06 FEATURE: RENEWABLE ENERGY IN SUB-SAHARAN AFRICAN CITIES

Despite facing many challenges, city governments across Sub-Saharan Africa have heeded the call to act on renewable energy and have joined global initiatives to advance the deployment and use of renewables.

Due to rapid population growth and urbanisation, as well as rising energy demand, cities across Sub-Saharan Africa increasingly recognise the opportunities around renewable energy use. Common drivers for renewables in the region include improving energy access and reducing energy poverty, as well as boosting the resilience and reliability of power systems.

Cities in Sub-Saharan Africa have supported local renewable energy deployment in a variety of ways, including by facilitating collaborative projects led by national governments, development finance institutions and/or private actors. Some local governments, especially in cities where transport is responsible for a large share of energy consumption, have entered into public-private partnerships to advance e-mobility (sometimes linked to renewable electricity) at the city level. In addition, cities have joined networks such as the Covenant of Mayors in Sub-Saharan Africa (CoM SSA) that help to build knowledge and internal capacity regarding renewable energy data and projects.

While city governments have played a key role in shaping the region's energy landscape – including advancing efforts to meet renewable energy targets set at the country level – legislative, financial and technological constraints persist in many cities. These constraints include weak fiscal decentralisation, limited municipal mandates across key sectors, and limited human capacity to execute municipal functions.

Key barriers and opportunities for advancing renewables in urban settings of Sub-Saharan Africa fit into four categories:

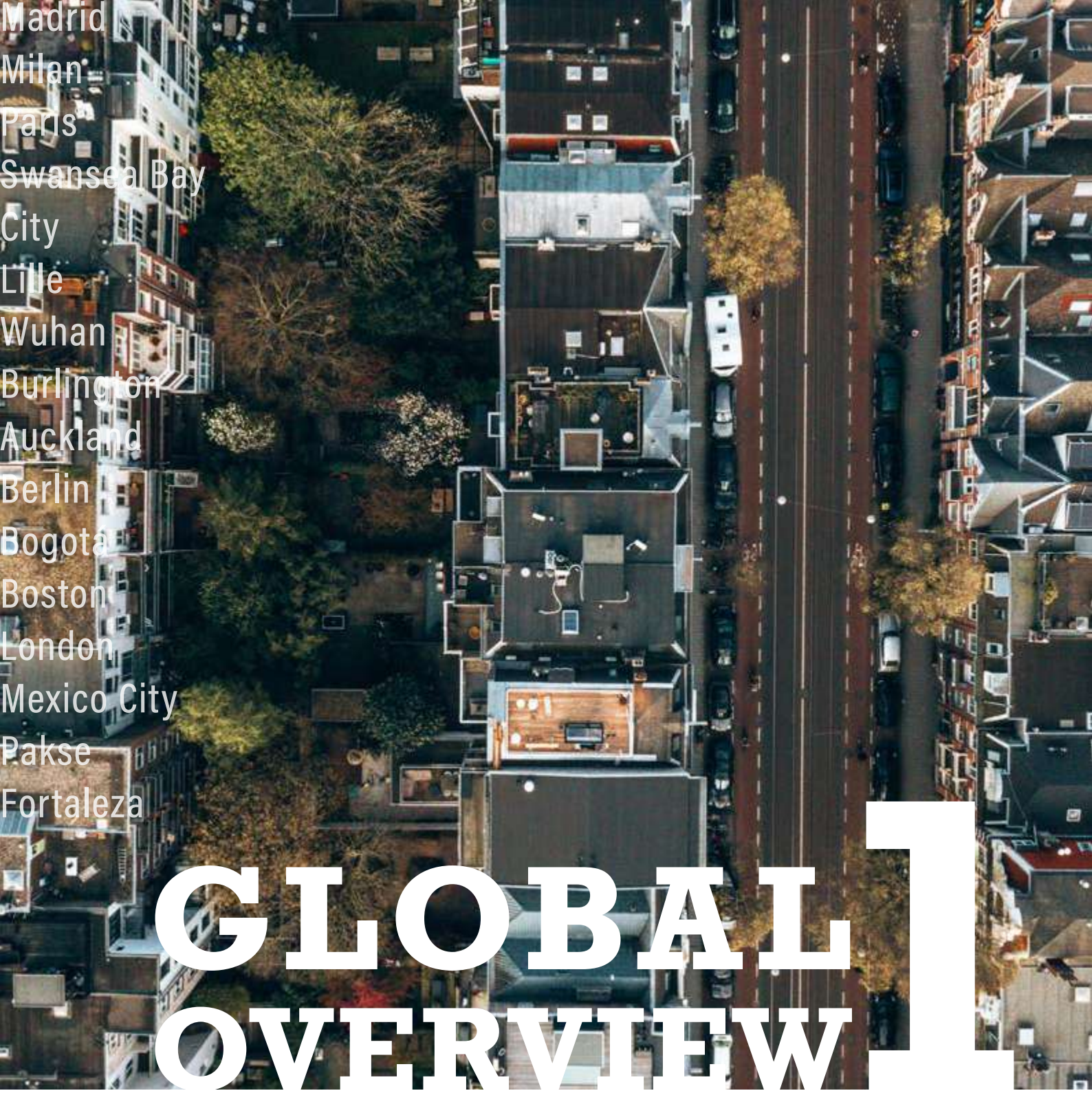
Policy and regulation: Through the CoM SSA, the C40 Climate Action Planning Africa Programme and other initiatives, municipal governments have enacted policies to accelerate the deployment of distributed renewables. These policies cover all energy-consuming sectors, although with less of a focus on the power sector because it remains largely the domain of national governments and/or centralised utilities. While city authorities often have limited powers, they are well placed to co-ordinate efforts to encourage local renewable energy deployment, which require collaboration across various stakeholders, including national policy makers.

Access to financial markets: Most local governments in Africa depend on national government grants as their main source of revenue, which is spent largely on operations instead of capital investments. This leaves little funding to invest in new infrastructure projects such as distributed renewable generation. Nonetheless, cities across the region have demonstrated progressive leadership on renewables through piloting various demonstration projects.

Data needs: Scarcity of primary data in the African context, particularly at the city level, is a major barrier for private investment in grid expansion plans and energy projects more generally. This places local governments, which generally are closer to the population (potential customers), in a unique position to provide investors with such information or to engage with relevant entities, including electric utilities, to facilitate data collection.

Internal capacity: Capacity constraints (in skills, experience and knowledge, and human and financial resources) have limited the ability of local governments to play a more pro-active role in renewable energy deployment. To build internal capacity and knowledge and to support renewable energy implementation, municipalities in Sub-Saharan Africa have formed partnerships with external organisations, established or joined city networks, and developed public-private partnerships to facilitate private sector engagement.

Ruiru, Kenya



1 GLOBAL OVERVIEW OF RENEWABLES IN CITIES

GLOBAL OVERVIEW OF RENEWABLES IN CITIES

City[i] governments around the world are taking action to accelerate the global uptake of renewable energy. During 2020, the engagement of local governments continued to grow, driven by air pollution concerns, public pressure, and the need to create clean, liveable and equitable communities, among other factors. In some cases, these actions have been reinforced by the global health and economic crisis triggered by the COVID-19 pandemic. City governments use different types of targets, policies and actions to show their renewable energy ambition: overall, more than 1 billion people – around 25% of the urban population – lived in a city with either a renewable energy target and/or policy in 2020 (→ *see Figure 1 and Table 1*).[1] Other actions indirectly support the shift to renewables – such as efforts to reduce carbon dioxide (CO_2) emissions, including through net-zero commitment goals and the electrification of public transport.

More than
1 billion people
live in a city with a renewable energy target and/or policy.

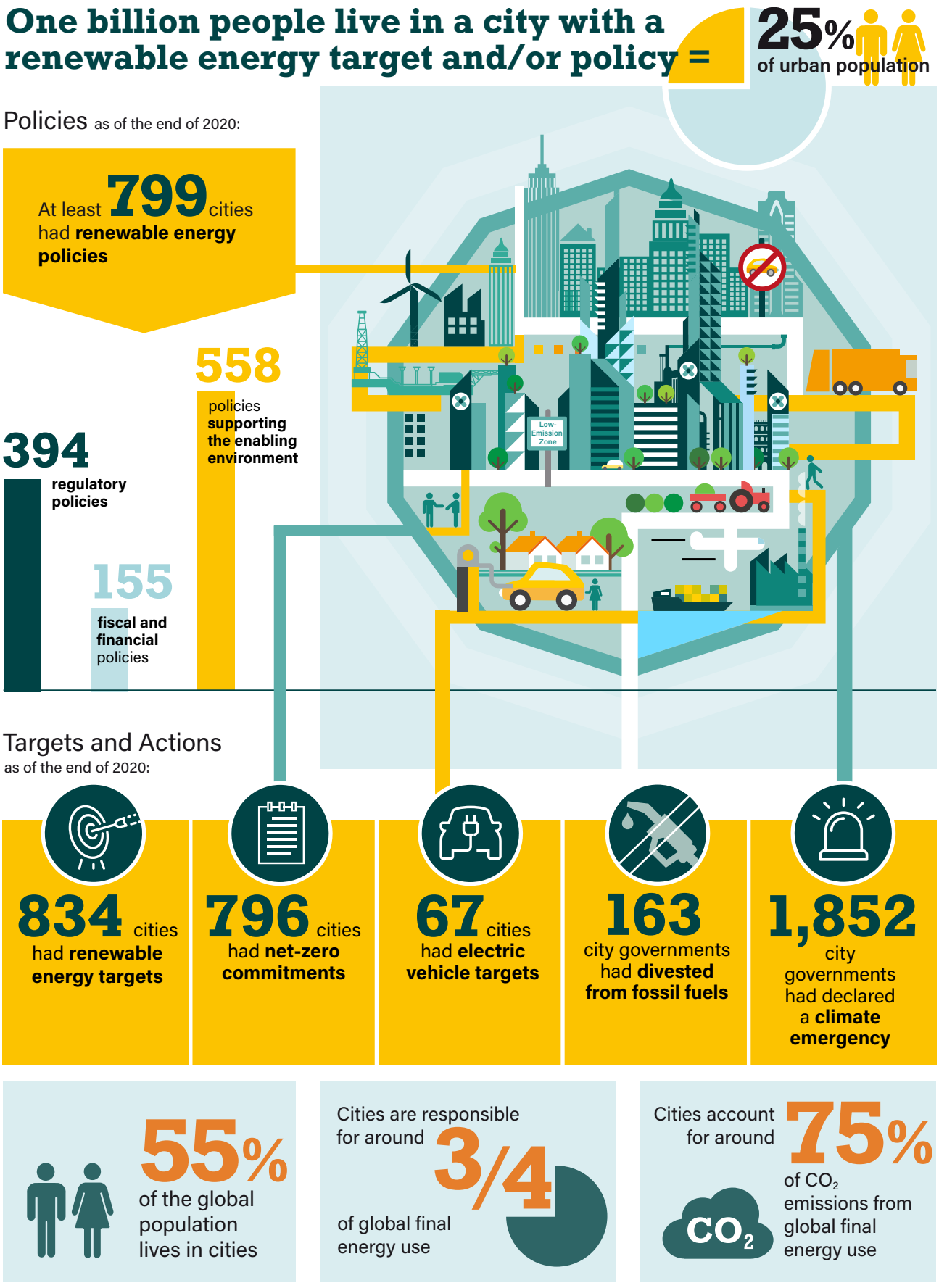
Cities' ambition to support the deployment of renewables is relevant because urban energy use has increased sharply in recent decades. In 1990, cities accounted for less than half (45%) of global final energy use, but by 2018 this share had risen to around three-quarters, and cities release a similar share of global energy-related CO_2 emissions.[2] Cities are now home to more than 55% of the world's population, and urban inhabitants worldwide are negatively affected by the burning of fossil fuels.[3]

Energy demand in cities has surged in all end-use sectors – power, transport, industry and buildings – due mainly to rising global population growth, urbanisation and urban economic activity. Municipal government operations account for only a small percentage of urban energy use, including for public buildings, municipal services and vehicle fleets[ii]. The bulk of urban energy is used at the city-wide level, in the form of electricity, heating and cooling (for residential and commercial buildings and industrial activities) and private transport.[4]

i According to the United Nations, the term "city" can connote a political or civic entity, a geographic unit, a formalised economy or an infrastructure bundle. In some instances, local communities, neighbourhood associations, urban businesses and industries may be subsumed under the term "city". Throughout this report, both "municipal government" and "city government" refer to city-level decision-making bodies and government authorities (the mayor's office, city council, etc.). "Local government" is a more generic term that can refer to different sub-national levels of public administration, including also counties, villages and other intermediate levels of government. In addition to municipal governments, key "urban actors" include individual citizens, groups of citizens and private enterprises, as well as various civil society groups that are active within the city.

ii Depending on ownership structures, municipal transport fleets may entail public transport (e.g., buses and rail systems), street sweeper and refuse collection vehicles, maintenance vehicles, vehicles assigned to police, fire and other public services, taxi and car-sharing fleets, and delivery vehicles (e.g., postal and courier services). See Glossary.

Figure 1. Key Facts and Trends in Cities, 2020



Source: See endnote 1 for this chapter.

Table 1. Overview of Targets, Policies and Actions in Cities, 2020

	Number
Renewable energy targets	
Cities with renewable energy targets and/or policies	1,327
Cities with renewable energy targets	834
Cities with 100% renewable energy targets	617
Cities with renewable power targets	612
Cities with renewable heating and cooling targets	145
Cities with renewable transport targets (excluding e-mobility)	65
Cities with economy-wide renewable energy targets	266
Other targets and declarations	
Cities with emission reduction targets	> 10,500
Cities with net-zero emission targets	796
Cities with e-mobility targets	65
Cities with climate emergency declarations	1,852
Policies	
Cities with renewable energy policies	**799**
Cities with renewable power policies	363
Cities with renewable heating and cooling policies	144
Cities with renewable transport policies	331
Cities with renewable energy policies in buildings	153

Over
1,300 cities
have renewable energy targets and/or policies, covering more than 1 billion people.


Cape Town, South Africa

Note: The number of cities with renewable energy policies by sector (power, heating and cooling, transport and buildings) does not equal the total number of renewable energy policies in cities, as cities with more than one policy in the same sector are counted only once. Cities with policies in multiple sectors are counted more than once. A total of 192 cities have policies in more than one sector.

Source: See endnote 1 for this chapter.

In addition, cities are responsible for global energy use that does not actually take place within urban boundaries.[5] They contribute indirectly to energy use (as well as to greenhouse gas emissions) through their supply chains, which include construction materials (concrete, steel, etc.), everyday goods (food, clothing, electronics, etc.) and other products consumed in cities but produced beyond their borders.[6] Thus, action in cities has the potential to make significant contributions to decarbonising the energy system, enhancing its resilience, and accelerating the development of renewable energy and other projects and investments – all of which contribute to key international goals such as limiting the average global temperature rise to 1.5 degrees Celsius (°C), as stipulated in the Paris Agreement.[7]

In cities with rapidly growing informal settlements and slums[i], often located in the periphery of urban areas, many inhabitants lack access to basic services, including modern energy sources and city infrastructure, such as sanitation and public transport.[8] Despite rising energy demand, 176 million people in urban areas still did not have access to electricity in 2019, and 2.6 billion people worldwide lacked access to clean cooking.[9] Municipal governments can play a key role in expanding sustainable energy access and reducing energy poverty for their residents, including the 1 billion urban and peri-urban dwellers living in slums and informal settlements.[10] Considering that the generation and use of renewable energy in cities is critical for achieving sustainable communities, and vice-versa, municipal governments can contribute to achieving United Nations Sustainable Development Goal 7 (on sustainable energy for all) as well as interlinked goals[ii].[11]

i Various factors have contributed to the emergence of informal settlements and slums, including population growth, urbanisation, lack of affordable housing, economic vulnerability, marginalisation and displacement. See endnote 8 for this chapter.

ii Urban areas are expected to play a key role in achieving the United Nations Sustainable Development Goals (SDGs), in particular SDG 11 on Sustainable Cities and Communities. By one estimate, meeting 65% of the targets of the SDGs depends on the involvement of local governments and how they can engage their citizens and civil society using their roles and core competences in areas such as infrastructure, transport, housing, water use, land use and energy.

DRIVERS AND OPPORTUNITIES FOR RENEWABLE ENERGY IN 2020

The drivers[i] for renewable energy in cities are broad, with efforts motivated by diverse economic, social and environmental objectives depending on the local context and priorities. Generally, municipal governments have pursued the uptake of renewables as an opportunity to create more liveable urban areas and to enable a better quality of life for residents.[12]

In 2020, the unfolding of the COVID-19 pandemic and the government-initiated lockdowns to slow the spread of infections had major impacts on both cities and the drivers for renewables. Economic activity fell sharply in the early months of the pandemic, reducing energy demand globally and severely affecting urban energy use, notably in the transport sector.[13] Physical distancing measures and fear of contagion led to an unprecedented drop in public transport ridership, greatly altering urban mobility patterns.[14]

These developments resulted in a shift in government (especially municipal) priorities, as efforts to ensure public health and well-being were pushed up the policy agenda.[15] Although COVID-19 recovery plans were still being prepared as of early 2021, initial proposals emphasised local economic development and job creation, with some municipal governments announcing "green recovery" packages – including renewable energy options – in line with similar plans proposed at the national and supra-national levels (such as the European Green Deal) (→ *see Sidebar 1*).[16]

Kuala Lumpur, Malaysia

Images of blue skies and clearer air during the early lockdowns helped to increase societal pressure towards reduced pollution and a green recovery.[17] Outdoor **air pollution**[ii] from the burning of fossil fuels – particularly coal, diesel and petrol – is a major source of fine particulate matter and was responsible for an estimated 8.7 million premature deaths in 2018 (earlier estimates were found to be greatly underreporting the effects of air pollution).[18] Increases in industrial activity, heat and power generation, and road transport have been the main sources of outdoor air pollution in many cities worldwide, and in some urban areas the use of charcoal and fuelwood for heating and cooking contributes to poor air quality indoors as well.[19] Several cities have pledged to jointly tackle local air pollution: as of 2020, 37 city governments worldwide had signed the C40 Clean Air Declaration (initiated in 2019), committing to pollution reduction targets and clean air policies by 2025.[20]

During 2019 and 2020, **citizens** also exerted growing pressure on their city (and national) governments to act on climate change.[21] Partly in response to this pressure, a record 1,852 cities had declared climate emergencies by the end of 2020 (up from around 1,400 governments in 2019), indicating a shift in priorities for municipal governments, some of which have used the declarations to plan and financially support renewable energy deployment.[22]

Other drivers for renewable energy uptake include:

- **Supporting local economic development** by attracting new industries and businesses, and creating local jobs.[23]
- **Mitigating climate change**, since renewables can help cities reduce emissions that contribute to global warming and address urban vulnerabilities to the impacts of climate change; these impacts include more-severe storms, fires, droughts, floods and sea-level rise, all of which put pressure on urban water supplies, sewage services, and food and energy security.[24]
- **Adapting to climate change and enhancing resilience**, since decentralised power generation from renewables can help make energy systems more resilient while reducing risks associated with dependence on external energy sources.[25]
- **Reducing expenses and managing costs**, by limiting cities' exposure to volatile fossil fuel prices and providing greater savings as the costs of electricity from solar photovoltaics (PV) and wind power continue to decline.[26]
- **Poverty alleviation**, since greater access to energy and new opportunities for learning and jobs can help reduce energy poverty and support sustainable development.[27]
- **Ensuring a stable and secure energy supply**, since renewables can support municipal governments in increasing energy security and independence while strengthening energy resilience.
- **Energy justice and democracy**, with sustainable energy access supporting an inclusive and just transition, with energy for all.

i For a detailed discussion of drivers, see REN21's *Renewables in Cities 2019 Global Status Report*, available at www.ren21.net/reports/cities-global-status-report.

ii More than 90% of urban areas were exposed to air pollution, and more than half of the population was exposed to air pollution at least 2.5 times above the guidelines established by the World Health Organization (WHO), from WHO, "9 out of 10 people worldwide breathe polluted air, but more countries are taking action", 2 May 2018, https://www.who.int/news/item/02-05-2018-9-out-of-10-people-worldwide-breathe-polluted-air-but-more-countries-are-taking-action.

SIDEBAR 1. COVID-19: General Impact and Responses

The year 2020 was marked by lockdowns in response to the global health crisis precipitated by the COVID-19 pandemic. This triggered a major economic shock with disruptions to various sectors, including energy. Disease prevention and containment measures greatly altered global energy use patterns (including electricity demand) and mobility habits, especially in urban areas with high concentrations of people and economic activity.

Global electricity demand dropped 2.5% in the first quarter of 2020 compared to the same period in 2019. This decline in demand was clearly linked to government containment efforts, as demonstrated in the European Union (EU) where electricity demand returned to normal (2019) levels during August-October 2020, after restrictions were lifted. Despite these declines, renewable electricity supplies worldwide continued to grow. While the demand for coal and gas dropped sharply in 2020, renewables were the only source of electricity in the global energy mix to experience record growth due to low operating costs and priority grid access through regulations. In several EU countries, wind and solar power hit record shares in electricity generation during the lockdown period.

Despite these positive narratives around renewable electricity, however, COVID-19 also had negative impacts on renewable energy deployment. Notably, many cities experienced delays in the development of renewable energy projects due to supply chain disruptions, labour shortages and emerging financing challenges. These impacts varied by technology and region.

Road transport activity decreased 50-75% in cities with lockdowns by late March 2020, resulting in a 17% drop in daily global CO_2 emissions by early April (from average 2019 levels). In Europe, an 88% reduction in car and motorcycle emissions during lockdowns led to a 58% decline in CO_2 emissions. Nitrogen dioxide levels also fell sharply during lockdowns in Wuhan (China) and in European cities such as Madrid (Spain), Milan (Italy) and Paris (France). Overall, the reduced pollution from urban transport led to local air quality improvements during the first half of 2020.

However, the reduction in emissions was only temporary: by the end of 2020, emissions and air pollution increased again, especially in bigger cities, as people opted to drive private cars over using public transport, and because of higher heating demand as people worked from home during the colder months. In the United Kingdom, the use of gas boilers – a major source of local pollution[i] – increased an estimated 56% during the winter of 2020 as the majority of people continued to work from home.

In many places, the COVID-19 pandemic stimulated greater societal pressure on city authorities to plan their economic recoveries by adopting integrated, sustainable approaches that place higher emphasis on air quality and the overall living environment. Because municipal COVID-19 recovery plans were still under development as of early 2021, no consolidated overview was available of the role of renewable energy in these actions. However, some examples exist of municipal governments linking the recovery to a scale-up of renewables.

In June 2020, Swansea Bay City (Wales, UK) launched a GBP 60 million (USD 74 million) ocean energy project that aims to accelerate the city's climate actions and to help the county of Pembrokeshire in its COVID-19 economic recovery. Lille (France) allocated EUR 20 million (USD 24.5 million) through its Rebound Fund, a business support programme that requires small businesses to incorporate environmental actions and/or energy transition into their projects to be able to benefit from the fund. Burlington (Vermont, US) announced a Green Stimulus package in April 2020 that allocates USD 800,000 to advance energy efficiency and promote the uptake of heat pumps and electric vehicles (EVs) – both of which can run on renewable electricity – in support of the city's Net Zero Energy goal while helping with the local economic recovery.

The C40 Cities network, through its Global Mayors COVID-19 Recovery Task Force, launched the C40 Mayors Agenda for a Green and Just Recovery in July 2020, outlining steps for the post-COVID period. Through this agenda, more than 40 city mayors committed to an equitable and just recovery based on stimulus packages that focus only on sustainable transition, including providing green jobs, divesting from fossil fuel and creating liveable communities.

Local governments also took more immediate action to alleviate the COVID-19 challenge in their cities, such as establishing bicycle lanes and expanding safe public spaces for pedestrians. These measures were implemented in cities including Auckland (New Zealand), Berlin (Germany), Bogotá (Colombia), Boston (Massachusetts, US), London (UK), Mexico City (Mexico), Milan (Italy) and Paris (France).

In response to the economic and social impacts of COVID-19, several national governments passed economic stimulus packages, and some multilateral development banks and private institutions made available climate funds. However, of the USD 20.5 trillion pledged to recovery efforts as of late 2020, only USD 1.1 trillion was committed to cities, due in part to barriers in directly providing funding to cities.

Source: See endnote 16 for this chapter.

i In London alone, gas boilers account for 21% of total nitrogen oxide emissions across the city.

GLOBAL RENEWABLE ENERGY TRENDS

At a global level, renewable energy capacity has continued to grow in the power sector, where supportive policy frameworks have helped solar PV and wind power become the most affordable sources of new electricity nearly everywhere in the world[i].[28] Renewable energy broke another record in 2019, with the total installed power capacity of renewables increasing more than 200 gigawatts (GW).[29] The renewable power sector also demonstrated greater resilience than fossil fuels during the COVID-19 pandemic, as electricity supplied by renewables was the only source of power generation to grow in 2020.[30] The share of electricity production met by variable renewable energy sources (wind and solar PV) reached record levels in several markets during the year, including in China, Europe, India and the United States.[31]

Despite these advances, the global energy system is transforming at a slow pace. Renewables in the heating and cooling and transport sectors have gained significant ground only in a few countries, while globally these sectors continue to lag.[32] Unlike for renewable power, renewables in heating and transport have demonstrated greater vulnerability to global shocks, such as the COVID-19 pandemic, than other energy sources[ii].[33] Heating, cooling and transport are critical for shifting the entire energy sector to renewables, as they are responsible for around 80% of final energy demand (→ *see Figure 2*).[34] These sectors are nevertheless plagued by weak and inconsistent policy frameworks, which contribute to uncertain and risky long-term investment options.[35]

CITY RENEWABLE ENERGY COMMITMENTS

Action in cities often has progressed faster than trends and policy steps at the national level. In 2019 and 2020, city governments around the world demonstrated leadership on climate and energy and took action to accelerate the global uptake of renewables.[36] Reporting on government operations and city-wide energy and climate targets increased, and several cities raised their ambition by adopting higher targets or setting earlier target years for reaching their goals.[37] These city government commitments have taken different shapes, ranging from binding targets and comprehensive policies to participation in initiatives and campaigns. Strong sub-national leadership sends a signal to industries and service providers as well as to regional and national governments, and also helps to inform overall procurement processes that require clean services and products (→ *see Urban Policy Landscape chapter*).[38]

City governments have directly supported renewables by setting specific **renewable energy targets**, investing in renewables and passing policies to encourage renewables city-wide. By the end of 2020, city governments in at least 834 cities in 72 countries, covering 558 million people, had set renewable energy targets in at least one sector (power, heating and cooling, and/or transport)[iii]; this includes around 617 cities with targets for 100% renewables.[39] Altogether, cities worldwide had a combined 1,088 renewable energy targets.[40] Despite this momentum, data challenges remain regarding tracking and reporting on progress as well as the scope of application.[41] Geographically, renewable energy targets have increased in all regions of the world, although most targets are in North America[iv] and Europe, followed by Asia.[42]

In many cases, city targets and policies are far more ambitious than those in place at higher levels of government.[43] While most local renewable energy targets address the power sector – similar to national-level developments – momentum has grown for policies that go beyond power and are expanding to heating and cooling and the transport sector or an integrated policy approach (→ *see Leveraging Renewables City-wide section*).[44] Given slow advances at the national level worldwide, urban policies and decentralised renewable energy technologies play an important role in decarbonising these sectors.

Targets for renewables in cities are often more ambitious and have progressed faster than trends and policy steps at the national level.

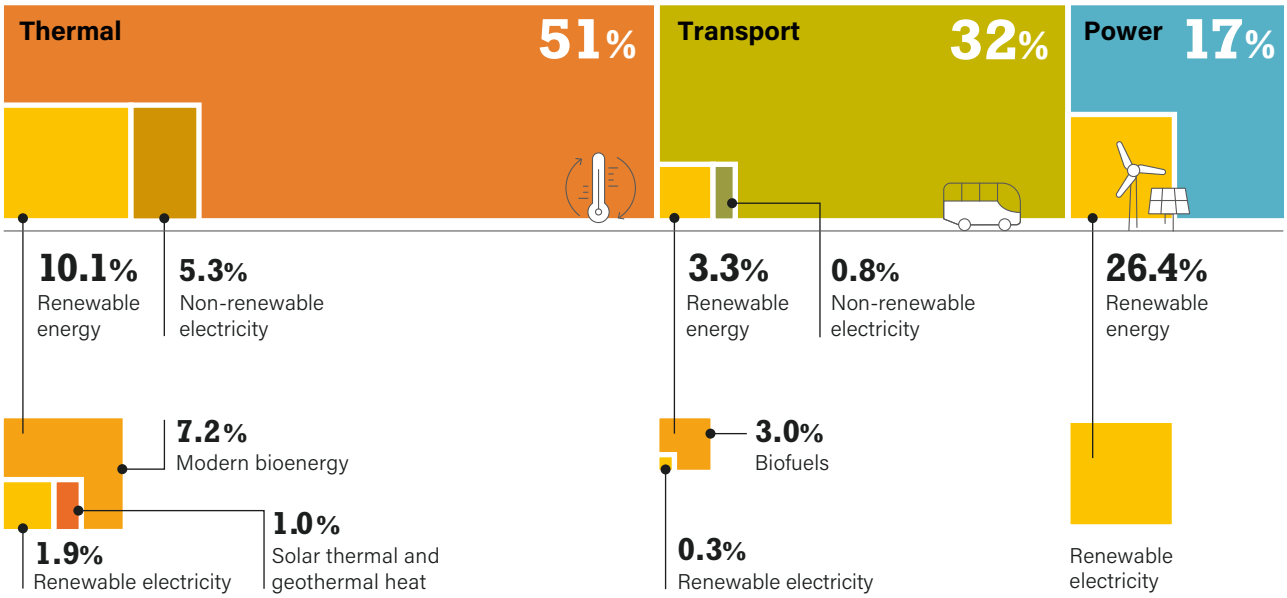
i Wind and solar energy have become increasingly cost-competitive with fossil fuel power plants. In countries on all six major continents, renewables are the cheapest source of new electricity generation, and in some of the world's major energy markets (including China, India, Europe and the United States), building new solar PV or wind plants is more cost-effective than continuing to operate existing coal-fired power plants. Renewables also are outcompeting natural gas-fired power plants on costs. See endnote 28 for this chapter.

ii This refers to the fact that consumption of renewable heat and production of biofuels, which account for the vast majority of renewable energy in transport, were both heavily affected during the crisis. The rapid increase in electric vehicle sales is a counterpoint to this statement; however, electric mobility continues to meet only a marginal share (around 1.3%) of energy demand in transport, and relies mostly on electricity from fossil fuels.

iii Based on REN21 Policy Database; list may not be comprehensive. This total includes multiple targets for the same city. It includes targets for renewable energy consumption of all energy, electricity, heating and cooling, and transport; targets for specific installed capacity; as well as targets for enabling technologies such as e-mobility.

iv In this report, North America includes Canada and the United States; Mexico is considered part of Latin America and the Caribbean.

Figure 2. Renewable Share of Total Final Energy Consumption, by Final Energy Use, 2017



Note: Data should not be compared with previous years because of revisions due to improved or adjusted methodology.

Source: Based on IEA data. See endnote 34 for this chapter.

The growing trend of emission reduction targets – including **net-zero**[i] commitments – had a record-breaking year in 2020. By year's end, more than 10,500 cities globally had adopted CO_2 emission reduction targets, and around 800 cities had committed to net-zero emissions – up sharply from the 100 cities with such commitments by the end of 2019.[45] Although emission reduction targets typically have not been linked explicitly with renewable energy development, they can stimulate the uptake of renewables indirectly by mandating the reduction or removal of greenhouse gas-emitting technologies. Many cities had yet to publish plans on how renewable energy is being deployed or used to achieve this goal.[46]

Increasingly, city governments are producing climate and/or energy action plans outlining how to achieve their targets. Abundant examples from Australia, Europe and North America are captured through reporting platforms such as the CDP-ICLEI Unified Reporting System (with local governments reporting progress over time), supported by city networks and initiatives including ICLEI – Local Governments for Sustainability and the Global Covenant of Mayors for Climate & Energy.[47] As such initiatives expand globally, reporting is increasingly supported in Asia, Latin America and Sub-Saharan Africa. Action plans are being developed or updated in cities ranging from Kigali (Rwanda) and Pakse (Lao PDR) to Fortaleza and Recife (Brazil).[48] Generally, city-level reporting and tracking of the electricity sector is more comprehensive, whereas most cities lack clear reporting on heating and cooling uses and transport (→ *see Box 1*).[49]


Pakse, Lao PDR

i "Net-zero" emissions can be achieved, for example, by using natural sinks, such as reforesting land or adopting agricultural best practices, or through a technological solution, such as carbon capture and storage. Net-zero targets also are referred to commonly as "climate-neutral", "carbon-neutral" or "zero-emission" targets, although technically these are not the same. Carbon neutrality refers to net-zero emissions of only CO_2, whereas climate neutrality indicates a broader focus on net-zero emissions of all greenhouse gases. There is no agreed-upon definition, and implementation of these targets also varies broadly. See endnote 45 for this chapter.

BOX 1. Data on Renewables in Cities

Tracking the evolution and uptake of renewable energy in urban areas is challenging because of cities' geographical distribution; their different political, economic, social and environmental contexts; and their diverse institutional capacities. As a result, the limited data that are available tend to be outdated and are rarely consolidated. In addition, these data often do not consider the changing roles that cities play in the energy system, including their ability to produce energy. Consolidated data on energy supply/production and energy demand/consumption thus are available only for relatively few cities worldwide.

Even where data are reported, imprecise terminology can limit their usefulness: in some instances, it remains unclear whether the data refer to electricity or to energy. Also, since electricity accounts for most cooling needs and for a growing share of heating needs, it can be difficult to identify what amount went to heating and cooling versus lighting and other appliances. In transport, reporting in most cities tracks only the number of electric, plug-in hybrid and hydrogen fuel cell vehicles, but does not track vehicles running on liquid biofuels and biomethane.

Increasingly, reporting is improving on financing indicators and city investment needs as well as on the trend of local governments to create their own funds to implement their renewable energy targets, particularly in the northern hemisphere. However, data gaps and limitations remain in the following key areas:

- shares of renewables in municipal and city-wide energy use;
- targets and policies that promote renewables in the power, heating and cooling, and transport sectors, both for municipal and for city-wide energy use;
- generation capacity for renewable electricity, heating and cooling, and transport fuels, either by municipal authorities and/or public utilities and other urban actors (private sector, residents, communities); and
- community energy projects in cities, including the number of projects, installed capacity and investments.

The lack of comprehensive and consolidated data makes it challenging to effectively assess the role that cities play in advancing renewable energy, to determine objectives and baselines, and to monitor progress. Improving the data situation is important for better engaging cities in the energy debate in a more holistic way, and for integrating policy and regulatory frameworks at the local, sub-national and national levels. More robust data availability also makes it possible to increase knowledge about the opportunities that renewables present for cities and to further accelerate renewable energy development.

Source: See endnote 49 for this chapter.


Cape Town, South Africa


Madagascar

MULTI-LEVEL GOVERNANCE OF URBAN ENERGY SYSTEMS

The possibilities and strategies for municipal governments to scale up renewable energy to achieve their urban climate and energy targets depend on a variety of factors. Each city has its own characteristics such as urban form[i] and density, climate, geography and ownership structure[ii] for key infrastructure – all of which influence a city's ability to advance the deployment and use of renewables.[50]

Also, no city is an island in the context of local renewable energy procurement and use, target-setting and policy making. Depending on governance structures[iii], cities are subject to **market rules and energy regulations** set at the national and state/provincial levels, and to the political dynamics that shape these instruments.[51] The design of markets and infrastructure – and whether electricity markets are liberalised and decentralised – is determined largely at higher levels of government (→ *see Sidebar 2*).[52] In addition, municipal governments typically are required to enforce standards that have been established out of their control, at the state or national levels.[53]

Despite potential limitations resulting from different regulatory systems, city governments around the world have taken different actions to increase renewable deployment. Several local governments have engaged with or challenged higher levels of government to remove legislative or regulatory barriers to the production and procurement of local renewable energy. To raise their voices and increase their advocacy capacity, local governments also have joined forces in national, regional and global networks (→ *see City Leadership: Networks and Initiatives section*).

Persistent subsidies for fossil fuel consumption and production, issued at the national level, present a challenge to increasing the share of renewables in cities. Such policies contribute to ongoing economic dependence on fossil fuels in transport, households, industry and businesses, as well as in electricity production and supply.[54] Although global subsidies for fossil fuel consumption fell by USD 120 billion in 2019 (to USD 318 billion, down from USD 438 billion in 2018) – mainly because of lower average fuel prices during the year – both subsidies and low fossil fuel prices encourage greater demand for the fuels and challenge renewable energy developments.[55] If the true costs to society of fossil fuels were accounted for, including negative externalities related to climate change and air pollution, then their total "subsidies" would be considerably higher, at USD 5.2 trillion.[56]

Cities' **energy systems and infrastructure** are physically connected to national or regional systems and rely on them for most of their energy supply and to manage and balance their energy flow. However, the dynamics of this relationship have changed over the last decade as municipal governments have become more aware of the various potential benefits of renewables.[57]

The emergence of distributed renewable energy technologies (such as rooftop solar PV) and digital technologies (such as the Internet of Things) has reshaped the dynamics between end-users and the traditional energy system, which historically has been operated mainly by centralised utilities.[58] Coupled with new business models, this has enabled municipal governments (as well as households, businesses and communities) to scale up and diversify local production of renewables.[59] In 2019, households and small- to medium-sized companies installing solar PV on and near their buildings accounted for one-fifth of all renewable capacity deployed globally.[60] However, in 2020, COVID-related lockdown measures prevented access to many buildings, leading to a slowdown in distributed solar PV installations in cities.[61]

Vienna, Austria

i Urban form refers to a city's physical characteristics, including size, shape and population density. For example, low-density cities (per square kilometre of urban area) tend to have more land and rooftop space available for distributed solar PV, while compact high-density urban areas have the necessary business case for renewable district energy systems (where proximity of floor area is a major determinant). See endnote 50.

ii For example, where the city government is the owner and operator of municipal energy utilities or of public transport and associated infrastructure, it has greater capacity to develop and invest in renewable energy projects. If this infrastructure is not under municipal control, the shift to renewables entails co-ordination with a greater number of actors (such as national and state/provincial governments and private companies, for example through public-private partnerships) that may have conflicting priorities. In many developing and emerging economies, the lack of secure, reliable and affordable public transport, exacerbated by low density and sprawling cities, contributes to informal and private on-demand transport. This tends to be more difficult to regulate (and to enforce regulations), including shifting to renewable-based transport solutions.

iii The governance structure of a city determines the city's level of dependence on higher levels of government in policy making, regulation, renewable energy purchasing, etc.

SIDEBAR 2. Multi-level Governance: The Interdependence of National and Municipal Policies

It is increasingly clear that the fight against climate change will be won or lost in the world's cities. However, even the most empowered city governments can deliver only a fraction of their mitigation potential unilaterally. National leadership and co-ordination, and integration with national-level action – also known as multi-level governance – is vital. Supportive national policies, combined with ambitious and pro-active city targets and action, are key to ensure that rapid urban population growth drives economic productivity within a climate-friendly environment.

National governments generally have recognised the importance of cities in their climate and energy agendas, as evidenced by their endorsement in 2015 of the 2030 Agenda for Sustainable Development, which includes making "cities and human settlements inclusive, safe, resilient and sustainable". However, national governments worldwide are at varying stages of integrating this recognition in their economic strategies, budget allocations, infrastructure planning and governance structures. As of 2019, around half of all countries had a national strategy for cities[i], and only 23 of the 160 countries that had submitted their Nationally Determined Contributions (NDCs) for reducing emissions under the Paris Agreement acknowledged the urban opportunity for climate change mitigation.

The world is not on track to limit global warming to well below 2°C, let alone 1.5°C as stipulated in the Paris Agreement (to achieve this goal, CO_2 emissions would need to nearly halve by 2030 from 2010 levels, and to reach net-zero around 2050). As the major centres of production and consumption, cities play an important role in meeting the emission reduction targets set at various levels of government, from supra-national to sub-national. A large share of the potential for abating emissions in cities lies in decarbonising the urban electricity supply.

Yet at the same time, the electricity supply needs to expand rapidly to meet the demand of growing urban populations and to achieve the Sustainable Development Goals. This will require massive investments in renewable electricity generation and distribution infrastructure in and around cities to meet electricity demand across end-use sectors such as buildings and transport in a sustainable way. However, investment alone is not enough to address the challenges of the energy transition – energy systems and their evolving governance are also firmly in the spotlight. Energy policy historically has fallen under the mandate of national governments, with national or regional utilities typically supplying electricity to urban areas. In contrast, city governments have had minimal authority over energy supply.

National governments can support local climate action in cities in various ways, including by: clarifying the responsibilities and powers of different levels of government; supporting local actors in designing, financing and implementing low-carbon measures (including renewable energy projects); and fostering a culture of experimentation, participation and learning that enables successful local initiatives to be scaled and replicated nationwide. For example, the Digital City Strategy of Hamburg (Germany), backed by national legislation and financial support, aims to show how the country's north-east can be supplied with 100% renewable energy by 2035. Greater digitalisation will facilitate decarbonisation and create possibilities for new players to emerge in the market, with potential to challenge the city's distribution company.

National governments are well placed to align climate and energy policies adopted at different governance levels (such as city, state and national) and to disentangle conflicting incentives that support the transition to a renewables-based energy system. Policy clarity and coherence is especially important for stimulating and shaping activity in the private sector. National and state governments also can go farther by empowering local governments to set more ambitious renewable energy targets – for example, by prohibiting the sale of fossil fuel vehicles, banning the use of fossil fuels to heat buildings and introducing renewable energy requirements in building codes and mandates. For example, the United Kingdom has banned sales of new petrol and diesel vehicles starting in 2030, which will have significant implications for the use of renewable fuels and electricity in urban transport. Such an approach ensures that emissions across all cities in a country fall steadily, while enabling ambitious city governments to advance faster.

National governments also play a role in financing low-carbon, resilient and inclusive cities, namely by fostering a fiscal system that generates the desired amount of public revenues and creates appropriate incentives for firms, households and sub-national governments. Responsible fiscal decentralisation can enhance the accountability of city governments for local service delivery and underpins their creditworthiness so that they can access capital markets. Local governments need the authority and capacity to control their own revenues, among others, to be able to provide grants, loans and subsidies to support the decarbonisation of urban systems. For example, the Marburg-Biedenkopf district (Germany) has built on its ability to subsidise the installation of electric vehicle charging stations to set the requirement that the electricity supplied to the stations must be renewable.

National governments can build a multilateral system that fosters inclusive, zero-carbon cities by setting a zero-carbon urban transition firmly on the global agenda, strengthening international frameworks that accelerate rather than undermine the transition, and using multilateral architecture – particularly the multilateral development banks – to support countries' own urban climate actions.

Source: See endnote 52 for this chapter.

i As of 2019, 108 countries out of 195 had a fully formulated national urban policy (termed a "National Urban Policy", "National Urbanisation Policy", "National Urban Strategy" or a similarly close variant).

RENEWABLES IN MUNICIPAL OPERATIONS

To increase the share of renewables in their own operations, municipal governments have used their assets to deploy distributed renewable energy generation capacity on and alongside public buildings (for example, schools, hospitals, sport centres and social housing), along city streets (including street lighting) and for municipal fleets. Most of these local projects have been solar PV systems, sometimes combined with battery storage or solar thermal systems. In some cities, municipal governments and other actors also have tapped into local wind, biomass and hydropower resources, either for electricity, direct thermal heat production and co- and tri-generation for power and heat, or to support the integration of renewables in district energy systems.

Some municipal governments have faced constraints to installing renewable energy within city limits – such as high land costs, land scarcity or building regulations. In many cases, they have opted instead to import renewables from outside of urban areas through procurement and strategic partnerships with third-party providers, including neighbouring communities. This has allowed them to use virtually any renewable energy source available, including bioenergy, hydropower, solar, wind, geothermal and ocean energy[i].[62] Some municipal governments also have bundled demand with neighbouring cities, building on economies of scale to develop their own renewable energy projects or to procure renewables in bulk; other cities with vast rural hinterlands have established partnerships with these surrounding territories.[63]

Some city governments have moved from single-sector planning to designing integrated (and circular) urban systems. This includes linking their energy supply with other urban activities to find cost-effective solutions to multiple challenges – for example, using urban waste and wastewater streams as feedstocks to produce biogas, biomethane and other renewable fuels.[64] The recycling of waste heat (also called waste heat recovery) has evolved, with some cities feeding the heat from industrial activity and data centres into district energy systems. While this is not in itself a renewable energy technology, such innovations have played an important role in creating integrated, efficient urban energy systems.[65]

By scaling up renewables in municipal operations, city governments also have led by example to help drive change city-wide and build up the local capacity. This has been an important first step to demonstrate the business case and raise awareness of the opportunities that renewables present.

LEVERAGING RENEWABLES CITY-WIDE

Achieving urban renewable energy targets depends not only on political commitment and municipal investment in renewables, but also on cities' ability to mobilise and enable the uptake of renewables city-wide, by other actors. To support this broader deployment of renewable energy, municipal governments have expanded their policy portfolios. By the end of 2020, at least 799 municipal governments had implemented regulatory policies, financial and fiscal incentives, and indirect support policies to enable the uptake of renewables in buildings and transport city-wide (→ *see Urban Policy Landscape chapter*).[66]

Policy trends for **buildings** include the rise of municipal building codes that mandate the use of renewable energy for electricity or heating (in addition to focusing on reducing energy demand and promoting nature-based solutions). These codes typically apply to new buildings, while renewables for existing buildings often are encouraged through financial and fiscal incentives such as grants, rebates and low-interest loans.[67] Most local government policy making has focused on growing the share of renewables in the **power** sector, mainly through solar PV systems, sometimes combined with battery storage or solar thermal systems. Momentum also has grown for electrifying space and water heating in buildings, resulting in more buildings using electricity generated from rising shares of variable renewables in the energy mix. In addition, the emergence of bans and restrictions on fossil fuels for **heating** in buildings, present in more than 53 cities worldwide, has contributed to rising electrification and the use of renewables (→ *see Figure 11 in Urban Policy Landscape chapter*).[68]

In the **transport** sector, city governments have made strides to decarbonise municipal transport fleets and mobility infrastructure to improve urban air pollution, protect public health and well-being, and mitigate congestion and noise.[69] Although some cities have continued to support the use of biofuels in fleets, urban policies and procurement increasingly have focused on the electrification of transport. However, only a few cities have taken e-mobility as an opportunity to increase the share of renewables in the sector, for example through direct investment in new renewable electricity capacity, via power purchase agreements, by setting obligations/requirements for procurement and by subsidising the use of renewable electricity to charge electric vehicles.

To support the decarbonisation of transport, cities have established low-emission zones and bans on certain fuels or vehicles, which are in place in 249 and 14 cities respectively.[70] In addition, to reduce the overall need for individual motorised transport, city governments have encouraged the transition to more efficient modes of transport – such as (renewables-based) public transit, including buses, metros and trams – and have improved walking and cycling infrastructure.[71]

i For an overview of the status of renewable energy technologies, see the Market and Industry Trends chapter in REN21's *Renewables 2020 Global Status Report*, available at www.ren21.net/gsr.

City governments also have shaped urban energy systems to better accommodate rising shares of renewables in the energy mix. They have expanded district energy networks and grid infrastructure, implemented efficient end-use technologies, expanded the electrification of transport and thermal demand (supported by technologies such as heat pumps and energy storage systems) and facilitated other demand-side flexibility. All of these measures provide the potential side-benefits of greater system efficiency, improved reliability of service and lower overall system costs.[72]

Trends in urban financing and investment for renewables generally depend on the availability of capital for funding projects, including the ability of municipal governments to mobilise their own fiscal revenue collection and borrow money. Many cities have limited funds at their disposal and/or depend on national governments to provide a significant amount of finance.[73] Despite context-specific challenges, the finance and investment trends related to renewables in cities closely mimic those at the global level, including divestment from fossil fuels and re-investment in renewables (→ *see Financing and Investment chapter*). As of 2020, more than 160 city governments and pension funds had divested from fossil fuels, including 12 members of the C40 Cities network that pledged[i], as part of their COVID-19 economic recovery plans, to divest city assets from fossil fuel companies and then re-invest the funds in climate solutions.[74]

Municipal governments are responsible for only part of the financing that occurs within a city. Businesses, households, communities and other urban actors also play a role, often encouraged by policies. In Europe and the United States, as well as elsewhere, more and more citizens have chosen to purchase energy from providers offering renewable electricity or heat, to increase self-consumption of renewables, and to join together to create community energy projects in cities. City governments also have used participatory governance to include citizens in urban planning, budgeting and policy development processes.[75]


Amsterdam, Netherlands

CITY LEADERSHIP: NETWORKS AND INITIATIVES

Local governments have worked together in global and regional networks to raise their voice, increase their advocacy capacity and sharpen their role in the climate, sustainable development and energy debates. Collectively, these networks have played an important role in encouraging cities to adopt renewable energy targets and implement local climate action, and they have offered a platform for effective information and resource exchange and inspiration.[76]

- In 2020, more than 1,750 cities were part of the network of **ICLEI – Local Governments for Sustainability**, committing to sustainable urban development.[77] ICLEI worked with CDP[ii] in 2019 to launch the CDP-ICLEI Unified Reporting System in an effort to streamline city climate and energy reporting. During 2020, 812 local governments from 93 countries reported their data to this system.[78]
- By mid-2020, 97 cities were part of the **C40 Cities** network (no change from 2019), representing more than 700 million citizens and one-quarter of the global economy.[79] C40 cities aim to collectively halve their local greenhouse gas emissions by 2030, and 88 of the cities have signed on to Deadline 2020, a commitment to develop a climate action plan compatible with the Paris Agreement.[80] During 2019 and 2020, C40 cities continued to be frontrunners in climate and energy ambition, including:
  - By 2019, 28 cities (including 5 non-C40 cities) had joined the Net Zero Carbon Buildings Declaration, committing to net-zero carbon for new buildings by 2030 and for all buildings by 2050.[81]
  - In 2019, 35 cities (including 7 non-C40 cities) pledged to procure only zero-emission buses starting in 2025 and to ensure that a major area of the city is zero-emission by 2030[iii].[82]
- **Energy Cities**, the European association of cities in the energy transition, brought together 1,000 local governments in 30 countries as of 2020, with the goal of transforming European governance and legal frameworks to enable cities to play their part in the energy transition.[83]
- As of 2020, the **ASEAN Smart City Network**, launched in 2018, brought together 26 pilot cities in member states of the Association of Southeast Asian Nations to work on smart, sustainable urban development. [84]

i These 12 cities are signatories of the Divesting from Fossil Fuels, Investing in a Sustainable Future Declaration.

ii CDP, previously the Carbon Disclosure Project, is a disclosure platform for companies, states, cities and regions; see www.cdp.net.

iii These initiatives are, respectively, the Green and Healthy Streets Declaration and the Fossil Fuel Free Streets Declaration.

Many city networks also exist at the regional level, often in collaboration with global partners. Some local governments have organised themselves in national networks (as in Austria).[85] In the United Kingdom, the UK 100 network brings together around 100 local governments that have pledged to shift to 100% clean energy by 2050; in 2020, some member cities committed to achieve net zero by 2045.[86]

Momentum also grew during 2019 and 2020 for specific initiatives and campaigns that engage local governments in energy and climate action, often in collaboration with city networks.

- The **Global Covenant of Mayors for Climate & Energy**[i] is the largest global coalition of cities and local governments. Signatories commit to reducing community-scale greenhouse gas emissions, adapting to climate change and improving access to sustainable energy (i.e., renewables and energy efficiency). As of mid-2020, more than 10,500 cities in 142 countries had committed to the Global Covenant of Mayors (232 new cities in 2019 and 177 as of mid-2020), with most of these cities (more than 9,600) in Europe, followed by Latin America and the Caribbean and North America.[87] Of the total signatories, 9,482 had climate change mitigation targets, and 5,460 of these also had mitigation plans; 1,870 cities had set adaptation goals, and 335 of these also had adaptation plans.[88]
- The **Covenant of Mayors for Sub-Saharan Africa** (CoM SSA) was established in 2015 as part of the Global Covenant of Mayors, and by 2020 it had been signed by 175 local governments from more than 35 countries across Sub-Saharan Africa.
- CC35, under the **Mayors for Climate** ("Alcaldes por el clima") initiative, brings together local governments in Latin America to pass binding decarbonisation legislation, and had 274 members as of mid-2020.[89]
- **Race to Zero**, a global campaign under the United Nations Framework Convention on Climate Change and supported by leading net-zero initiatives and city networks, brings together businesses, cities, regions and investors to facilitate the shift to a decarbonised economy. By the end of 2020, the campaign had 454 participating city governments, with the goal of mobilising 1,000 by the time of the United Nations Climate Change Conference in Glasgow (Scotland) in late 2021.[90]
- To demonstrate city action towards the Paris Agreement, in 2020 a record 255 cities from 53 countries participated in **WWF**'s One City Planet Challenge, a competition that was won by Mexico City.[91]
- By 2020, under the **Sierra Club's Ready for 100** campaign, 172 US cities had made commitments to 100% renewable energy by 2050 at the latest (up from 131 cities in mid-2019), and 48 cities had already achieved that goal.[92] Other initiatives in the United States include the We Are Still In campaign, the Climate Mayors network and the US Conference of Mayors Climate Protection Agreement.[93]

Although most countries' Nationally Determined Contributions[ii] towards reducing emissions under the Paris Agreement do not reference city-level renewable energy commitments (or specify the role of cities in achieving emission reductions), national governments will need to rely on urban actors to fulfil their obligations.[94] Many of the NDCs highlight urban adaptation and resilience and include targets that also apply to urban areas, such as the decarbonisation of buildings, energy, transport and waste.[95] By the end of 2020, 190 parties had submitted their first NDCs, and 8 had submitted their second.[96] Cities can contribute to attaining NDCs not only by reducing their own emissions, but also by participating in international initiatives.


Havana, Cuba

City networks

have encouraged municipal governments to adopt renewable energy targets and implement local climate action.

i The initiative started as the European Union's Covenant of Mayors in 2008 but has since grown to cities in 140 countries by the end of 2020. The Global Covenant of Mayors for Climate & Energy combined the EU's Covenant of Mayors with the Compact of Mayors (launched in September 2014 by UN Secretary-General Ban Ki-moon). See European Commission, "EU Covenant of Mayors and Compact of Mayors launch largest global coalition of cities committed to fighting climate change", press release (Brussels: 22 June 2016), https://ec.europa.eu/commission/presscorner/detail/it/IP_16_2247.

ii NDCs include policies, targets and measures that serve as the basis for national climate plans. See World Resources Institute, "National Climate Action under the Paris Agreement", https://www.wri.org/ndcs, viewed 15 November 2020.

REGIONAL TRENDS

EUROPE

European cities have been global leaders on urban energy and climate issues, often driven by the push for greater climate action as well as a desire to improve the health of city residents.[97] For example, cities in Europe spearheaded the "climate emergency" movement and accounted for 45% (826) of the total 1,852 climate emergency declarations issued worldwide as of the end of 2020.[98] Additionally, at least 357 European cities had a renewable energy target in place by year's end.[99]

European cities were the most numerous participants in city networks and dominated local climate action in 2020: by the end of the year, more than 10,000 cities in 43 European countries had signed the Covenant of Mayors for Energy & Climate, and over 6,700 of these had submitted action plans as well, many of which specify a role for renewables.[100] In line with the European Green Deal, cities also have been committing to net-zero goals and developing more holistic strategies and integrated solutions to decarbonise activities in urban areas, including scaling up renewables on municipal buildings, using waste and wastewater as inputs to produce renewables, integrating solar and geothermal district heating, and shifting to renewable-based municipal vehicle fleets.[101]

In late 2020, the European Green City Accord was launched with the aim of speeding Europe's transition to sustainable development by getting different levels of government to work together and mobilise other stakeholders. The Accord will support city efforts towards achieving the following five goals by 2030: significant improvement in air quality; important progress in improving the quality of water bodies and the efficiency of water use; considerable progress in conserving and enhancing urban biodiversity; advancement towards the circular economy; and significant reduction in noise pollution.[102]

In contrast to many other regions, cities in Europe are shaped by infrastructure that extends back centuries, and they typically have a more settled urban form and low rates of new building construction. The focus is thus on renovating and retrofitting existing structures, often with dedicated funding from other levels of government, such as the EU's "renovation wave" strategy[i].[103] Cities and communities have taken on growing importance at the EU level, exemplified by targeted projects providing financing for innovative cities.[104] For example, so-called lighthouse cities have been selected as climate innovation leaders to set positive examples and lay the path for other cities to follow.[105] In contrast, only a few national governments have fully understood the key role of local authorities in the energy and climate transition.[106]

Hagafoss , Norway

Europe and North America

remain leading regions for city-level renewable energy and climate action.

Milan, Italy

i The EU's renovation wave strategy focuses on the need to improve, retrofit and decarbonise existing buildings. See European Commission, "Renovation wave", https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en, updated 18 January 2021.

NORTH AMERICA

North America remained a leading region for city-level renewable energy action, driven by local ambition to decarbonise and diversify energy supplies while increasing economic competitiveness and boosting resiliency.[107] As of the end of 2020, at least 350 municipal governments in the United States and Canada had renewable energy targets, and several cities had made significant progress towards their 100% renewable electricity goals, with several cities achieving these during 2019 and 2020.[108] Key trends in the region included procurement of renewables for municipal operations, galvanised support for distributed renewable energy generation projects, diverse community solar models, and robust incentives or mandates for energy efficiency upgrades and building electrification. North American cities continued to leverage municipal green bonds, federal and state funding, clean-tech incubator support and other innovative financing mechanisms to support the development of renewables.[109]

In the United States, local government renewable energy transactions increased considerably after the federal government stated its intention in 2017 to withdraw from the Paris Agreement (the country rejoined in January 2021).[110] Cities accounted for most of the new renewable power capacity added by local governments during 2019 and 2020 – primarily through off-site power purchase agreements (PPAs) signed with developers of large-scale solar PV projects, mainly in California and Texas.[111] In Canada, a major policy focus in large cities – notably Montreal, Toronto and Vancouver – was increasing the share of renewable energy across not just the power sector but also heating, cooling and transport.[112]

Although North American cities have struggled to deploy renewables more widely in heating, cooling and transport, an increasing share of municipal governments partnered with legislative or regulatory bodies at higher levels of governance, as well as with community stakeholders and/or the private sector, to remove legal, technical and financial barriers restricting renewable energy deployment and use across all end-use sectors.[113]

Oak View, California, United States

ASIA

In Asia, growing concerns about air pollution and smog have driven public demand for renewable energy technologies and electric vehicles to improve public health.[114] Although national governments have tended to dominate city-level actions to promote renewables, municipal-level commitment has been growing. By the end of 2020, at least 51 municipal governments in Asia had set renewable energy targets, and 37 had implemented renewable energy policies, most of which were in buildings and transport.[115] In addition, local governments have been instrumental in pushing the national governments in Japan and the Republic of Korea to commit to carbon neutrality and/or adopt net-zero targets.[116] Cities in Asia increasingly have sought to develop and strengthen public-private partnerships and to take advantage of digitalisation and use smart technology to attract more foreign direct investments in renewables.

Chinese cities have actively promoted renewables, guided mainly by national and regional policies and action plans, many aimed at reducing air pollution.[117] In addition, several municipal governments have subsidised renewables in buildings and supported the phase-out of fossil fuels for heating purposes. China dominates the global e-mobility market, accounting for 98% of the world's electric buses and for the majority of electrified cars, two-/three-wheelers and trucks.[118] Green hydrogen for transport (and other uses) also is garnering interest in both China and the Republic of Korea, with several cities having ongoing or planned pilot projects.[119] Municipal governments in the Republic of Korea have dominated the number of climate emergency declarations issued in the region, representing 228 out of the 288 as of 2020.[120]

India launched a smart cities programme in 2015 to increase solar power generation capacity in urban areas, and some of these efforts have been coupled with the electrification of urban transport (part of the country's Faster Adoption and Manufacturing of Electric Vehicles (FAME)-II in 2019-2020).[121] Momentum is growing for the expansion of district cooling in the Indian cities of Amaravati, Gujarat International Finance Tec-City (GIFT City) and Rajkot, as well as elsewhere in Asia including in Bangkok (Thailand), Cyberjaya (Malaysia), Manila (Philippines) and Singapore.[122] Still, data on renewable energy progress in Asia remain limited, often due to language barriers and to low participation in international reporting.

Bacoor, Philippines

SUB-SAHARAN AFRICA

Due to rising urbanisation, population growth and energy demand[i], the opportunities around renewable energy use in cities are increasingly recognised in Sub-Saharan Africa. At least 19 cities, including Cape Town and Durban (both South Africa) and Kampala (Uganda) have in place renewable energy targets, and 34 cities have policies.[123] Common drivers for renewables in the region include reducing poverty and inequality (including by addressing energy access and energy poverty) and boosting the resilience and reliability of power systems.[124]

City governments play a key role in shaping the energy landscape of Sub-Saharan Africa. However, competing development priorities, weak fiscal decentralisation, limited municipal mandates across key sectors, and constraints in skilled capacity to execute municipal functions continue to hinder the wider adoption of renewables.[125] Nonetheless, cities have supported local renewable energy deployment in a variety of ways, including by facilitating collaborative projects led by national governments, development finance institutions and/or private actors.[126] Some Sub-Saharan local governments, especially in cities where transport is responsible for a large share of energy consumption, also have entered into public-private partnerships to advance e-mobility (sometimes linked to renewable electricity) at the city level.[127]

Still, the number of cities and towns in the region that have reported data on renewables remains low, due in part to poor or non-existent Internet access, lack of technical (information technology) equipment for local government staff, and the absence of systematic and robust data collection (a worldwide challenge) – all of which impact the availability of data necessary for analysis and trend identification over time.[128] This affects local decision making and resource allocation, and also is a barrier for private investors.[129] To address this challenge and to access technical guidance, many Sub-Saharan African cities have joined international city networks such as ICLEI and initiatives like the Covenant of Mayors in Sub-Saharan Africa, which support knowledge and internal capacity on renewable energy data collection and developing robust implementation projects (→ *see Feature chapter*).[130]

LATIN AMERICA AND THE CARIBBEAN

Despite facing many challenges, **city-level action** to support renewables is expanding, including in developing and emerging economies.

In Latin America and the Caribbean, concerns about traffic and congestion, inadequate infrastructure, air pollution and the effects of climate change have accelerated investment in renewables and the electrification of public transit.[131] By the end of 2020, several municipal governments had renewable energy targets (39 targets), and cities in the region were among the frontrunners in setting net-zero targets (212 targets).[132] Many cities already have high shares of renewable electricity in their energy mixes, including Bogotá (Colombia), Curitiba (Brazil) and Quito (Ecuador).[133] This has been facilitated by the large contribution of hydropower to national and regional grids, emerging national-level regulations for integrating distributed power generation, the growing penetration of wind and solar PV power (incentivised by national policies) and the emergence of renewable energy auctions.[134]

The liberalisation of electricity markets in Argentina, Brazil, Colombia, Mexico and Peru has made it possible for municipal governments and other large energy consumers in these countries to procure renewable electricity directly from local or nearby projects (although residential users remain excluded from choosing their supply companies).[135] Additional trends include the integration of solar PV and solar thermal systems in public buildings; the creation of public-private partnerships to implement larger decarbonisation projects (such as investments in public transit infrastructure); and growing momentum for the electrification of public bus fleets, with e-buses operating in cities in more than 10 countries.[136]

Cape Town, South Africa


Baños, Ecuador

i Despite rising energy use in the region, energy consumption in Sub-Saharan Africa remains among the lowest in the world and relies heavily on traditional biomass, mainly wood and charcoal. See International Energy Agency (IEA), *Africa Energy Outlook 2019 – Analysis Scenarios* (Paris: 2019), and IEA, *World Energy Outlook 2020* (Paris: 2020).

OCEANIA

Renewable energy deployment varies widely across Oceania. Many Pacific island nations have turned to renewables to decrease their dependence on fossil fuel imports, reduce energy costs, and increase energy security and resilience, with most of these efforts being dominated by national and/or sub-national governments.[137] In Australia and New Zealand, momentum is growing for renewable energy in cities, also facilitated by rising concerns about climate change and energy insecurity. By the end of 2020, 114 municipal governments in Australia and New Zealand had declared a climate emergency[i], and 16 cities had a renewable energy target in place, including several cities that have committed to (or already achieved) 100% renewable energy targets, including Adelaide, Melbourne and Sydney (all Australia).[138]

Renewable power purchase agreements gained momentum in Australia, with several major cities, including Melbourne and Sydney, negotiating PPAs in 2019 and 2020 to help achieve their ambitious renewable electricity goals.[139] Australian cities also continued efforts to decarbonise transport, with electric refuse trucks starting operation in Adelaide, Casey and Yarra.[140] Investment in renewable energy projects in Australia has increased in recent years, mainly in the private sector and supplied by domestic banks. In the wake of the widespread 2019 wildfires, municipal governments created several recovery and reconstruction funds to support the installation of solar PV systems in cities and towns.[141]

MIDDLE EAST AND NORTH AFRICA

Across the Middle East and North Africa, concerns about air pollution and health have risen, and energy security challenges remain. Generally, municipal-led renewable energy developments have progressed slowly, due to lack of financial and human resources and strong centralisation of the energy system.[142]

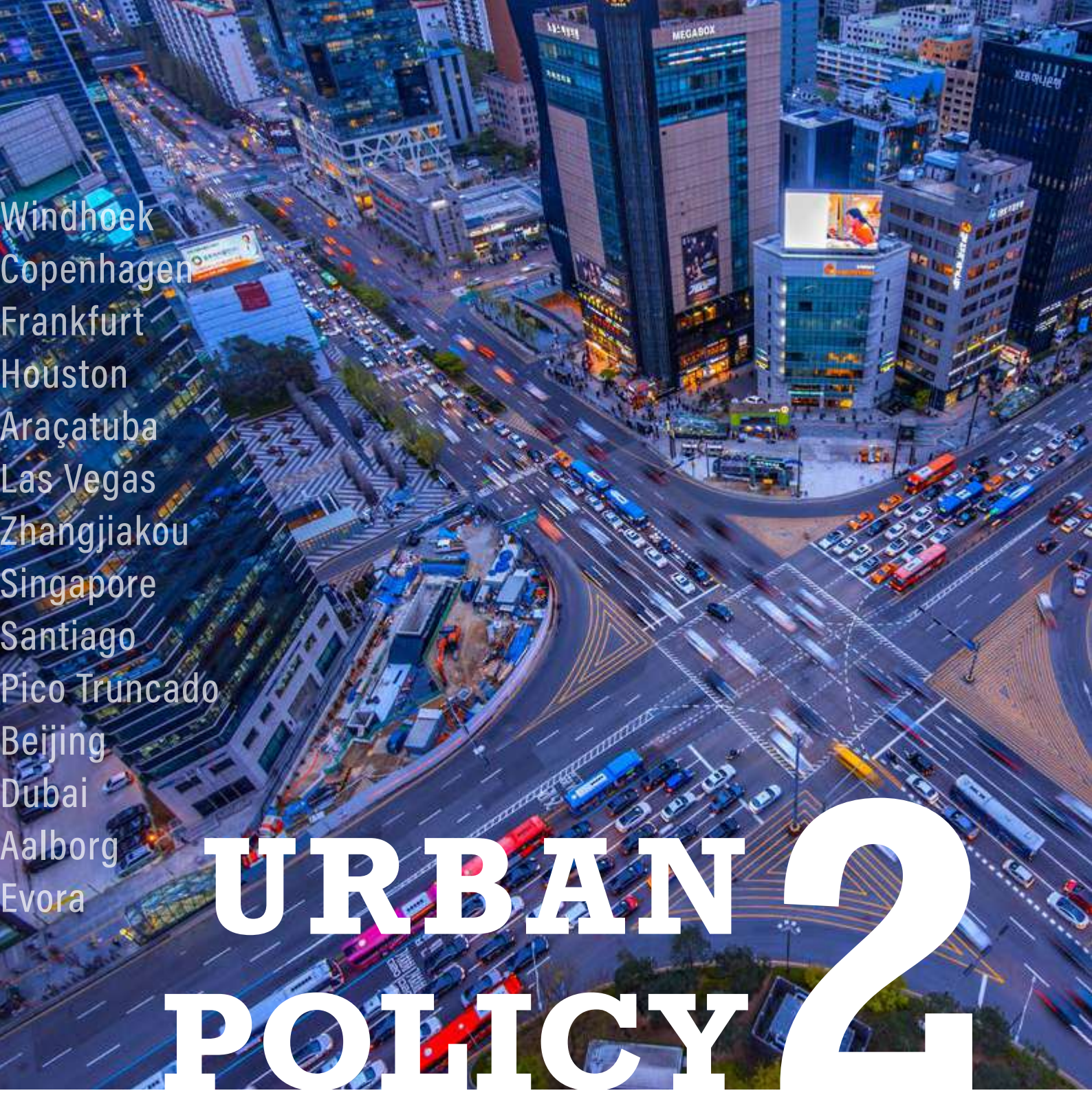
City governments tend to have comparatively little political autonomy, and thus national rather than municipal governments have largely driven efforts to deploy renewables (exceptions include Abu Dhabi, Dubai and Ras Al Khaimah in the United Arab Emirates).[143] Some renewable energy projects in cities have been funded by national governments, whereas in less affluent regions investment has been supported by foreign development aid as well as rising involvement from the private sector and civil society.

The key drivers for renewables vary across world regions, but concerns about **air pollution** are global.

Taupo Volcanic Zone, New Zealand

Dubai, United Arab Emirates

i At the end of 2020, New Zealand's national government also declared a climate emergency and set a goal to be carbon neutral by 2025.



Windhoek
Copenhagen
Frankfurt
Houston
Araçatuba
Las Vegas
Zhangjiakou
Singapore
Santiago
Pico Truncado
Beijing
Dubai
Aalborg
Evora

URBAN POLICY 2

LANDSCAPE

Orlando
Adelaide
Rajkot
Seoul