies, and enable resource recovery.

This includes centralized treatment plants, modular systems for peri-urban zones, and dedicated industrial wastewater facilities tailored to sectoral needs. Applying technologies such as activated sludge, managed aquifer recharge wells and constructed wetlands, or membrane bioreactors supports efficient and low-emission treatment. Sludge can be safely processed for reuse, including composting or biogas production, contributing to circular economy goals. Treated wastewater can be reused in agriculture, landscaping or industrial processes, reducing freshwater demand and supporting decarbonized operations. For example, the water-stressed city of Windhoek in Namibia developed a system for recycling wastewater, which now supplies 35 per cent of its drinking water (Veolia, 2018).

4. Buildings and facilities

Residential

Objective: Provide inclusive, low-carbon and climate-resilient housing options for all urban residents.

Decarbonizing the residential sector hinges not only on energy efficiency measures but also on reducing the embodied carbon in construction materials, particularly those from energy-intensive industries such as steel and cement. Incorporating low-carbon alternatives, such as recycled, bio-based and locally sourced materials, directly lowers the demand for high-emission industrial outputs, linking urban building practices to industrial decarbonization pathways. This approach not only advances sustainable urbanization but also catalyzes cleaner supply chains, which are integral to industrial transformation.

Productive

Objective: Transform industrial areas into high-performance hubs designed to minimize environmental impact and drive sustainable growth.

The transitioning of traditional industrial areas into eco-industrial parks involves symbiotic resource use, waste valorization and shared low-carbon infrastructure. Targeted efficiency upgrades and on-site renewable energy generation reduce operational GHG emissions while enhancing energy autonomy. This reconfiguration positions industrial zones not as pollution hotspots, but as strategic nodes in net-zero urban systems.

Public and social

Objective: Modernize and decarbonize public service buildings to enhance community resilience, health, education and administrative capacity while reducing environmental impact.

Upgrading public buildings such as schools, hospitals, and administrative facilities with renewable energy systems and energy efficiency measures reduces operational GHG emissions while enhancing service reliability. Climate-resilient infrastructure design features safeguard functionality during extreme weather events, particularly in underserved urban areas, and requirements for low-carbon materials drive investment in industrial decarbonization. The integration of green spaces within social infrastructure contributes to urban climate mitigation and supports public well-being. These interventions modernize essential services, catalyze demand for cleantech and sustainable materials, and embed long-term resilience into the urban fabric.

5. Transport

Moving people

Objective: : Promote a seamless, multimodal and low-emission urban mobility system that enhances accessibility, efficiency and climate resilience. Encourage walking, cycling and public transport through safe, inclusive and health-promoting infrastructure, thereby reducing GHG emissions and car dependency.

The electrification of public and private transportation is central to decarbonizing urban mobility and advancing industrial development. EV adoption hinges on expanding EV infrastructure, including charging networks and the integration of smart grids. For example, Delhi has rapidly expanded public and private EV charging stations and piloted smart-grid integration, and has seen a sharp rise in EV registrations as a result. This transition also stimulates job creation and the emergence of new industries across the EV value chain, from battery manufacturing and charging infrastructure to digital mobility services and grid management.

Investment in cycling and pedestrian infrastructure reduces urban congestion and GHG emissions while driving production of bicycles, e-bikes, safety equipment and urban street furniture. Mobility-as-a-Service (MaaS) integrates different transport services, such as public transit, ride-hailing, bike- and car-sharing, and taxis, into a single digital platform that allows users to plan, book and pay for their journeys seamlessly. MaaS platforms expand industrial opportunities in the sharing economy, digital mobility solutions, fleet management and data services. Electrified transit modes, metro, light rail and bus networks deliver substantial emission reductions, expand public transport access and sustain industries involved in vehicle manufacturing, system integration, and maintenance.

Transit-Oriented Development (TOD) is an urban planning approach that promotes compact, mixed-use communities centred around high-capacity public transport. By reducing use of private vehicles and enhancing transit efficiency, TOD lowers carbon emissions and fosters concentrated industrial and commercial activity around transit hubs. For example, Bogotá's large-scale bus rapid transit system reduces GHG emissions by 350,000 tonnes of CO_2 equivalent annually (ICLEI, 2014).

Enhancing last-mile connectivity with e-bikes, shared scooters, feeder buses and pedestrian infrastructure strengthens network integration and creates markets for micro-mobility technologies and urban design innovations. Inclusive mobility designs addressing the needs of vulnerable populations expand both social equity and specialized mobility industries.

The 15-minute city model promotes proximity-based urban living, reducing travel distances and supporting decentralized manufacturing, repair and circular economy services. This concept, which has been applied in LMIC cities such as Bogotá, Pune and Shanghai, aligns industrial innovation with decarbonization goals by fostering local clean mobility technologies and green job creation.

Moving goods

Objective: Promote green urban logistics to reduce GHG emissions.

Urbanization and industrialization converge in transforming city logistics toward cleaner, more efficient delivery systems. The adoption of electric cargo bikes, electric vans and urban consolidation hubs significantly reduces the carbon footprint of last-mile deliveries, while fostering new manufacturing and service sectors focused on clean vehicle production and fleet management. The implementation of low-emission zones restricts high-pollution freight vehicles in dense urban areas, thereby improving air quality and creating demand for low-emission commercial vehicles and retrofitting services. Advanced digital logistics, including smart routing, load optimization and real-time tracking, enhances operational efficiency and supports the growth of technology providers and software developers. Digital platforms integrating MSMEs into affordable, low-emission delivery networks expand economic opportunities for local businesses and stimulate innovation in logistics services. Reverse logistics systems for the collection and reuse of goods and packaging support circular economy practices, generating industrial activities in waste management and recycling. In general, urban logistics modernization drives decarbonization and industrial growth in tandem.

6. Nature

Nature-based solutions (NBS) in urban areas

Objective: : Integrate natural processes and green infrastructure into urban environments to address climate, social and health challenges while enhancing biodiversity and resilience.

NBS in urban contexts present strategic avenues for advancing industrial innovation alongside decarbonization and climate resilience. The implementation of urban forests, street trees, green roofs and green walls delivers multifaceted benefits by mitigating urban heat islands, enhancing air quality and reducing building energy demands, thereby lowering GHG emissions. The engineering and construction sectors, which are engaged in designing rain gardens, bioswales, permeable pavements and constructed wetlands, drive growth in sustainable infrastructure markets focused on natural water management and flood mitigation. The development of green corridors and ecological networks underpins biodiversity conservation efforts, while also catalyzing ecosystem services industries, such as habitat restoration and environmental monitoring. Moreover, community gardens and urban agriculture foster circular economy practices, social equity and local agri-food innovation. Integrating these natural systems into urban-industrial frameworks enables a transformative approach that simultaneously strengthens ecological resilience and accelerates the development of net-zero industrial systems.

Air quality and soil remediation

Objective: Improve urban environmental health by addressing pollution through natural and engineered interventions that restore degraded air, soil and land systems.

Urban air quality is often impaired by uncontrolled, decentralized waste combustion due to the lack of reliable and integrated waste collection and management systems. Household energy demand for cooking and the continued use of solid fuels remain a major burden, causing disease through indoor air pollution. At the same time, it also intensifies pressures on peri-urban and remote forest ecosystems. For example, charcoal production remains a dominant energy carrier in many parts of Africa. Several technical solutions have been developed in response. For example, pyrolysis of organic waste residues and the subsequent use of pyrogenic carbon as biochar for soil regeneration have been applied in various urban greening projects. These practices enable the regeneration of often compacted, degraded and arid soil conditions in urban areas, and enhances the survival rates and drought resilience of vegetation in green spaces.

APPENDIX B

Project examples

The table below provides an overview of three selected UNIDO initiatives and illustrates how they map across key urban sectors – energy; resources, materials and solid waste; water; buildings and facilities; and transport - as well as UNIDO's main technical cooperation levers for urban decarbonization: policy and governance; technology, innovation and entrepreneurship; finance; knowledge sharing, partnerships and capacity building; and digitalization and data. The initiatives are:

• Introducing Systemic Resilience Methodologies in Infrastructure Investment Planning **(Investment planning)**

• The Sustainable Cities Integrated Approach Pilot (SCIAP) in India **(India SCIAP)**

• Energy Districts in Colombia **(UNIDO ED2)**

	POLICY AND GOVERNANCE	TECHNOLOGY, INNOVATION, AND ENTREPRENEURSHIP	FINANCE	KNOWLEDGE SHARING, PARTNERSHIPS, AND CAPACITY BUILDING	DIGITALIZATION AND DATA
ENERGY	Investment planning UNIDO ED2	Investment planning India SCIAP UNIDO ED2	Investment planning India SCIAP UNIDO ED2	Investment planning India SCIAP UNIDO ED2	India SCIAP UNIDO ED2
RESOURCES, MATERIALS, AND SOLID WASTE	India SCIAP	India SCIAP	Investment planning India SCIAP	India SCIAP	India SCIAP
WATER	Investment planning India SCIAP	Investment planning India SCIAP	India SCIAP	India SCIAP	India SCIAP
BUILDINGS AND FACILITIES	Investment planning UNIDO ED2	Investment planning UNIDO ED2	Investment planning UNIDO ED2	Investment planning UNIDO ED2	UNIDO ED2
TRANSPORT	Investment planning	Investment planning India SCIAP	Investment planning India SCIAP	India SCIAP	India SCIAP

The projects are described in more detail below, followed by the example of UNIDO's partner city, Xi'an in China.

Project example: Introducing systemic resilience methodologies in infrastructure investment planning

The project provides technical assistance to the Governments of Egypt, Uganda, and Antigua and Barbuda to help builds their capacity to adopt enhanced climate resilience and mitigation solutions for capital investments. The primary focus is on identifying alternative design specifications for infrastructure investment projects under preparation, in order to improve their resilience and mitigation potential. In addition, beneficiary government agencies receive training and knowledge resources to apply the same methodology to future projects.

This GEF-funded technical assistance has total budget of $1.3m and is structured in three components: (i) identification of design options for a selection of capital investment projects currently in the planning phase (ii) estimation of "climate-smart" costs for each project, including capital and operating expenditures over the expected life-cycle of each project, as well as the estimation of carbon-emissions saved as a result of improved mitigation and foregone rehabilitation or reconstruction costs as a result of improved resilience (iii) provision of support for knowledge and capacity building in the area of climate-smart investment planning.

By supporting cities at the capital investment planning level, the project aims to impact the whole pipeline of planned investments. With the concentration of production and consumption in cities, the potential to achieve results at scale is high. While GHG emissions in cities cannot be attributed exclusively to investments realized by local governments, they play a fundamental part in setting standards and demonstrating precedents that will guide decisions by the private sector as well. Furthermore, the project emphasizes opportunities for public-private partnerships where city administrators define requirements that will determine design and technological solutions to be adopted by private investors.

In the case of industrial parks, for example, cities play a fundamental role that can go beyond the administrative function of issuing permits, leasing land and providing basic infrastructure services. Local officials can set up concession agreements that stipulate, among other things, mitigation and adaptation standards, including circular economy requirements and quality of public services. By planning interventions at the early stage when the definition of ends and means can still determine project outcomes, municipalities can also tap revenue opportunities (for example, through land value-capture mechanisms), which are essential to leverage financing and to attract capable private partners and responsible investors.

Project example: The Sustainable Cities Integrated Approach Pilot (SCIAP) in India

The project was financed by the GEF-6 Integrated Approach Pilot (IAP) through a $12.11 million grant, complemented by co-financing from municipal, state and national partners, as well as development banks and private actors. The project was implemented in collaboration with the Ministry of Housing and Urban Affairs and five pilot cities: Jaipur, Bhopal, Mysuru, Vijayawada and Guntur. UNIDO served as the GEF implementing agency, and the project's objective was to demonstrate and promote the integration of sustainability strategies into urban planning and management while creating conditions for long-term investment in resilient, low-carbon infrastructure and improved municipal service delivery.

The project combined policy and practice through four components: planning tools such as the Urban Sustainability Assessment Framework; clean technology demonstrations in waste, water and energy; knowledge platforms and partnerships connecting cities to national and global networks; and monitoring and evaluation systems to ensure accountability and enable replication.

SCIAP has demonstrated how India's rapid urbanization, growing industrial activity and the imperative of decarbonization can be addressed through integrated action. With 500 million people (36 per cent of the population) already living in cities, pressures on waste, water and energy systems have been acute. Waste alone is projected to reach 230 million tonnes annually by 2041, while only 21 per cent of wastewater is treated nationwide. Left unmanaged, these trends would lock cities into high-emission growth. SCIAP responded by embedding decarbonization in urban service delivery. Bhopal deployed 250 bio-gas waste collection vehicles, cutting reliance on diesel. Mysuru commissioned 550 tonnes per day of waste-processing capacity, diverting organic waste from landfills and using it instead to produce compost. Guntur introduced 220 electric three-wheelers and a floating solar plant with a peak capacity of 500 kilowatts, reducing emissions from both mobility and power. Jaipur upgraded two sewage treatment plants and constructed a new state-of-the-art treatment plant to process and clean over 215 million litres of wastewater per day, while Vijayawada rehabilitated four biogas plants for renewable energy generation. Together, these pilots contributed to the project's target of 5.72 million tonnes of CO_2 equivalent mitigated.

By institutionalizing tools like the Urban Sustainability Assessment Framework, SCIAP ensured that these results go beyond isolated pilots, anchoring decarbonization in governance systems and proving that urban growth can drive climate-smart industrial transformation.

Project example: Energy districts in Colombia

Financially supported by the Swiss State Secretariat for Economic Affairs (SECO) to the level of CHF4.8m (approximately US$6m), the objective of UNIDO's ED2 project was to promote energy districts as an energy-efficient, environmentally friendly alternative to address the fast-growing demand for air conditioning and cooling in the built environment and to enhance integrated energy planning and use across sectors.

UNIDO ED2 pursued this objective by working closely with national counterparts such as the Ministry of Environment and Sustainable Development, the Ministry of Mines and Energy, the Mining and Energy Planning Unit and the local governments of ten cities in Colombia to improve and implement national and local policies as well as regulatory frameworks to promote uptake and development of energy districts. The project reinforced the knowledge and capacities of all relevant stakeholders. It included the establishment of a Competence and Knowledge Centre for Energy Districts in partnership with the Colombian Association of Air Conditioning, Refrigeration and Ventilation; the integration of energy districts in national professional qualification standards, and the expansion of a national energy district research competition to 12 universities.

The ED2 project also worked with national and local governments, energy utilities, engineering design and consulting companies, energy efficiency and renewable energy project developers, investors and energy end-users to support the development of 21 energy districts' feasibility studies across the country and the implementation of three of them. The energy district feasibility studies, in 10 different cities and across five different sectors (commercial, public administration, health, industry, residential) with the involvement of 48 private sector entities, not only generated unique and otherwise unavailable project-specific information but also structured a methodology for analysis and feasibility of energy district projects, and provided capacity and business experience and track records to eight different design and engineering companies to continue developing and evaluating energy district projects in the country.

Energy districts as energy systems that smartly combine production, recovery and supply of energy in a neighbourhood, significantly improve energy efficiency, and enhance the use of renewable energy (both production and storage), thus contributing to the reduction of power demand and GHG emissions. Energy districts are implemented in urban areas or interconnected groups of buildings, like industrial parks, often also offering the opportunity to use waste-heat resources productively. Energy districts can efficiently and economically provide multiple types of energy services, including air-conditioning, cooling, heating, domestic hot water, power, steam and compressed air.

In the light of steadily growing and accelerating global electricity demand for cooling applications and for heating electrification, which put growing pressure on countries' electric power systems and related investments; and the low level of application of integrated energy planning approaches in urban, industrial and energy sectors; and the overarching need to decarbonizing electrical and thermal energy, energy districts represent a key energy-efficient, low-carbon infrastructure solution on the path to sustainable urban development and industry decarbonization, and an ideal use case to demonstrate and deploy integrated smart energy planning approaches and methodologies for sector-coupling and urban-industry symbiosis.

With the continued financial and strategic support of SECO, in December 2024, UNIDO started the implementation of the Global Energy Districts Programme, which aims to support additional emerging economies and developing countries by demonstrating the sustainability and economic potential of energy districts and kick-starting market development.

Example of UNIDO's partner city Xi'an, China: Integrating urbanization, industrialization and decarbonization

In recent years, Xi'an, capital of the Chinese province of Shaanxi, has undertaken a set of citywide strategies aimed at aligning its rapid urban growth and industrial development with China's national carbon peaking and neutrality goals. These strategies include large-scale promotion of new energy vehicles (NEVs): battery electric vehicles, plug-in hybrid electric vehicles and fuel cell electric vehicles, systematic upgrades in traffic management through micro-transformations of road networks, and the rapid deployment of distributed PV systems in urban and industrial areas. Taken together, these interventions cover the metropolitan region of more than 13 million people, and they draw primarily on municipal and national government financing, complemented by partnerships with leading enterprises such as BYD, Geely and Shaanxi Automobile.

The nexus of urbanization, industrialization and decarbonization is especially clear in Xi'an's trajectory. One of China's historic capitals, the city is now also a manufacturing hub with a fast-growing economy valued at ¥1.2trn ($168.6bn) in 2023. Its industrial base, particularly in the automotive sector, has become both a driver of growth and a lever for decarbonization. Xi'an leveraged this industrial strength by fostering large-scale NEV production and ensuring demand through policy measures: 100 per cent electrification of new buses and taxis, expanding use of electric vehicles in sanitation and logistics, and consumer incentives such as free parking and access to bus lanes. This strategy turned the challenge of growing urban mobility demand into an opportunity for industrial competitiveness and climate action.

Urbanization pressures also required transport efficiency improvements. Instead of costly large-scale demolition and reconstruction, the city implemented micro-transformations of urban trunk roads. By redesigning intersections, upgrading signals and introducing smart traffic systems, congestion was reduced by up to 21 per cent at only one-third of the cost of traditional methods. This approach illustrates how fine-grained management of infrastructure can deliver significant emissions and quality-of-life benefits in fast-growing cities.

On the energy side, Xi'an expanded its distributed PV generation, especially in industrial parks. By mid-2024, rooftop PV installations had reached a total capacity of 1.76 gigawatts, equivalent to the output of a mid-sized coal power plant and saving over one million tonnes of coal annually. Building-integrated photovoltaics (BIPV) were piloted in new industrial zones such as Jinghe New City, where 34 megawatts of rooftop capacity now generate around 35 million kilowatts hour per year. These interventions demonstrate how energy transition measures can be embedded directly into the urban fabric and industrial growth model.

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