



City net zero profiles



November 2022



Accra, Ghana

Accra's Climate Action Plan 2020-2025 aims to achieve carbon neutrality by 2050 and outlines measures to reduce greenhouse gas emissions by 73 percent. The Climate Action Plan puts emphasis on strengthening climate and urban governance whilst ensuring public participation and climate equity.¹ The climate action plan focuses decarbonization efforts in the solid waste and management sector, transportation and energy and buildings sectors.

The Government of Ghana has been at the forefront of SDG implementation and budgeting. These efforts are reflected in how the Accra Metropolitan Assembly develops their development plans leveraging on climate governance tools such as green budgeting, mainstreaming of SDG implementation with emissions reduction at the core of urban development and economic recovery.

The city is both a signatory and a key player in international city networks mobilizing for greater city action on emissions reductions.² Leveraging international donor finance and technical assistance the city is implementing The Greater Accra Resilient and Integrated Development Project (GARID), supported by the World Bank that aims to strengthen the resilience of critical urban infrastructure against climate hazard such as floods.

Urban sprawl, population growth coupled with public transport inefficiencies, has led to traffic congestion and an increase in air pollution. The Accra Metropolitan Assembly in collaboration with the national government are piloting electric buses with the objective of increasing the fleet of zero emission buses. The lack of charging infrastructure remains a significant challenge to increasing the uptake of electric vehicles.

In the waste and sanitation sector, the Accra Metropolitan Assembly has partnered with the United States Environmental Protection Agency under the Climate and Clean Air Coalition to develop and implement solid waste management strategies that potentially contribute to the reduction of short-lived climate pollutants and greenhouse gas emissions in the city.



Built environment: Energy efficiency revolving fund³



The Accra Metropolitan Assembly has set up an energy efficiency revolving fund as an incentive package to encourage developers to construct green buildings by offering rebates on property rates and building permits.

In tandem with the updating of the building code by the national government, adoption of the Ghana Net Metering alongside the uptake of green building programs, the city aims to drive down emission from the buildings sector. This is expected to lead to energy cost savings considering the demand for cooling throughout the year.

Addis Ababa, Ethiopia

The Addis Ababa city administration has been leading decarbonization efforts towards climate action. The city has seen an increase in population and economic growth that has put pressure on the city's energy system, transport network and an increase in waste.

Decarbonization of the transport sector has been at the forefront of climate action in Addis Ababa as the sector contributes to 47 percent of the cities total greenhouse gas emissions⁴ The city launched Africa's first renewable energy-powered light-rail train network. The train is powered by Ethiopia's power grid, which is fueled almost exclusively by hydropower, geothermal, and wind power. Emissions reductions from the project are estimated to grow from 55,000 tons of CO₂ per year in 2015 to 170,000 tons CO₂ per year by 2030. The city is also advancing active transportation to encourage cycling and walking, diversifying the modal mix.

Through partnerships and collaboration with diverse stakeholders, the city of Addis Ababa has implemented a series of projects that tackle emission reductions in the city. For example, Addis Ababa has partnered with Climate and Clean Air Coalition and C40 cities to tackle air pollution mainly from the transport sector.

Urban sprawl and housing affordability concerns have led to a proliferation of shantytowns. The Addis Ababa City administration have taken the lead in advancing low – carbon building designs that will see the provision of energy efficient housing for low-income groups.

Addis Ababa's multisector approach to decarbonization of the energy, transportation, and waste sectors has accelerated climate action. It is the first city in the African continent to develop the waste to energy plant to ensure sustainable management of waste diverting waste from landfills.⁵ To further address food waste, the city is a part of C40's Food Systems Network which supports citywide efforts to create and implement integrated food policies to reduce greenhouse gas emissions and increase resilience to deliver positive public health benefits outcomes and to establish a thriving circular economy.



Energy: Reppie waste-to-energy plant⁶



The Addis Ababa City Administration in partnership with Cambridge Industries has set up the Africa's first waste to energy plant. The plant uses municipal waste as fuel for power generation. It has a capacity to treat 1400 tonnes of waste on a daily basis to generate steam that drives two 25MW turbines. The two generators combined have the capacity to generate 185,000,00 kwh. The combustion process also sorts metal. The plant has cross – sectoral impact on waste and built environment sectors as the green energy produced from 80 percent waste is used to power 30 percent household electricity needs.

Alexandria, Egypt

Alexandria is Egypt's second largest city and is host to its main port. It is a member of ERBD Green Cities and as part of the program, will focus climate action on water, air quality and waste. The city has one of the oldest parks in the country that could play a role in the city's resilience and adaptation strategy. Rising population growth coupled with the city's proximity to the Mediterranean Sea is having an impact on critical infrastructure. Rising sea levels and increased rainfall have destroyed infrastructure particularly in low-income neighborhoods and important archaeological sites. To strengthen the resilience of the local authorities erected concrete barriers to break strong tides. The Egyptian government has also allocated funding for strengthening climate resilient infrastructure and other protective measure along the shoreline.

The City of Alexandria implemented a city development strategy for sustainable development to simultaneously address environmental degradation of Lake Mariout, local economic development, and participatory urban upgrading. Through this project a department for implementation and long-term development sustainability was established to coordinate and drive sustainable green development in the city. This signals the importance of strong climate governance structures for implementing and accelerating climate action

The city of Alexandria handles approximately 55 percent of imports and exports and there is need to for energy efficient transport.⁷ A EUR250 million loan from the European Bank for Reconstruction and Development (EBRD) aims to finance a high-capacity electric metro system in Alexandria. This upgrade will improve air quality and reduce noise levels. The project aims to result in a modal shift from road transport contributing to significant greenhouse gas reductions.



Built environment: The Rise⁸



Under the presidential initiative 'Go Green', Alexandria inaugurated its first sustainable project. Specifically, the Rise sets standards for low energy use and carbon emissions and its impact on natural resources. The project provides for the harnessing of solar energy, wind energy and thermal cooling to reduce water use and treatment and provides green spaces. The objective is to have a holistic approach to decarbonizing the built environment considering the role of citizens, biodiversity, and climate.⁹

Amman, Jordan

The city of Amman faces great challenges, as Jordan is the second most water scarce country in the world. Largely a desert, the effects of climate change are increasing the city's vulnerability. The city has also experienced a sharp increase in population due to the Syrian civil war, which has increased demand for energy, water resources and service delivery. The city is host to most of Jordan's population and therefore accelerated climate action is critical.

The city of Amman has put in place a bold climate action plan that considers economic prosperity through ambitious emissions reduction and green growth policies. The Greater Amman Municipality has made significant strides in the water, waste, and sanitation sectors, considering the city's fragility. The waste sector is the second largest emitter of greenhouse gases, mainly methane from large amounts of organic waste¹⁰.

Natural resource shortage coupled with irregular rainfall patterns, drought and rising temperatures in the summer months calls for resilient climate adaptation, innovative policy, the application of technology and partnerships to transition towards net zero.

The city places a specific emphasis on ensuring climate action benefits women in the city. Research¹¹ indicates that the impacts of climate change affect women in a significant way due to their roles as caregivers, domestic roles, and social norms. Urban heat waves are especially a concern for women who undertake household work while simultaneously providing cooling solutions. The Amman Green City Plan aims to empower women, by striving to ensure energy efficiency in buildings, sustainably providing cooling, and deeply engaging and involving women in the journey towards carbon neutrality.

As the city grows in numbers one of the major challenges will be to strive to ensure that climate action is inclusive and equitable. This is especially critical for the large refugee populations in the city and in the peri-urban areas. Alongside this is establishing a strong governance structure to ensure effective implementation towards net zero. Lastly, raising funds from municipal service to cater for climate action projects remains a challenge.



Waste and sanitation: Ghabawi Landfill Gas Capture and Power Generation Project¹²



Led by the Greater Amman Municipality this waste-to energy project main objective is to conduct power generation, gas combustion using landfill gas (LFG) and methane gas generated from the site. The Ghabawi Landfill gas will generate 4.8MW per hour by burning methane that will eventually cover the municipality's energy consumption. The power generated can power the landfill and the remainder will be directed to the national grid. This project hopes to reduce greenhouse gases emitted, optimize waste treatment, and reduce to the pressure on current energy systems. This project is funded by the European Bank for Reconstruction and Development.

Amsterdam, The Netherlands

The City of Amsterdam launched the Climate Neutral 2050 campaign to drive acceleration towards 95 percent reductions of emissions by 2050.¹³ The city's approach to climate action towards net zero is inspired by technology, innovation and experimenting novel solutions to help maximize the most suitable decarbonization pathways. Decarbonization across the sectors has been guided by effective climate governance, planning and citizen engagement.

Top emitting sectors in Amsterdam are mainly from energy consumption, followed by buildings, transportation and from industry and port activity¹⁴. In addition to this, 63 percent¹⁵ of emissions in the city are caused by products and materials consumed directly in the city, hence an emphasis on decarbonizing the waste sector and building a strong circular economy.

The city has adopted a monitor that tracks and evaluates progress in implementing a circular economy. This monitor is developed based on the doughnut model¹⁶ developed by the economist Kate Raworth, that looks at both the use of materials but also the social fabric of the city. This intersectional approach is critical for developing equitable policies on climate action that benefit the socially and economically marginalized in the city.

Amsterdam's cutting-edge climate action policies have benefited from diverse and innovative funding mechanisms. For example, the Amsterdam Climate and Energy Fund¹⁷ provides risk bearing financing such as loans, warranties, and other market competitive financing to projects that can contribute to decarbonization the city's energy sector.



Waste and sanitation: Amsterdam Circular



Amsterdam has put in place a strategy that gives direction for the next five years for the municipality, residents, and business in three areas of the city's circular economy. These are food and organic waste, consumer goods and the built environment. The city has specifically selected the three areas of focus due to the economic significance to the city and they impact on the environment. The city has put in place bold ambitions such as deploying spatial planning and innovation policy to advance and deepen the decarbonization of the waste sector by designating specific locations for the collection and reuse of waste.¹⁸ It has set targets that by 2022, 10 percent of the city's procurement will be circular; by 2023, all of the city's invitations to tender in the built environment will be circular; by 2030, it will have 50 percent less new raw materials in Amsterdam; and by 2050, it will be a 100 percent circular city.

Atlanta, United States

The City of Atlanta launched its climate action plan in 2015.¹⁹ Atlanta's approach to climate action puts an emphasis on community engagement. This commitment ensures that climate justice remains a pillar for accelerated climate action.

The State of Georgia has been at the forefront of emission reductions meeting the federal target of 50 percent by 2030. This has positively impacted the emissions profile of the city of Atlanta and its metropolitan areas. The state's highest emitting sectors are primarily transportation and energy. This is mirrored in the emission inventory of the City of Atlanta, which has implemented several bold measures to decarbonize the transport sector through the introduction of electric buses in vulnerable neighborhoods.

The City of Atlanta has also made significant progress in decarbonizing the buildings sector through leading by exemplifying. The Better Building's Challenge²⁰ was implemented in city owned building, schools, and commercial buildings – this led to a reduction in energy and water use by 20 percent.

The city has established a Mayor's Office of Sustainability and recently appointed a Chief Sustainability Officer. This shows the city's commitment to ensuring effective climate leadership is in place to drive climate action. This new appointment should see the updating of the current climate action plan, putting in place a sustainable procurement strategy and to leverage climate finance from federal sources particularly the recently passed climate legislation, the Inflation Reduction Act. The above traction towards decarbonization provides an opportunity for Atlanta to help ensure effective monitoring and evaluation processes are in place.



Mobility and connectivity: Atlanta's first electric buses



The Metropolitan Atlanta Rapid Transit Authority (MARTA) has launched the city's fleet of electric buses. With support from a consortium of partners such as the Federal Transit Administration, Siemens, New Flyer and the Center for Transport and the Environment, it introduced three electric buses in May 2022.

The electric buses will serve dense urban corridors. This strategic decision is to ensure underserved areas with vulnerable populations have access to transport services. The introduction of electric buses to MARTA's fleet hopes to reduce emission by approximately 935 ton of greenhouse gasses²¹ as well as fine particle matter linked to several health issues.

Barcelona, Spain

Barcelona's transition to net zero is anchored on achieving successful economic recovery, growth, and diversification. The city's climate action plan has set an ambitious carbon neutrality goal by 2050. The city has focused efforts in emitting sectors – transport at 30 percent and buildings at 24 percent²² – and has made significant impact. This traction is partly due to robust policies and impactful implementation of initiatives that tackle energy efficiency across the built environment, transport, and waste sectors.

A unique characteristic of Barcelona is its old housing stock. The average age of a building is 62 years old mainly located in vulnerable areas of the city, increasing exposure to climate hazards. Subsequently only 2 percent of the city's building stocks meets current energy efficiency requirements. Barcelona has put in place robust adaptation measures across to meet several sectoral net zero targets. To help reduce the energy consumed in cooling buildings during heat waves, the city is working together with homeowners and the private sector to retrofit commercial and residential home and increasing the use of renewable energy through solar power.

Alongside partnerships and collaboration, Barcelona is leveraging on technology to test their decarbonization plans and strategies through the application of digital twins. By applying this, the city aims to measure and track the impact and progress of their ambitious net zero climate action plan.

Recognizing the importance of climate equity, the city in conjunction with higher levels of government have put in place measures such as public transport subsidies to encourage ridership. The city has also put in place programs that educate lower income groups on how to save money for energy bills as well as subsidies to tackle the rising problem of energy poverty.

One of the major barriers to accelerated climate action is the tension between available climate finance and city administrative and management structures. Navigating the city's complex bureaucracy and creating an environment of trust between key stakeholders is critical for the scaling up of climate action and decarbonization.



Waste and sanitation: Zero Waste initiative



The city's Zero Waste²³ initiative aims to deepen implementation of an individualized system of collection and a waste fee linked to the volume of waste generation, to encourage city dwellers to sort their waste. The strategy is a multipronged approach that focuses on policy, citizen engagement and economic growth. The initiative of door-to-door collection of waste is supported by municipal led awareness raising amongst stakeholders complemented with incentives for waste and repair schemes, that can enrich the city's circular economy.

Specific targets include to reduce waste generation to less than 1.2kg per inhabitant per day; to reach recycling levels of 60 percent of municipal waste; and to reduce the polluted fraction of organic waste to below 8 percent.

Beijing, China

Climate action in Beijing is anchored on green economic growth, innovation, and the adoption of technologies to drive the city towards net zero. Beijing seeks to have 20 percent of its primary energy use generated from non-fossil fuels by the year 2030. Leading by example, municipal buildings are energy efficient and efforts towards decarbonizing government operations are underway. The city has powered its streetlights using solar energy.

Despite an efficient public transport system, the sector contributes significant emissions in the city. Beijing is taking a multi – pronged approach to decarbonization, by expanding transport infrastructure such as the subway to encourage ridership that has been affected by the COVID-19 pandemic. The city is promoting active transportation by launching bike sharing programs and incentivizing EV purchase through subsidy.^{24, 25, 26}

Leveraging on partnerships and collaboration the city is discouraging car use through the establishment of the Green Traveler Platform, initiated by the Beijing Environmental Exchange, a corporate domestic and international environmental equity public trading platform. The platform brings together car networking companies, insurance companies, banks and other partners to promote a new integrated model in which public and private stakeholders work together to encourage a low-carbon society. The participants of the program receive a substantial financial incentive based on how much time was spent in driving.

The Beijing Chaoyang Circular Economy Industrial Park is a major industrialized waste treatment park. The park serves as a solid waste recycling center, a solid waste treatment research and development education center and a circular economy's industry development demonstration center. This innovative approach to decarbonizing the waste sector is a comprehensive project that deals with different types of waste such as organic, food and medical. The facility is also equipped with an electric vehicle charging park to fuel up to 400 vehicles that transport waste.



Built environment: Energy savings subsidy²⁷



The Beijing Municipal Government and the Haidian District Government granted an energy saving endorsement and financial subsidy to the Microsoft Beijing campus rewarding the buildings performance. Johnson Controls partnered with Microsoft Beijing Campus for its ongoing retrofit and optimization of building operations, achieving 27.9 percent energy savings, and ensuring key equipment uptime to 98 percent.

The subsidy encourages developers, companies, and other key stake holders to implement energy efficiency in building operations aligning with the city's climate action plan that aims to arrive at net zero in the energy and built environment sectors.

Bogotá, Colombia

The city of Bogotá has an award-winning climate action plan that aims to achieve net zero status by 2050. The transport sector contributes 48 percent of greenhouse gas emissions, followed by the built environment at 20 percent. With a nonexistent railway system, the city is heavily dependent on an informal freight and trucking sector that has been a stumbling block for accelerating decarbonization of the transport sector. It is key to note that the informal freight cargo in Bogota is the oldest in Latin America.

Bogotá is the main transport artery connecting all parts of the country, and with no effective rail system, large volumes of freight cargo contribute to poor air quality which is a major public health concern. Due to the informal nature of the sector vehicle owners do not have the financial resources to upgrade or retrofit their vehicles. This leads to significant air pollution and traffic congestion. Despite these challenges, the transport sector in Bogota has seen rapid decarbonization. The city has adopted a wide range of mitigation and adaptation measures that aim to expand and improve public transport, walkability and cycling and using land use planning as way to ensure supporting infrastructure for cleaner non-motorized modes of transport.

In the energy sector, policy rests with the central government. Private sector companies whose main objective is to maximize profits have played a significant lobbying role that favor fossil fuel dependence. The municipality of Bogota therefore has limited leeway to advance climate action in the energy sector.

Unique to the city of Bogotá is the consumer preference for natural gas rather than electricity. New builds are designed and wired for natural gas rather than electricity as the former is a cheaper option, which end consumers are demanding. This trend is predicted to result in stranded assets in the long term as both oil and gas reserves are running out. The city does not have jurisdiction over building restrictions making the transition of the buildings sector to net zero challenging.



Mobility and connectivity: BiciCarga



Freight cargo mainly old trucks are responsible for around 40 percent of fine particulate pollution in Bogotá. The BiciCarga pilot project funded by the World Bank and coordinated by the Bogotá transport commissions aims to save 16 metric tons of particulate matter each day by switching trucks for electric cargo bikes.²⁸

Another objective of the project was to solve bottlenecks of last mile distribution to facilitate the delivery of merchandise quickly and efficiently and streamline operational inefficiencies in distribution.

Budapest, Hungary

Adopted in 2021, the city of Budapest has put in place an ambitious sustainable energy and climate change action plan. The city has made significant investments moving the transport sector towards a low emitting sector. The city's action plan aims to reduce car use to 30 percent of all city traffic.²⁹ The city has a well-organized and expansive public transport system that is affordable. Through the Budapest card, passengers can travel without restrictions and for free within city boundaries via buses, trams, trolleys, subway and even boats. To further decarbonize the sector, the city has put in place measures and targets to increase active transportation and encourage cycling as means of moving around the city.

With an emphasis on public spaces, the city is leveraging on nature-based solutions to expand green areas. The city currently has 5m² of green area per capita, which is significantly less than other European cities.³⁰ The city is implementing an initiative called 'pocket parks' in a bid to increase access to parks and green the city to reduce the urban heat island effect. Considering the architecture of the city's apartment buildings that have internal gardens covered with concrete - the city is removing the concrete and establishing green pocket parks to help improve the microclimate and water retention capacities. Through innovation and technology, the city can leverage on the river Danube to help decrease the urban heat island effect.

The establishment of community gardens in the city has also been a significant initiative part of the city's pathway to net zero. This unique approach actively engages citizens in co-partnering with the city to advance implementation of the climate action plan and deal with issues of food security amidst rising food costs. The city of Budapest has leveraged on spatial planning to advance both climate mitigation and adaptation initiatives. This approach allows the city to accelerate the decarbonization of multiple sectors such as transport, built environment and increasing resilience of critical urban infrastructures.

As the city of Budapest transitions to net zero, attracting climate finance remains a challenge. Funding mechanisms are not flexible enough to cater for more than one policy sector. The robust, integrated, and holistic climate action plans in place or Budapest require significant and innovative funding mechanisms to meet climate action targets. The city has also had a long history of social tension and segregation and therefore concerted efforts to address these concerns is of importance.



Mobility and connectivity: MOL Bubi Budapest bike sharing service³¹



With a decline in usage, the Budapest Transport Sector in partnership with the state oil company MOL, relaunched MOL Bubi, a bike sharing service. MOL Bubi has been given a facelift with new bikes and an upgraded rental system that is user-friendly, accompanied with a mobile application and website. The bikes are supplied locally by a Hungarian bike maker. To help ensure that the initiative is equitable and accessible to all, a security deposit system will be abolished, and a cheaper pricing system will be implemented. The system launched in April 2021, with a fleet of 1200 bikes. The city hopes to re-ignite the culture of cycling and active transportation to rapidly lower car dependency.

Buenos Aires, Argentina

The city of Buenos Aires has been at the forefront of setting very clear and ambitious emissions reduction goals through their Climate Action Plan 2050. The city has leveraged on quality data to inform their net zero pathway enabling effective monitoring and evaluation of impacts. The city's holistic approach to climate action is premised on four levers. The first is a prepared city that aims to increase the city's resilience through sustainable infrastructure and nature-based solutions, the second is close city that is walkable and accommodating to non- motorized transport. The third is an inclusive city where climate action leaves no one behind. Lastly, a low carbon city that leverages of innovative and technology to drive decarbonization across emitting sectors.

Unique to their Climate Action Plan 2050, is the intersectional understanding of the impacts of climate change not only across high emitting sectors but across the diverse urban makeup of the city residents and natural landscape. This integrated approach to climate mitigation and adaptation in the city is anchored on strong climate governance and collaboration across diverse stakeholders. The city has established a variety of participatory initiatives such as the Expert Advisory Council on Climate Change that brings together academics, scientists, and experts to assist the city government in the development or public policies on climate change. The city has also set up similar platforms to engage the private sector and the residents of Buenos Aires.

Despite the fact Argentina has some of the world's best solar and wind resources, increasing the city's uptakes for renewables need to be deepened.³² For example, the transport sector which currently contributes 30 percent³³ of greenhouse gas emissions and has been difficult to decarbonize, could benefit from reliable and available renewable energy. The uptake of electric vehicles has been slow due to cost and lack of incentives. Secondly, the lack of convenient charging infrastructure has been prohibitory and most of the electricity in the city comes from nonrenewable sources. Despite this the city is promoting active transportation by offering low-cost bicycle rental options using mobile applications and designating bike paths to ensure safety and better access.



Built environment: Barrio 31



Buenos Aires has taken a unique approach to increasing the uptake of renewable energy. Considering the link between climate mitigation, equity, and social inclusion. The city has primarily focused on low-income neighborhoods, proving installation of solar water heater and panels in low-income homes.

In one of the largest informal settlements, locally know as Barrio 31, the city has embarked on transforming the neighborhood through clean energy. By installing rooftops with solar panels, Barrio 31 residents now have access to electricity and a steady supply of hot water. This does not only ensure that buildings are energy efficient, but also helps to ensure that target reduction emissions for the energy sector are met in an inclusive and equitable manner.³⁴

Cairo, Egypt

The City of Cairo has over the last years been affected by extreme weather events such as flooding and rising temperatures. Climate action at the city level has become paramount. The Government of Egypt in 2022 launched the National Climate Change Strategy 2050 to guide the transition to a low carbon society. The government's climate plan is anchored on five pillars with emphasis on innovation and technology, attracting climate finance and achieving economic growth through low emissions development in strategic sectors.

Aware of its vulnerability the Cairo Governate is working together with the national government and other key stakeholders to strengthen its resilience. In the Greater Cairo area, the transport sector contributes approximately 26 percent of greenhouse gas emissions,³⁵ affecting the city's air quality. To encourage the uptake of public transport and cleaner transport such as electric vehicles, the national government enacted a fuel subsidy removal in 2014. Road expansions and infrastructure improvements in the Greater Cairo region have been implemented to ease traffic congestion. The city is also expanding and improving the mass transit network to encourage ridership.

The energy transition in Greater Cairo should be driven by increasing the uptake of renewable energy and putting in place measures to decarbonize the built environment sector. The Cairo Governate is leading by example as office buildings use solar power. The city has also benefited from small but impactful projects such as green roofs, urban gardening supported by non-government organizations. Green roofs are especially important in Greater Cairo, where the weather is hot and dry. The demand for cooling can be managed by increasing green spaces around the city.

With a growing population, waste management is a challenge. The City of Cairo has established a robust solid waste management plant to reduce emissions from the waste sector and is working on improving systems for solid waste management in partnership with private sector to benefit from innovative ideas and technological solutions. The city through the Cairo Cleanliness and Beautification Authority (CCBA)³⁶ brings together formal and informal waste collectors to raise awareness on the importance of emissions reductions in the sector.



Built environment: Greater Cairo Air Pollution Management and Climate Change project³⁷



Funded by the World Bank the Greater Cairo Air Pollution Management and Climate Change Project objective is to reduce air and climate emissions from critical sectors and increase resilience to air pollution in Greater Cairo. Key components of the project include reduction of air pollution and greenhouse gas, strengthening Cairo's resilience to air pollution, support the operationalization of solid waste management master plans in greater capacity building, and institutional strengthening.

Cape Town, South Africa

Cape Town's largest source of emissions are mainly from the built environment and transport sector emitting 42 percent and 31 percent respectively.³⁸ The city's Climate Change Strategy puts emphasis on strengthening data for evidence-based policies, leveraging climate finance to invest in net zero projects, private sector partnerships and effective monitoring and evaluation processes. The city has embarked on a major retrofitting of 60 percent of municipal buildings to drive the value of energy efficiency and to lead by example. Total electricity consumed in the city is by the residential sector and the heating of water is considered to a high energy user.³⁹ The city has been promoting the installation of solar water heaters in homes as part of the accredited solar water heater program.

The country has been experiencing an energy crisis that has resulted in load shedding across cities except for Cape Town. This is because the city has additional energy generation capacity via its Steenbras hydro-electric pumped storage scheme. The city is far ahead in terms of energy policy, readiness to transition to cleaner energy and only requires approval from National Government to procure energy from independent power producers. To further decarbonize the energy sector, Cape Town has launched a set of guidelines and associated tariffs for small scale embedded energy generators with a generation capacity of less than 1MVA. Guidelines and tariffs have been compiled for commercial, industrial, and residential generators and are applicable for both renewable energy generation and co-generation. Small scale generators will be permitted to connect to the grid and in so doing be able to both import energy from and export a limited amount of energy onto the city's grid, which they will be credited for.

The city's growing population coupled with limited land fill capacity has led to the establishment of a growing circular economy. The city has implemented several initiatives that aim to decarbonize the waste sector. For example, the collaboration between the city and a consortium of private sector companies under the Western Cape Industrial Symbiosis Programme aims to add value to waste materials linking business opportunities and resource efficiency. The projects also aims to reduce industrial and commercial waste produced by businesses.



Built environment: Cape Town ceiling retrofit project⁴⁰



The city undertook retrofitting of several homes the city to address the demand for energy. The project involves the insulating of ceilings which would decrease the energy cost for residents and improve health complications caused by inappropriate insulation materials. Cape Town's cold climate makes its residents susceptible to tuberculosis and other illnesses, especially in low-income neighborhoods where housing often lacks the proper insulation further affecting indoor air quality. Through this project, the city has been able to address energy efficiency and public health concerns, illustrating the many ways that equitable climate action can be realized. Ultimately the initiative aims to realized reduced healthcare and energy costs, a reduction in emissions and improved quality of life for residents.

Chicago, United States

The city of Chicago has set bold ambitions to reduce carbon emissions by 62 percent by the year 2040. Chicago's climate action plan puts emphasis on equitable climate action and leverages on partnerships and innovative collaboration to transition to net zero. The city has put in place plans to advance environmental justice and aims to simultaneously strengthen economic prosperity and urban health.

Sources of emissions are from buildings at 69 percent, followed by transport at 24 percent and waste at 7 percent⁴¹. The city's governance structure helps to ensure effective collaboration with state and federal agencies to drive climate action at the city level. The need to put in place effective monitoring and evaluation measures is critical to the transition to net zero amidst rising temperatures, colder winters, and population growth.

Leveraging on partnerships, the city of Chicago in partnership with Exelon, has developed the world's largest municipal solar installation. The 40-acre site is host to a 10MW installation. In addition to this, Chicago is famous for its green roofs and is currently installing over seven million square feet across the city to decarbonize the built environment.

Particularly challenged by the fact that Chicago was built on a swamp, the rising water levels in Lake Michigan are causing damage to buildings and adversely impacting low-income neighborhoods. The city will require substantial investments towards climate adaptation to reduce loss and damage costs. In addition to this, is the need to leverage on new technologies that can accelerate the transition to net zero.

With a central focus on climate equity, the city has put in place a unique approach that links direct financial investments into inclusive climate action, engaging community leaders and financing projects that can help improve the livelihoods of historically marginalized groups and reduce the impact of climate change both at the macro and micro level.



Waste and sanitation: Chicago waste strategy⁴²



Chicago has developed a robust strategy to divert waste from landfills, increase recycling, address environmental injustices, and create green jobs. The city of Chicago has taken a unique and intersectional approach to decarbonize the waste sector. The strategy considers that the transition to net zero must be just, fair and provide economic opportunities.

Furthermore, the city has developed this strategy in partnership with a specialized nonprofit organization dealing in municipal solid waste management planning and the University of Illinois at Chicago. The waste strategy will focus on the following waste sectors: residential waste reduction, organic and wasted food, specialty materials, construction and demolition debris, source reduction, reuse and repair, municipal management and data tracking, and industrial, commercial and institutional waste reduction.

Dakar, Senegal

The city of Dakar has developed the Local Climate and Energy Plan to guide climate action in the city. A unique element of the action plan is the emphasis on strengthening urban governance for a just energy transition. Climate action and the transition to net zero is not only about emissions reductions. Socio-economic development and economic growth are intricately linked to sustainable development. Biomass represents half of Senegalese energy consumption, while petroleum account for approximately 36 percent.⁴³

Dakar has benefited from international climate finance mainly from international development and multilateral institutions. For example, as a member of the C40 Cities Finance Facility, Dakar will implement the landscaping redevelopment of the Zone de Captage storm water retentions basin. The project aims to reduce the city's vulnerability to flooding and improve public health conditions by preventing the discharge of waste water and household waste into the basin.

As a coastal city, Dakar faces challenges linked to sea level rise, rising temperatures and extreme weather events. As part of the Local Climate and Energy plan, the city has prioritized green infrastructure to increase the city's resilience amid climate change impacts. In partnership with the Food and Agricultural Organization, the city established an innovative and environmental friendly microgardens program⁴⁴ that uses local waste materials as growing substrates such as sand and coconut fiber to sustain food security.

Endowed with solar resources, Dakar has an opportunity to accelerate the energy transition. Initiated by private sector stakeholders, Dakar Future is a unique initiative linked to the famous Dakar rally. The project is a live lab of solar panels that will generate enough energy to power cars that take part in the rally. Based on the success of this project, the city can partner with investors and replicate the project to increase the uptake of solar power and decarbonize the energy sector.



Waste and sanitation: Solid waste generation data⁴⁵



As part of the Climate and Clean Air Coalition, Dakar is leveraging the power of data to strengthen solid waste management and to reducing climate pollutant emissions from the waste sector. Eighty percent of the city waste stays in landfills and the city lacks recycling facilities. Data provides the city with information to plan towards suitable interventions that can help improve waste management across the city.

Dubai, United Arab Emirates

As the most populous city in the United Arab Emirates and with an average temperature exceeding 30C and up to 40C in the summer months, transition to net zero is critical. The country and all the emirate islands have leveraged the sunny climate to facilitate the rapid uptake of solar energy. The city is host to Mohammed Bin Rashid Al Maktoum solar park, the largest single site generator of solar energy with a capacity to produce 5GW by 2030. Dubai will also be host to a net zero urban technology and innovation hub. The hub will be an incubator for innovative ideas that aims to deepen sustainability in cities and will create 4000 jobs in green innovation.

With a robust real estate market, growing population and rising temperature, the city of Dubai needs to resolve the demand for cooling energy. Leading in deep decarbonization of the built environment sector, Dubai is ranked as the third amongst global cities with the greenest buildings in the world. Despite this ranking, residential segments are lagging. The Dubai Municipality has made it mandatory for all existing and new buildings to implement green building standards.

Dubai municipality is leveraging on cutting edge technology to accelerate the transition and progress to net zero. In partnership with the Mohammed Bin Rashid Space Centre, the city launched the region's first environmental nanometric satellite in 2021⁴⁶ to advance the development of solutions to address climate change through environmental forecasting.

Keeping up with a growing population will require Dubai municipality to deepen climate action across all sectors to maintain the momentum that has already been achieved. With a large migrant worker population, the city lacks a clear roadmap for equitable climate action. The distributive impacts must be spread amongst all city residents and citizens from all walks of life should play a role in decision making to ensure that no one is left behind in the transition to Net zero.

Dubai's sustainability and net zero ambitions have had a significant impact on its attractiveness as an investment location. Creating incentives for economic growth whilst moving the city towards net zero has been shaped by effective climate governance both at the national and local level. The city has leveraged on key partnerships and collaboration that boosts the city's magnetic capacity to attract investments.



Built environment: Dubai building code⁴⁷



The code was developed by the city to unify building design across the municipality. The building code is easy to use and mandates minimum requirements to help ensure sustainable development of buildings, health, safety, welfare of people inside and around buildings and design techniques to reduce impact of the surrounding environment.

Built environment: Al Sa'fat Dubai green building system⁴⁸

The city has crafted its own unique green building requirements which are mandatory requirements for all new buildings to meet certain performance rankings. The Al Sa'fat system enhances buildings users' safety and aims to ensure a more sustainable environment and spurs innovation, integration between green technology in building design that leads to improved performance, low energy consumption, efficiency of electrical and mechanical system and low carbon footprint through the life cycle of the building.

Dusseldorf, Germany

Endowed with green spaces and parks, Dusseldorf is considered a green city. The city has set targets to arrive at net zero by 2035. Dusseldorf is host to Europe's largest green façade, located in the downtown core. The building is covered with approximately 30,000 hornbeam plants. Designed in line with climate protection at the core, the building sets an example for developers to design and construct buildings that will have a positive impact on emissions reduction and energy performance.

The City of Dusseldorf provides financial support for green roofs, façades, inner courtyards, and urban gardens as well. This program is meant to strengthen the power of green infrastructure leveraging on nature to provide a cooling effect during hot summer months and to act as a buffer during periods of heavy rain.

In 2009, the city enforced a low emissions zone and only vehicles with an emissions sticker can access the zone. The city also has an extensive cycling network of around 700 kilometers and there are numerous bike rental systems in place. In 2022, the city launched the Cargo Bike Automat⁴⁹, that provides municipal employees the opportunity to rent a cargo bike at no cost, to deliver packages and travel around for city. This initiative is in line with the city's goal of driving down emissions to zero in the transport sector.

The City of Dusseldorf has put in place measures to decarbonize their operations through sustainable procurement. Decarbonizing municipal operations is a first step to taking ownership and responsibility of transition to net zero.



Mobility and connectivity: E-buses greening public transport⁵⁰



Dusseldorf is deploying state of the art e-buses in its public transport fleet, the Rheinbahn. The city would like to see Rheinbahn as the first choice for mobility and turning around the transport sector with modern and intelligent solutions is a game changer in the transition to net zero mobility.

Hamburg, Germany

The City of Hamburg has updated its climate goals aiming to reduce emissions by 55 percent by 2030 and achieve net zero status by 2050. The Hamburg Parliament has passed a Climate Protection Act⁵¹ and has enshrined the limitation of global warming in the constitution. In the transition to net zero, the city has identified four sectoral pathways to decarbonization with a focus on mobility transition, the economy, climate adaptation and heat transition and building efficiency.

Hamburg is a leader in district heating. The network can supply approximately 20 percent of households and there are plans in place to increase the capacity. The city is planning the construction of a 60MW waste water heat pump will supply heat to the port city in 2025 climate-friendly heat, avoiding 66,000 tonnes of carbon dioxide emissions.⁵² Also, through the development of HafenCity, a new city development within Hamburg, a standard is being set for sustainable urban development. Unique to this development is the use of a steam turbine and fuel cell heating plant that emits less emissions compared to fossil fuel heat supply.

Hamburg is a historically green city. The Green Network Hamburg (Grünes Netz Hamburg) is a network of green open spaces that are connected to the city center. Designed over 100 years ago, the network is now supporting active transportation with bike lanes and increasing walkability. Also, a leader in green roofs, the city aims to ensure that 70 percent of all suitable rooftops are green. The Hamburg government has dedicated finances to increase green roof construction for old and new buildings in the city.

With plans in place to arrive at net zero mobility, the City of Hamburg is committed to purchasing 100 percent electric vehicles and expanding the public transport fleet. Hamburg is one the most EV friendly cities due to the availability and accessibility of public charging stations. With a significant logistics industry, air pollution is a concern. Ships berthing at the port release pollutant emissions affecting air quality. Through Clean Air Plan for Hamburg, the city plans to expand on shore supply in the port of Hamburg which aims to reduce the pollution of nitrogen, sulphur oxides, and CO2 emissions.

Climate governance in the city of Hamburg is strong. Environmental criteria and considerations play a major role in the city's procurement strategy. The approach the city has taken has positive spillover effects to the private sector, spurring innovation and new business models that strengthen and accelerate climate action.



Mobility and connectivity: Zukunftstaxi⁵³



An innovative partnership between the City of Hamburg, Hamburg's taxi association, the Hamburg Chamber of Commerce taxis and Hamburg Taxis, will implement emission free taxis. The project is supported and financed by a consortium of private sector partners. Apart from meeting the cities net zero targets in the transport sector, the project aims to engage taxi businesses as co-partners in the transition to net zero. The EV mobility sector is increasingly becoming competitive as customers align their consumption choices to sustainable initiatives.

Hamilton, Bermuda

As the capital city of a small island, the impacts of climate change can be severe and therefore the need to decarbonize and move towards net zero is critical. The approach to net zero adopted by Hamilton aligns with the island's wider strategy for economic growth. Most islands, including Bermuda, import diesel which makes electricity retail prices very high as compared to other parts of the world. In a bid to increase the share of renewable energy and reduce the cost of electricity especially for the most vulnerable in society, the island has embarked on leveraging solar energy to green power generation in accordance with its Integrated Resource Plan. The impact of this is expected to further ensure a spillover effect of decarbonization to other sectors particularly the transport sector.

As a small island, traffic congestion can be quite a challenge, particularly in Hamilton. By encouraging the use of electric vehicles on the roads, the island expects to benefit from reduced dependence on fossil fuels, reduced emissions and noise pollution, and improved air quality, particularly in the city of Hamilton. The Government of Bermuda has implemented policies that encourage decarbonization of the transport sector. For example, electric vehicles have been duty free since 2012, batteries since 2017, EV charging stations, parts, and related accessories since October 2018.⁵⁴ Most recently, the island introduced electric buses to its fleet.

In other sectors such as the built environment, the Corporation of Hamilton has embarked on using nature-based solutions to enhance the island's capacity to absorb greenhouse gas emissions and to help improve quality of life of the residents. A tree farm park has been established where young trees are being planted as way to manage tree mortality rates across the city.



Hamilton, Bermuda (continued)

Waste and sanitation: Greening Hamilton's waste water network⁵⁵



The City of Hamilton has started several green initiatives to improve the performance of the Hamilton waste water network, with a goal to reduce pumping energy expenditures within the system. The current system is comprised of sixteen large waste water pumps, the energy costs of which can easily fall within the half a million-dollar range, per annum. An ideal reduction of 15 percent in energy consumption would result in average savings of approximately BMD75,000 per year. As an added benefit, reduction in energy consumption can further reduce maintenance costs and improve asset lifespans, a two-fold savings. Using a phased approach, the city has reduced the amount of 'inflow and infiltration' of both fresh and sea water into the waste water network. Sources of this water come from rain events, broken or damaged sewage lines, air conditioning condensate discharge lines, inappropriate roof drain connections and other sources. Fresh water and seawater, ideally, are handled by the city's street drain system and not the waste water network – a network that screens the inflow and removes solids before discharging it offshore.

Phase Two of this program included a full LED retrofit across the city as well as ongoing HVAC efficiency programs and solar installations. As HVAC systems make up roughly 30 percent of a building's energy consumption, this is a constant area to focus on.

The city has also installed solar panels on the roof of its pump station. The project encompassed 110 solar panels and generate approximately 35,000 watts of power for the pump station with an estimated annual electric cost saving of BMD18,000 per annum. Additionally, in 2019 the city installed a field of 210 solar panels on its roof at the works depot which has generated an approximate BMD40,000 reduction in the annual electric bill for the depot.



Hong Kong (SAR), China

Hong Kong (SAR), China's net zero Climate Action Plan 2050 aims to achieve net zero status by focusing on net zero electricity generation, green transport, waste reduction and energy savings and green buildings. This robust plan sets out a clear roadmap of decarbonizing high emitting sectors whilst putting an emphasis on public participation and community engagement. The city is also leveraging on technology, research and development and private sector collaboration and investments to drive net zero climate action.⁵⁶

As an international finance center, Hong Kong (SAR), China's commercial spaces account for the highest consumption of electricity within the territory.⁵⁷ This, coupled with recent heat waves, has led to an increase in demand for cooling. In response to this the government continues to promote the installation of district cooling systems in new precincts to promote energy efficiency and conservation.

Hong Kong (SAR), China has a very efficient and accessible public transport system, used by approximately 10.6 million passengers daily.⁵⁸ With most people relying on public transport the city of Hong Kong (SAR), China aims to ensure that 100 percent of its fleet achieves zero emissions. The city further plans to collaborate with stakeholders in the transport sector to test out hydrogen fuel cell electric buses and heavy vehicles. In addition, the Hong Kong Special Administrative Region (SAR) Government has implemented an EV charging at Home Subsidy Scheme to ensure accessibility to charging infrastructure for electric vehicles.

Hong Kong (SAR), China is known to be a vertical city being highly densified. One of the challenges it faces is lack of space to develop multiple renewable energy power stations. It therefore relies on energy imported from Mainland China as well as being heavily dependent on natural gas for power generation. These challenges present an opportunity for the city to explore new technologies for carbon capture utilization and storage to advance decarbonizing efforts in the energy sector. Alongside this, new technologies are offering solutions to advance renewable energy despite limited land space.



Energy: Solar power station carbon reduction⁵⁹



In collaboration with the Government of Hong Kong SAR, HK Electric built the city's largest commercial power systems with a generating capacity of 1MW. Using a new technology, the solar panels perform better under the city's high temperature making them more efficient and cost effective.

The solar power system is expected to generate 1,100,000 units of electricity annually. The power generated is fed directly to HK Electric's 380 V electrical system. This project is in line with the city's climate action plan that aims to achieve net zero electricity by 2050. This project is expected to reduced carbon emissions by 915 tonnes annually.⁶⁰

Jeddah, Saudi Arabia

Jeddah is recognized as a sustainable city with quality water and low pollution levels⁶¹ However, as a coastal city, the impacts of climate change are increasing Jeddah's vulnerability. This means strengthening climate adaptation measures to protect critical urban infrastructure is essential to achieving net zero. The Kingdom of Saudi Arabia has pledged net zero greenhouse gas emissions by 2060.⁶² Jeddah's pathway to net zero will be bolstered by effective multi-level governance.

The city has a vibrant industry mainly oil refining, food and beverage sector coupled with large productive factories. It has been observed that regional conditions such as aridity levels indicates that energy consumption and CO2 emissions are high.⁶³ Cheap fuel prices and water desalination plants are the major sources of GHG emissions in the city.⁶⁴ Potable water in the city of Jeddah is derived from water desalination plants that use high amounts of energy that emit high levels of CO2 emissions due to the burning of petroleum oil.⁶⁵ The national government however has put in place measures for zero carbon desalination through the Saudi Green Initiative. Alongside this is the "Circular Carbon Economy"⁶⁶ national program that aims to reduce greenhouse gas emissions in all sectors whilst ensuring socio- economic development. This initiative is anchored on the pillars of climate protection, socio-economic impact, and global leadership.

In partnership with the private sector, Jeddah was the first city in the Kingdom of Saudi Arabia to host an eco-friendly electric vehicle charging plant⁶⁷. The plant also provides special bicycle parking, energy and water saving measures as well. Integrated in this charging plant is a recycling component that encourages waste reduction.



Waste and sanitation/energy sector: Shuaibah 3-expansion desalination plant⁶⁸



As the largest desalination plant in the Kingdom of Saudi Arabia, the Saudi Water Partnership Company reconfigured the Shuaibah 3 plant to a green field reverse osmosis plant. This will reduce the reliance on fossil fuels to power the plant. With the application of cutting-edge reverse osmosis technology, emissions emitted have reduced. Secondly, the plant produces approximately 250,000 cubic meters of water a day, serving the city of Jeddah and its environs particularly during peak periods.

Kingston, Jamaica

As a small island, the city of Kingston is vulnerable to climate hazards including sea level rise, hurricanes, and extreme weather events. The impact of natural disasters is likely to increase in intensity requiring investments towards climate mitigation and adaptation. Increasing storms across the Caribbean has impacted coastal infrastructure and marine biodiversity. The Municipal Corporation of Kingston in partnership with the Jamaica Social Investment Fund implemented the Port Royal Street Coastal Revetment Project to protect the shoreline. This development aims to prevent further erosion of the shoreline by wave action and safeguard it from storm surges.

The Government of Jamaica has implemented policies that aim to reduce emissions from the transport sector. The Motor Vehicle Import Policy⁶⁹ will provide for cheaper rates for imported electric vehicles making them accessible. Secondly, the city of Kingston through the Jamaica Urban Transit Company will introduce 50 electric buses, encouraging both ridership and increasing clean transport options.

The country depends on imported petroleum products which means that energy costs are high. Energy infrastructure is being modernized, power plants and distribution systems are becoming more energy efficient. These activities should increase the uptake or renewables such as solar, wind, biofuels by up to 20 percent by 2030. In a bid to ensure energy efficiency in multiple sectors, the Government of Jamaica has also embarked on decarbonization of the built environment. The Municipal Corporation of Kingston's buildings such as hospitals, schools will undergo major energy retrofits signaling city led action in the transition to net zero.



Energy sector: Solar panel loans⁷⁰



The Development Bank of Jamaica and the National Housing Trust provide low interest loans to facilitate installation and retrofitting of solar water heating systems. The aim of the initiative is to increase energy efficiency in residential and commercial buildings. The loan is available to contributors who can provide a title for a residential property or who has at least enough funds in their Contribution Account at the NHT equal to the cost of the system, plus JMD20,000. The loan can be obtained at an interest rate of 3 percent over a maximum period of five years with a 5 percent service charge.⁷¹

Kuala Lumpur, Malaysia

Kuala Lumpur aims to achieve net zero status and increase its resilience against climate hazards by 2050. The Kuala Lumpur Climate Action Plan focuses on five strategies; mobility and infrastructure, waste management, green infrastructure, energy efficient, and climate resilient infrastructure. In addition to the net zero plan, Kuala Lumpur has also outlined a total of 245 low carbon programs under 10 strategic themes via the Low Carbon Society Blueprint 2030 across different sectors. These complementary activities aim to reduce emissions across high emitting sectors and subsequently accelerating the city's transition to net zero.

The transport sector is a major contributor to the city's emissions at 56 percent in 2017. The city records that 99.4 percent of emissions are from the on-road transport, thus leading to the city's commencement into deepening active transportation. To enhance connectivity in the city, Kuala Lumpur is constructing bicycle and pedestrian lanes to connect residential areas to the city center. This initiative is further strengthened through policy and guideline to lower motorized vehicle speed limits and create streets that are conducive for the uptake of active mobility. The city is also working towards expanding EV charging infrastructure to accommodate for the increasing appetite for EVs in the city.

The waste sector is also a major contributor to greenhouse gas emissions. The city's solid waste collection is outsourced via a concessionaire for a large part of the municipality with the exemption of private commercial areas and high-rise residential developments. Kuala Lumpur has partnered with the private sector to integrate waste management in the city through smart bins in selected public areas and a robust recycling system. By 2050, Kuala Lumpur targets a solid waste diversion of more than 50 percent from landfill disposal. To achieve this, the city will develop a waste masterplan for the management of solid waste, which will include waste reduction and recycling targets, strategies, and enforcement measures. The city also leverages public private partnerships to develop waste to energy plants to further divert municipal waste from landfills.

Aligned with the climate action plan, Kuala Lumpur also plans to increase the city's adoption of green infrastructure. As part of increasing resilience amid rising temperatures and increased rainfall, green infrastructure should be designed to protect the city from climate hazard and at the same time function as space for recreation and leisure. Initiatives such as imposing on developers to use at least 30 percent renewable energy components in projects (commercial or residential) and the installation of solar photovoltaic systems at municipal buildings are some of the measures Kuala Lumpur has implemented to help ensure carbon neutrality across the built environment sector. The city also plans to introduce policies to mandate reporting of energy usage of all buildings, following the proposed action on implementing mandatory building performance rating and benchmarking system to reduce energy consumption through targets setting based on building types.



Built environment: Sustainable towns in the heart of Kuala Lumpur



Kuala Lumpur is positioning itself as a leader in sustainable climate action. One of the best models for sustainable urban environment is Sunway City, an 800-acre development in Kuala Lumpur with a fully integrated green township. It has also been awarded the status of a low carbon city in 2016.

Sunway City is an example of a resource-efficient and low carbon city as envisioned in the Low Carbon Society Blueprint 2030. In collaboration with private stakeholders, the development can be used as a template for developing low carbon cities and showcasing new business and partnership model that other cities can adopt to advance their net zero plans.

Lagos, Nigeria

Lagos is the only city in Nigeria to develop a Climate Action Plan, covering 2020 to 2050.⁷² The energy sector is the highest emitting sector at 55.1 percent, by waste at 25.3 percent and transport at 19.6 percent.⁷³ Recognizing the importance of balancing climate adaptation and mitigation, Lagos has put in place bold measures to reduce emissions in high emitting sectors and implement a resilient pathway towards climate action. In delivering the climate action plan, the Lagos State Government has established governance structures such as the State Climate Change Council, the Climate Change Secretariat, and the State Climate Change forum to coordinate the implementation of the city's transition to climate action.

Lagos is one of the largest coastal mega cities in the world. A growing population coupled with rising temperatures and increasing climate hazards such as floods and sea level rise, increase the city's vulnerability. Eko Atlantic City, a major project, was constructed with a 6.5km sea barrier aimed at protecting the city from sea level rise as well as mitigating against coastal erosion.

Road transport is the major mode of transport in the city. Traffic congestion and air pollution are increasing emissions and affecting air quality. The Lagos Metropolitan Transport Authority in partnership with Oando energy⁷⁴ solutions plan to deploy electric buses and contribute to the decarbonization of the transport sector. Additionally, the city is leveraging on its waterways to decongest the roads. Travelling by ferry will be an option for residents, broadening the modal mix of transport in the city.

The Lagos State Government has taken the lead in sensitizing key stakeholders including investors to speed up the adoption of renewable energy, particularly solar energy, which has the most potential. Through seminars and workshops, the state hopes to scale interest in the sector.

The city through international city networks is strengthening its capacity in several thematic areas such as building energy efficiency, clean air and urban flooding. Knowledge sharing and transfer is essential as the city implements its climate action plan. Lagos also has a vibrant start up ecosystem, that can be leveraged on to spur innovation and ideas for local solutions that can accelerate climate action.



Built environment: Building energy efficiency code⁷⁵



Buildings contribute up to 40 percent of emissions in the city,⁷⁶ making this a decarbonization priority. The Lagos State has partnered with the Nigerian Energy Support Program to adopt a Building Energy Efficiency code. The objective of this program is to advance energy efficiency projects in the building sector, train and capacitate relevant stakeholders on the code for effective implementation. The city sees this as a significant first step towards moving the built environment towards net zero, whilst strengthening socio-economic development in the city.

Lisbon, Portugal

Lisbon is considered a leader in climate action. The city's Sustainable Energy and Climate Action Plan boldly outlines mitigation and adaptation strategies for key priority areas such as spatial planning, water quality, transport, waste management, energy, and agriculture. Lisbon's pathway to net zero puts emphasis on effective climate governance, delivery capability, public participation, monitoring and increasing access to climate finance.

Host to one of the world's largest electric car charging networks, the city is successfully decarbonizing the transport sector. However, as more people choose to live outside of the city due to high housing prices, the dependency on cars remains. The COVID-19 lockdown period presented an opportunity for Lisbon to accelerate the implementation of clean mobility. The city expanded walking areas to the addition of approximately 100 public spaces. To encourage cycling, more than 100km of new cycle paths are scheduled to be added on to the network with the aim of connecting homes and workplaces. The city is also expanding the electric fleet of buses and is encouraging micro-mobility through the responsible use of scooters. Leveraging on innovation and technology, Lisbon has adopted a Mobility Data Specification tool establishing a template so that dock less bike shares, e-scooters and other shared mobility providers are able to share data to inform public transport planning and management.

Rising temperatures are also affecting the city of Lisbon but the city is increasing resilience efforts. Lisbon's Life Lungs Project⁷⁷ is an innovative climate adaptation project that aims to increase resiliency in the city, mitigating against the effects of heat waves, water scarcity and other climate hazards. Life Lungs is an integrated project that promotes biodiversity, reduces energy consumption, and promotes citizen awareness and capacity building.



Built environment: Lisbon city council's building retrofit⁷⁸



Built in the 19th century, the City Hall is both an iconic and historic building in Lisbon. The retrofit project is a successful template of how public service buildings can improve energy performance while still preserving their architectural and historic character.

Interventions included replacing heating systems, energy efficient lightings, procurement of renewable energy and leveraging technology for better energy management. The retrofit decreased the building's energy usage by 36 percent, decarbonizing the city government's operations.

A unique aspect of this project was the use of a 3D model simulation of the city hall building that helped to identify the most appropriate suite of retrofit solutions. The simulation allowed modelers to understand the interaction between weather, usage patterns, lightings systems and building materials.

London, United Kingdom

London aims to transition to net zero by 2030.⁸⁰ The city's net zero plan identifies the 'Accelerate Green' pathway as the preferred route for driving climate action. This pathway takes in account the urgency to act, ambitious goals and targets, social justice, and delivery capability. This pathway can only be effectively realized by establishing innovative partnerships with diverse stakeholders, accessing substantial climate finance and citizen engagement.

The council is prioritizing the built environment, transport, and energy sectors as it moves towards meeting bold net zero targets.⁸¹ Residential buildings contribute a third of London's greenhouse gasses. Therefore, heating and insulation of homes, is a key priority for the city as most of the housing stock are not well insulated and rely on gas for heating. The city's Retrofit Accelerator program aims to create warm, affordable low carbon home by upgrading the old and energy inefficient housings.

The transport sector is a major contributor to greenhouse gas emissions. The council has implemented number of initiatives such as the zero emission bus fleet that has placed 550 electric buses on London's roads, the largest in Western Europe. Charging infrastructure in the city is accessible and available with over 7000 charge points. Walking and cycling has increased due to the introduction of the Streetpace program, low traffic neighborhoods and the addition of cycle lanes have also boosted active transportation. Other initiatives aimed at decarbonizing the transport sector include the introduction of hydrogen powered bus fleet under the 'Hydrogen London' program.

With increasing temperatures and heat waves exacerbated by the urban heat island effect, the London Environment Strategy aims to protect, increase, and improve green infrastructure. The Council is leveraging on the city's natural capital to mitigate against heat and aims to capitalize on the economic and environmental value of green infrastructure.



Energy sector: 'Be seen' energy monitoring guidance⁸²



The guidance document explains how developers and owners of new major developments should monitor and report actual operational energy performance of buildings. It sets out what each responsible party needs to do to comply with the policy from the inception stage of a development to full occupancy. It provides information on the reporting templates applicants will need to use to report and explains how and when to report to the Greater London Authority. Applicants are required to provide accurate and verified estimates of each of the performance indicators of each reporting stage through the appropriate 'be seen' reporting template.

The objective of the monitoring guidance is to assist London to have an informed understanding of actual operational energy performance of buildings to achieve net carbon buildings across the city. This can help bridge the performance gap between design theory and actual energy use.

Luanda, Angola

Luanda is a coastal city with a growing population. With the rise of extreme weather events, the municipality is confronted with several challenges mainly, providing adequate water supply, sewerage infrastructures and reliable 'green' energy to a growing population. The city is extremely vulnerable to climate change. To strengthen climate action, the city requires reliable data to make informed decisions on climate investments. The Government of Angola recently approved the National Strategy on Climate Change 2022-2035. It is expected that cities including Luanda will be guided by this plan. However, with no documented climate action in place, the city is still addressing the challenges posed by climate change.

Luanda grapples with traffic congestion, air pollution and emissions from road transport. To resolve this, the city aims to rehabilitate its public transport system by creating and enabling environment for private sector to cash in on the lucrative e-mobility market. For example, T'Leva, an Angolan ride-sharing app, aims to include electric cars and motorbikes.

Luanda's public transport infrastructure is largely dominated by private shared taxis locally known as 'condongueiros'. The aging diesel fleet of taxis are non-compliant with international emission requirements. As a step towards decarbonization, the city government has deployed bus fleet in partnership with private sector to make the city more accessible in a bid towards decarbonizing the transport sector and inclusive economy. The government further plans to deploy 900 buses to help reduce the carbon emissions in the environment

Informal occupation of land in the city has led to the proliferation of informal settlements which exposes the vulnerable groups to climate hazards. To address this issue Luanda collaborated with UN-Habitat to prepare a framework through a holistic approach to support the territory and urban planning in the city.

Alongside city action, the national government is focused on preserving its environment through setting up financial programs and aligning with international protocols to conserve its natural ecosystem of green spaces and marine environment to adapt towards climate change events.



Energy sector: Solar power plant⁸³



Funded by the United Nations Development program, the medical provincial warehouse in Luanda was fitted with solar power plant. The initiative 'Solar for Health' assists the world's hotspots with sustainable power for schools, small clinics, hospitals and medical warehouses. The local authorities received training on the plant's operations.

Malé, Maldives

The Maldives is considered to be the most vulnerable country in the world. Eighty percent of the country's 1,190 islands are less than a meter above sea level, making them particularly vulnerable to rising sea levels.⁸⁴ Climate hazards such as flooding, coastline erosion is affecting critical urban infrastructure. Maldives have put in place climate adaptation measures such as coastal protection tools and community led resilience programs.

Given the size of the island, the Government of Maldives through the Ministry of Environment has been stewarding bold climate action in partnership with city councils including Malé. With the objective of arriving at net zero by 2030⁸⁵, the country is relying on international support to accelerated climate action. With a focus on early warning systems and strengthening emergency preparedness climate action is anchored on the national led urban development and resilience project with support from the city council of Malé.

The islands in the Maldives are geographically dispersed and the lack of land makes renewable projects such as installation of solar panels difficult. The island is approximately 98% water. The islands have relied on diesel generators for power supply, and this has not only contributed to higher carbon emissions, but high electricity prices that negatively impact low-income households. Alongside this is the difficulties around having a common power grid resulting in limited scale. The island has typically focused on adaptation due to its vulnerability to rising sea levels. The focus is now shifting to ramping up mitigation efforts. The Greater Malé region consists of artificial islands, and they are relatively elevated above sea level with robust coastal protection infrastructure. Secondly, popularly known for tourism the island has seen an increase in waste. Effective solid waste management is critical for retaining the islands place as a premium destination. With support from the Asian Development Bank, Greater Malé will establish a regional solid waste management system that will use waste to energy technology, recycling, and disposal infrastructure to reduce emissions and create a cleaner urban environment.



Energy sector/Industry: ASPIRE - De-risking solar projects to catalyze private investment in the Maldives



The ASPIRE⁸⁶ led by the World Bank in Maldives was set up to showcase and de-risk solar projects to attract private investment towards decarbonizing the energy sector and support the city in their decarbonizing goals. The ASPIRE project has mobilized significant investments to install 6.5MW of solar power in the Maldives, lowering the cost of electricity and reducing importation of diesel.

The project showcases the areas in which projects can be de-risked: foreign exchange risk, high cost of solar PV, payment delays and termination of power purchase agreements.

Medellín, Colombia

The second largest and intermediary in Colombia, the city of Medellín is setting the bar when it comes to aggressive climate action. The city is host to the country's only metro system, numerous bike lanes and electric buses that traverse “green corridors”.

Medellín has made significant strides in the built environment and energy sector stewarding natural based solutions to decarbonize high emitting sectors. Rising temperatures in Medellín has caused a demand in cooling, putting pressure on energy systems, and affecting the transition to net zero.

The award-winning initiative, the green corridors of Medellín, are an interconnected network of greenery across the city. The corridors connect existing green spaces, enhance urban biodiversity, significantly reduces the city's urban heat island, sequesters carbon dioxide, and reduces the average city's temperature by 2C degrees. These green corridors provide shade for workers, street vendors and people walking in the streets and serve as a natural cooling solution for rising heat waves. Through the green corridor, Medellín has showcased the benefits of how mitigation and adaptation sustainable transitions work in tandem to advance decarbonization and net zero.

The city's approach to climate governance is unique since 30 percent of Medellín is urban whilst 70 percent is rural. As the city implements its climate action, decarbonization polices will have to consider the urban and rural needs of the city.

As climate change continues to affect cities, Medellín is not immune to the struggles of attracting sustainable finance, however it stands as a model city for developing bankable projects that can attract large capital investment. The municipality is embarking on constructing a light rail system that will run on 100 percent electrical technology and reduce the amount of CO2 emissions in the transport sector.

The project financed by Bancocolombia., Davivienda and Financiera de Desarrollo Nacional (FDN)⁸⁷ will expand the public transport system making it accessible and improving metropolitan connectivity, which is not only important for discouraging the use of vehicles but brings services closer to those who do not have access to personal vehicles.



Energy sector: Electric stairs in Comuna 13⁸⁸



The municipality of Medellín has installed 56 solar panels for the operation of Comuna 13, a historically low-income neighborhood, that was once the most dangerous places in Colombia due to high homicide and drug crimes.

The project expects to lead to the reduction of electric energy costs for the escalator transport system and ultimately a reduction in the carbon footprint of the city. The solar panels will replace 21 percent of the electric energy used for the operation of the electric stairs.

The electric escalator further provides a clean alternative to commuters, providing services for approximately 25,000 people monthly. This initiative can not only ensure uptake of renewable energy but encourages active transportation that serves disadvantaged low income neighborhoods.

Montevideo, Uruguay

Over 90 percent of electricity consumption in Montevideo is from renewable energy (wind and hydro).⁸⁹ The city's largest source of emissions comes from the transport sector (52 percent).⁹⁰ The city recognizes market responsiveness to electric vehicles in private transport has been weak, due to higher acquisition costs as compared to internal combustion engine vehicles coupled with limited charging infrastructure. Underscoring the above challenges in moving the transport sector towards net zero is the national subsidy on fuel for public transport. This means that although there is significant share of residents using public transport due to cheap fares, emissions are still high since a large part of the fleet is not green. However, the city is engaged in a mobility policy towards the transition to electric public transport, which started in 2015 with taxis and in 2020 with buses. The goal is to reach 100 percent of the fleet in 2040. Infrastructure investments have also been made in sustainable mobility. One of them has to do with the pacification of urban areas. The bike lanes in the city have increased by almost 250 percent in the last decade and cover the main branches of the city. Traffic lights have also incorporated signaling to the cyclist.

Decarbonizing the energy sector has been a major priority for both the city and national government. Energy policy has remained focused on renewables and the results are paying off. Despite major gains in moving towards a low carbon energy sector, the city has narrowed its efforts in changing energy consumption habits in residential homes. Although heating generated by air conditioning is not an issue due to the country's green electric matrix discussed above, in other cases heating is by liquefied petroleum or natural gas. Considering the interconnectedness of the built environment and energy sector, the city has put plans in place to implement and support the retrofitting of older buildings to improve their environmental performance.

A major pathway for the city's transition to net zero is the aim to increase forest cover by 50 percent in the city. With a carbon neutrality target pegged at 2040, the city aims to leverage on green spaces and nature-based solutions to increase the number of carbon sinks.

Montevideo remains a robust city government taking calculated climate action, but the lack of finance to invest into large sustainable infrastructure projects is an impediment to accelerated decarbonization. Donor funding from international finance institutions, multi-lateral development banks and other large non-governmental relations remains an available source for climate finance. However, the city requires diverse sources of finance from different investors and stakeholders to benefit from innovation, new technologies that can deepen decarbonization across sectors. At a national level, the Uruguayan government is working on an important milestone which is the first emission of a Sovereign Sustainability-Linked Bond⁹¹ which includes SPT linked with the reduction of emissions per unit of real GDP and the increase of native forest area. A similar financing strategy might be followed by the city to achieve its net zero goals.



Energy sector: Solar energy for municipal buildings



The city is not only incorporating photovoltaic energy in municipal owned buildings – but are simultaneously learning how to implement the technology and leading by example by running energy efficient operations. This approach facilitates education, dissemination, and awareness of photovoltaic energy amongst residents to encourage uptake.

Montreal, Canada

The city of Montreal's 10-year climate action plan aims to achieve net zero by 2050. The action plan puts significant emphasis on an ecological transition to be adopted by all sectors. The city has also identified the importance of climate governance, putting in place measures that will consider environmental impacts across all decision making.

The city of Montreal benefits from a supportive provincial and federal government particularly with respect to accessing finance for sustainable investments. For example, cities in the province of Quebec including Montreal received funding for green infrastructure that will positively impact the local economy and create green jobs.⁹² The power of inter-governmental partnerships and collaboration is a significant driver for decarbonization across emitting sectors in the city.

Through the city of Montreal's engagement in regional and global city networks, the city has developed a resilient strategy that aims to tackle issues of climate injustice and enhance inclusion in climate action. The city's unique intersectional approach to climate equity is underscored by four levers: social development, effective climate governance, economic development and improved access to municipal services and activities.

Road transportation contribute 30 percent of emissions and buildings 28 percent of emissions in the city.⁹³ The decarbonization progress in the energy sector is underscored by the need to reduce emissions in the built environment sector. The city particularly grapples with rising temperatures in the summer months leading to heat waves and higher demand for cooling. Storms, heavy rain, and floods also pose a threat to urban infrastructure and could potentially raise loss and damage costs.



Energy sector: Rénoclimat⁹⁴



The city of Montreal benefits greatly from provincial led programs and initiatives, signaling the strong inter-governmental climate governance structure that is required for accelerated climate action. Rénoclimat is an energy efficiency program for residential homeowners that provides financial assistance to reduce energy efficiency by retrofitting homes. The program also provides free home energy evaluations and personalized advice on how to improve energy efficiency.

Under the Rénoclimat program, residents can channel financial assistance awarded to them to upgrading home insulation, installation and replacement of mechanical system doors and windows, all with the objective of maximizing the home's energy efficiency potential.

Mumbai, India

Mumbai is the first city in India to have its own Climate Action Plan aiming to transition to net zero by 2050. The plan emphasizes building the city's resilience and will focus on the following thematic areas: zero-emission public transport, air quality, green infrastructure, decentralizes waste management, low carbon electricity, climate resilient infrastructure and urban flooding and water management.

Studies⁹⁵ show that with the frequent occurrence of extreme weather events such as flooding and monsoons, the southern part of the city may be under water. Hence the importance the city is placing on resilience as a pathway to net zero. The city's climate action puts climate equity at the core by ensuring that the policy is inclusive and that outcomes from climate action are distributed equitably across citizens.

Majority of emissions in the city are from stationary energy at 72 percent followed by transport at 20 percent.⁹⁶ Energy use in residential and commercial buildings is high owing to the city's coal-based grid. Decarbonizing the electricity grid and transitioning to clean fuels is a major priority for the city. Through the solar rooftop program, the Government of India provides 40 percent subsidy to residential consumers and 20 percent to group housing societies and associations⁹⁷. Cities such as Mumbai are taking advantage of this program that will see a decrease in household electricity bills. Remaining electricity will be purchased by the Maharashtra state of which Mumbai is the capital through a net metering arrangement

The Brihanmumbai Municipal Corporation (BMC) has launched a dedicated EV cell that aims to put in place 1,500 EV charging stations and ensuring at least 10 per cent of EV penetration into the city by 2025. This initiative is partnership with the World Resource Institute signaling the importance of collaboration in the transition to net zero.

The implementation of the city's action plan is supported by strong leadership and climate governance structures that the city has put in place. For example, the city is setting up a dedicated authority to midwife Mumbai's transition to net zero.



Mobility and connectivity: Decarbonizing the BMC's operations⁹⁸



The Brihanmumbai Municipal Corporation is leading by example and decarbonizing its operations by acquiring electric vehicles to replace its current fleet of vehicles. Implemented in phases, the BMC will acquire, 32 dry waste vehicles, 12 E buses, 27 vehicles for official use and 12 E cleaning machine vehicles. Electric vehicles will also be bought to transport garbage. In addition to this, 85 charging stations will be put in place to ensure accessibility and availability.

Munich, Germany

Munich City Council declared a climate emergency and is accelerating climate action with the aim of getting to net zero by 2035.⁹⁹ The city's target is even more ambitious, 10 years ahead of Germany. The role of innovation and technology is paramount in Munich's transition to net zero.

The city's energy and buildings sector have been the highest emitters and therefore climate action has been centered around energy efficiency and low carbon buildings. A key lever for the city's ambitious transition to net zero is the decarbonization of its heating system. Moving away from fossil fuels and natural gas is essential. One of the measures the city is taking is exploring the use of geothermal power to heat over half a million homes. This could be a positive game changer for the city's ambitious net zero goals. Other steps include the integration of renewable energy in buildings through renovations and retrofits reducing dependence on fossil fuels or gas.

In early 2022, the City of Munich introduced its first set of solar buses. The city aims to ensure that pollution and emissions are reduced. Munich city has the most registered electric vehicles than the capital city Berlin. A total of approximately 36,000 battery powered electric vehicles and plug in hybrids, are found in the city.¹⁰⁰ Munich is also considered a short distance city that is walkable and cycle-friendly, with cycling accounting for 18 percent of all traffic.

Munich is famous for its waste management systems and to arrive at net zero by 2035, the city is putting concerted effort into achieving zero waste. Most of the city's waste is 70 percent recyclable. The city has put in place measures to establish a thriving circular economy. Munich's approach to decarbonizing the waste sector is in collaboration with diverse stakeholders and citizen engagement. Dialogue workshops and an online platform have strengthened public participation and citizen engagement. A Zero Waste Advisory Board has also been set up by the city to assist in the implementation of the city's zero waste concept.



Mobility and connectivity: E-scooters¹⁰¹



The Munich Transportation Authority (MVG) in partnership with TIER, a private company has introduced a rental system for e-scooters. Over 1500 e-scooters have been introduced as a transport option for the residents of Munich.

The e-scooters are available via the MVG and TIER applications ensuring that the user process is simple and efficient. This initiative has gained momentum as the Government of Germany approved the use of e-scooters on public roads.

Nairobi, Kenya

Nairobi's Climate Action Plan 2020-2050 is the main strategy driving decarbonization efforts with a focus on increasing the uptake of renewable energy, waste, and transport. The transport sector contributes the largest emissions at 45 percent followed by waste at 33 percent.¹⁰²

Nairobi county is expanding its infrastructure to support dedicated bus corridors, construction and renovation of commuter rail stations making public transport accessible and affordable. Led by the Kenya Power and Electricity company, an E-mobility network infrastructure system comprising of EV charging infrastructure, billing and payment system and service management will be rolled out in partnership with the Nairobi County to test the potential of electric vehicles. The Government of Kenya has also put in place incentives such as lower import duty for electric cars and motorcycles and bicycles. Adaptation measures such as decongestion of streets to reduce air pollution and to encourage walkability and the use of non-motorized transports have been spearheaded by the county.

With a growing population, limited landfill capacity and growing e-waste, waste management is a challenge. The county's climate action plan aims to put in place measures, guidelines, and strategies for zero waste. The city government established several partnerships with key stakeholders to set a biogas project that address energy poverty, recycling, and waste management. The county of Nairobi in partnership with the business community, have also established the Kenya Extended Producer Responsibility Organization (KEPRO). This collaborative partnership of all stakeholders in the produced material value chain seeks to work with city to accelerate decarbonization of the waste sector.



Energy sector: Dandora dumpsite waste to energy¹⁰³



Nairobi Metropolitan Services has partnered with KENGEN, a leading electricity power generation company to provide land for the upcoming Dandora to build a power plant that will harness energy from waste. The site will be a 45MW waste-fired thermal power plant.

New Delhi, India

New Delhi's State Action Plan on Climate Change 2021-2030 outlines bold climate action with an emphasis on addressing extreme weather events. The city recognizes the importance of both adaptation and mitigation measures in reducing the impacts of climate risks and hazards. Climate action in the city of New Delhi focuses on eight sectors, namely energy, transport, water, forest, health, agriculture, disaster management and urban development.

As a megacity, the demand for energy is high. The buildings sector account for nearly 50 percent of energy consumption the city¹⁰⁴. The city has therefore put in place measures such as promoting the use of LED lighting in housing to reduce energy consumption. Leading by the example the Delhi Secretariat building is one of the first green buildings with a dedicated solar photo voltaic plant that meets the operational needs of the buildings. To increase the uptake of renewable energy, the city in collaboration with other agencies are implementing the Advance Clean Energy Deployment aims at enhancing energy security, improving access to energy, conserving energy, and promoting clean energy development.

The Government of India has also taken bold steps to promote renewable energy such as laying of new transmission lines and creating a new sub-station capacity for evacuation of renewable power and waivers for Inter State Transmission System (ISTS) charges for inter-state sale of solar and wind. The city receives mandates for renewable energy bulk purchase for power utilities to decarbonize the city's grid and reduce fossil fuel dependency. The city launched an ambitious 'Solar City Initiative' that aims to accelerate solar rooftop development by aggregating consumers and matching them with solar developers. The initiative has an educative component on the benefits of solar alongside financing options for consumers that participate.

The transport sector in New Delhi is a major source of greenhouse emissions contributing to air pollution. The city government in partnership with the Rocky Mountain Institute set up the urban mobility lab¹⁰⁵ initiative that aimed at translating the city's electric vehicle policy to action, transforming mobility in the city by implementing and scaling up clean transport. The city's aims to be the electrical capital of India.



Mobility and connectivity: Switch Delhi¹⁰⁶



In 2021 the Delhi Government launched the Switch Delhi Campaign to raise awareness and inform the citizens on the benefits of electric vehicles through social media. The city recognizes the importance of implementing climate action by providing avenues for citizen engagement to encourage ownership and buy in. Switch Delhi is also an interactive one stop shop website providing a wide range of information on electric vehicles. The site also allows users to find charging stations and battery swapping stations. The site has an electric vehicle dashboard, that tracks the number of electric vehicles in the city.

The city further aims to launch the One Delhi mobile application that unifies all transport-related transactions such as paying for a bus ticket or locating an electric vehicle charging station in the city.

New York, United States

As a megacity, the City of New York (the City) has embarked on decarbonizing high emitting sectors such as buildings by 2030 through the new Carbon Challenge. Buildings contribute up to 66 percent¹⁰⁷ of the City's total carbon footprint. The City through the Local Law 97 implementation plan¹⁰⁸ has put in place policies and a series of initiatives that leverage multipronged pathways to decarbonize other high emitting sectors such as energy and transport. Local Law 97 is part of The Climate Mobilization Act passed by The New York City Council on April 18, 2019. This law aims to reduce New York City's carbon emissions 40% by 2030, and 80% by 2050. Reporting requirements for buildings over 25,000 square feet start in 2024.

Recent legislation and policy direction from the federal government, mainly through the Inflation Reduction Act, will see climate action in the City and the State of New York. Strengthened alignment and support by the federal government will likely hasten climate action implementation and strengthen the climate finance ecosystem. The City will likely have access to finances that will bolster their ambitious action plan.

The City Local Law 97 Implementation Action Plan¹ has put in place measure ensure accountability on climate justice. These include the landmark Climate Leadership and Community Protection Act (CLCPA) makes specific provisions for historically disadvantaged communities to benefit from City-led climate action.

A major challenge for the City¹⁰⁹ will most likely be the lack of readily available human capital to midwife the ambitious Local Law 97 Implementation Action Plan. With high living costs in the City, most professionals are moving away from the City. This migration of talent may have an impact on the delivery capability of the City's ambitious climate action plan.



Energy sector: Clean energy program



The City has implemented an energy program that aims to achieve multiple objectives that will reduce emissions in the energy sector. Expanding distributed energy resources, solar PV, energy storage installations across the City's building stock is major initiative. These initiatives as indicated in the Local Law 97 Implementation Action Plan aim to position the City as an energy efficient city. These include solar panels on building rooftops, solar canopies in parking lots, garages, and wastewater treatment facilities, and back-up technology that will ensure battery storage that can supply electricity in the case of a power outage.

New York City takes climate equity and collaborative partnerships down to the educational level. Through the annual NYC Solar School Education Program, public school teachers are trained on operations and maintenance of solar projects across the City. Connecting solar installations on school buildings to curriculum allows teachers to use the project as a real-life example for students to learn about renewable energy and sustainability, and to encourage STEM learning.¹¹⁰ This innovative approach of inculcating environmental responsibility, knowledge, and ownership in students is of critical importance in accelerating of actions between generations.

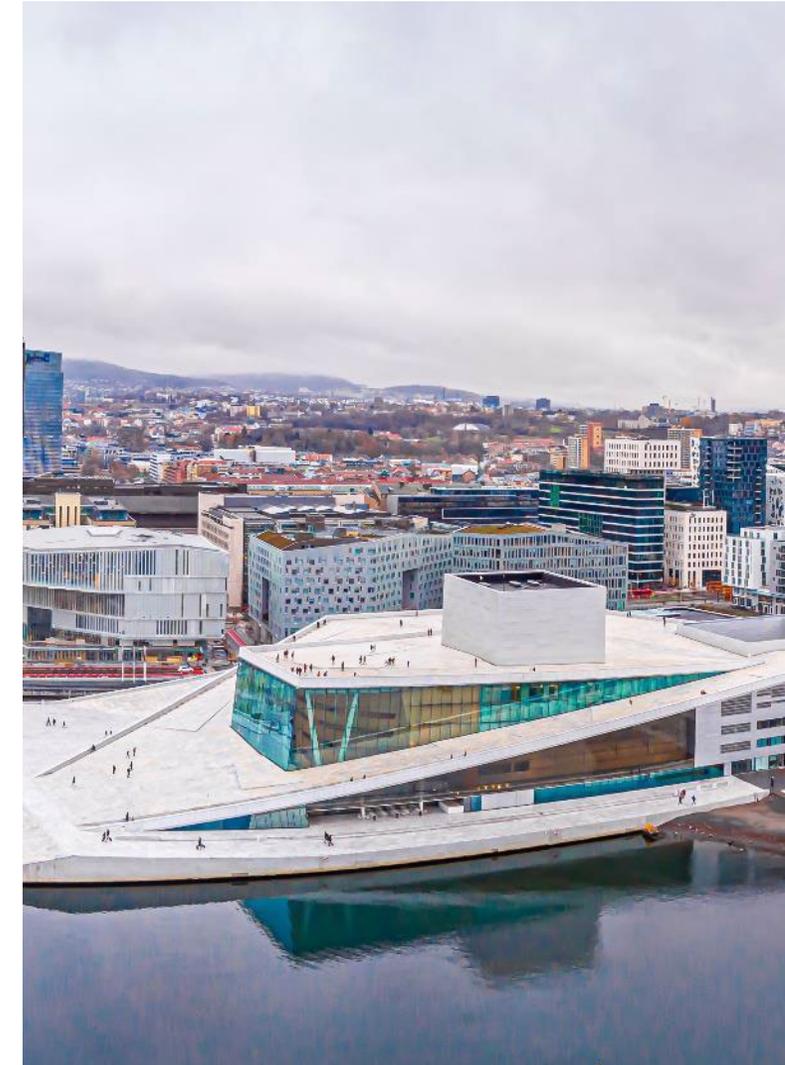
Oslo, Norway

Oslo, also known as Europe's green capital, is driving climate action towards net zero and aims to realize 95 percent reductions of direct greenhouse gas emissions by 2030 compared with 2009. With a vast supply of hydroelectricity, Oslo takes the lead in the transition to renewable energy. To achieve Oslo's net zero goals, effective climate governance is a key pillar. The city has a dedicated climate budget as a tool for delivering climate action. Other tools for climate governance include a sustainable procurement strategy and land use planning. Communication, and cooperation, and collaboration both locally and internationally are key elements in climate governance. The city is leading by example, making sure that their procurement practices are in line with the climate goals and targets .

The City of Oslo is the poster child for net zero transport, with more than 31.2 % of all cars being electric. The country records that 78% of new car sales are electric vehicles, with great accessibility and availability of charging infrastructure. The country has put in place measures such as high tax on gas and diesel to discourage the use of internal combustion engine vehicles. Through land use planning and urban design, the city is promoting and upgrading infrastructure to increase active and zero-emission transportation. This includes a city toll ring, restrictive parking measures and investments in public transport and bike infrastructure. Building resilience against climate hazards such as urban floods, is a key priority for the city. Heavy rainfall is a challenge to the city's sewage system and causes damage to roads and buildings. In response to this, the city put in place a stormwater management strategy in place to prevent future damages that may arise with episodes of extreme weather. A cross-sectoral action plan ensures collaboration across land use, wastewater system and management of green spaces for a transformative approach to stormwater management with open and local solutions, such as raingardens and reopening of rivers. To become a climate resilient city, which is one of Oslo's five climate goals, Oslo has a holistic approach to climate change adaptation considering impacts of both heavier rainfall and increasing temperatures in planning and regulations.

In addition to become a net zero city, Oslo's natural environment will be managed in such a way that natural carbon storage in vegetation and soil are protected, and the greenhouse gas removal in forests and other vegetation increase by 2030. There are many synergies and common actions between carbon storage and climate adaptation in Oslo, especially in urban land use and forestry.

Decarbonization of the built environment is also at the core of Oslo's transition to net zero emissions. Municipally owned and operated buildings such as schools, nursing homes and sports halls are constructed with strict material requirements, in terms of sustainability and CO2 emissions. The city relies on electricity and district heating, the latter mainly produced from municipal waste incinerators and biomass fed cogeneration plants, in order to provide heating to commercial and residential buildings. The provided electricity mix in Norway has a very high share of renewable energy sources, with hydropower being the significantly largest contributor. Oslo has made a concerted effort to ensure public participation and engagement in the transition to net zero. The city has also leveraged on innovative partnerships and business models to accelerate climate action.



Oslo, Norway (continued)

Built environment : FutureBuilt programme



A joint initiative between six municipalities in the Oslo region, FutureBuilt is an urban development pilot project that aims to showcase the possibilities of climate neutral urban areas with high quality architecture.

From the project's offset in 2010 and up until today, almost 70 pilot projects have been realized through the program. FutureBuilt projects aim to reduce carbon emissions by at least 50% compared to current regulations and common practice. The reductions need to be in a combination of the building's material use, as well as in transportation and energy in the use phase.

Projects include:

- The National Museum, Oslo: The project has high environmental ambitions and is planned according to environmental goals in four key categories: greenhouse gas emissions, energy, material choice and technical building solutions.
- Kristian Augusts gate 13: A ground-breaking re-use project where a building from the 1950s has been upgraded in accordance with FutureBuilt's criteria for circular buildings.
- Ruseløkka skole: Ruseløkka school is a pilot project for the use of second generation concrete and for circular measures. The school has set high energy ambitions and aims to be a near net zero energy building. The building site at Ruseløkka was fossil free, including the transportation of surplus landfill.



Panama City, Panama

Panama is a largely urbanized country with approximately 50 percent of the country living in cities. With a dense population, waste and water management are major concerns for the city. The city is particularly sensitive to drops in rainfall, and this affects the management of water. Sewage is also a major concern as untreated sewage can damage mangroves and pollute the Panama Bay. This has grave implications for flora and fauna, as well as public health. The growth of the city over the last couple of years has further strained the city's water infrastructure. However, through national initiatives the city is making efforts to improve water security and build resilience in their physical infrastructures.

Panama City has a rain forest within the city and the country boasts 62 percent land cover of natural forest. This creates a large carbon sink that supports sequestration of emissions. The country of Panama is considered carbon negative as its forests absorb more carbon than the emissions emitted. The approach to climate action has been equitable and inclusive with specific attention to the indigenous population. Through partnerships with NGOs, academic institutions indigenous groups play a critical role in protecting forests. With support from the World Bank, a forest carbon monitoring campaign was implemented.¹¹¹ Indigenous technicians are trained through land use planning, forest tracking etc.

The city in partnership with the central government have focused their climate action efforts in driving sustainable transportation and transitioning to renewable energy. The city's metro system is undergoing expansion and will run on electricity thereby reducing the emissions. With the rising cost of fuel globally the city is working towards increasing uptake of renewable energy.

A major setback for climate action towards net zero in Panama City is the fact that city authority and power is retained at the central government. Increased climate governance at the city level would ensure that Panama City is resilient and can adapt to increasing climate hazards.



Industry: Panama Canal Authority



The Panama Canal Authority¹¹² has embarked on driving climate action through the deployment of sustainable maritime routes. The canal aims to be carbon neutral by 2030, primarily through the decarbonization of operations and encouraging customers to switch to cleaner fuels and the use of solar and hydraulic energy.

Leveraging on the importance of data, the Panama Canal Authority through a pilot program has acquired electric vehicles that will collect data to inform the migration of the canals existing fleet from fossil fuels to cleaner energy. Furthermore, through an Emissions Calculator shipping lines can measure GHG per route, which then provides critical data for the authority to analyses operations.

Paris, France

The City of Paris aims to transition to net zero by 2050. Plan Climat the main guiding document lays out targets to reduce local emissions by 100 percent.¹¹³ Climate equity is central to the transition to net zero and the city is making concerted effort towards an inclusive and resilient transition.

Energy, built environment and the transport sectors are key priority areas for the city of Paris. By 2024, diesel powered mobility will be phased out and petrol-powered mobility by 2030. In addition to electrifying public transport, increasing the uptake of electric vehicles, and making available public charging infrastructure, the city is developing financial incentives and support measures for low carbon mobility. Active transportation is a key component of decarbonizing the transport sector. The city has implemented several self- service bike and electric vehicle sharing programs. Low emission zones within Greater Paris have been established to encourage the use of clean vehicles.

Rising temperatures across Europe particularly in the summer months has necessitated faster action to decarbonize the built environment. Paris is host to the world's largest eco-friendly underground cooling system. Currently at 89km, there are plans to lengthen the cooling pipes to by 163km extending cooling to the public sector which includes, hospitals, schools etc. The city is also accelerating the greening of its heating network and aims to renovate one million homes by 2050 to meet its net zero goals. In line with the city's inclusive climate action, the city has renovated social housing ensuring that they are energy efficient and reducing energy bills for low-income groups.

One of the city's busiest highways along the river Seine was converted to a pedestrian walkway. This pedestrianized riverbank caters to cyclists and has ample green space. The project is meant to strengthen the city's greening initiatives thereby tackling air pollution, encouraging active transportation, and improving the quality of life for people. The City of Paris has a complex multi-level governance architecture, with numerous layers of autonomous authority over regions in the greater Paris area. In line with Plan Climat, the city has an opportunity to strengthen climate governance and harmonize multiple climate actions for greater impact.



Waste and sanitation: Le Grand Paris Circulaire¹¹⁴



This is a city led collaborative digital platform which aims to become the gateway to the circular economy of the Greater Paris territory. Different groups can join as members and get access to free services and information. Members can get the latest circular economy news and identify opportunities, promote their business both locally and internationally. They can also establish partnerships with other members, access implementation tools and methodologies and benefit from feedback from other members.

The platform brings together key players in the circular economy sector spurring innovation, knowledge transfer, partnering with the city in a unique way to meet the city's targets of arriving at zero waste.

Port Moresby, Papua New Guinea

PNG aims to be carbon neutral by 2050. This is an ambitious commitment for a country that is prone to natural disasters, tsunamis, and volcanic activity. The country is also endowed with vast renewable energy resources. Greenhouse gas emissions in the Pacific nation of Papua New Guinea are mainly from the burning of fossil fuels for energy and industrial production of materials such as cement.

Despite two thirds of forest cover, the Pacific island is experiencing deforestation and pollution from mining activity, all of which contribute to emissions and are affecting resilience. The city of Port Moresby is heavily built up and there is an increasing demand for coastal landfill developments which are depleting mangroves and reef ecosystems.¹¹⁵ This is also increasing the risk and vulnerability of urban infrastructure across the city.

With urbanization as a recent phenomenon, most of the climate action in the city is aligned to the national government 2050 carbon neutrality goals. In partnership with the United Nations Development Program, the Government of Papua New Guinea is putting in place a national adaptation plan that will boost the country's resilience towards climate change and reduce vulnerability. A key expected outcome is the integration of the national climate change agenda into sub-national planning and budgeting. This is of importance considering the minimal role that the city of Port Moresby plays in driving climate action.



Waste and sanitation: Trash Tag-PNG¹¹⁶



The island faces a challenge with plastic waste and with limited recycling facilities. Therefore in 2018 the national government announced a total waste ban. Trash Tag-PNG is an awareness raising project that informs the public on issues of plastic pollution in the island. In collaboration with city parks and the municipality Trash Tag has found a way to engage citizens both directly and indirectly on the importance of waste management, recycling and has also brought to light the ills of plastic waste on the city's coasts and marine life.

Quebec City, Canada

Quebec City does not have a net zero action plan in place, however climate action is aligned to the 2030 Plan for a Green Economy document by the province of Quebec. It is the second largest city in the province of Quebec. Municipal led climate action in the city has not gained significant momentum compared to other provincial capitals across Canada. Gains in energy efficiency in Quebec City have been accelerated through provincial programs that provide financial assistance through four major programs. Electricity distribution and delivery for Quebec is undertaken at the provincial level. This signals the importance of multi-level governance in climate action and more so for territorial transition to net zero.

Quebec City was built around vehicles which inevitably encourages urban sprawl. The city remains fairly underserved with public transit facilities with exception of the downtown core. The city is not densified, and this is partly due to the increasing demand for detached homes and low-density neighborhoods in a bid to preserve the social fabric of neighborhoods. This has led to an increase in use of private vehicles and a lack of active transportation options due to the long distances. Despite these challenges, the downtown core of the city is also host to a well-maintained network of bike paths. Public transport is subsidized by the municipal government.

One major challenge affecting climate action and implementation is the disconnect between climate action and election gains. Informed and concerned citizens have over the last couple of years used their civic rights to demand more action from the municipality on climate action and particularly climate justice.



Energy sector: Decarbonizing buildings with steam



Québec City has led an innovative project that uses exhaust vapors from its incinerator to heat and air-condition a hospital. This reuse of the steam is enabling the Hôpital de l'Enfant-Jésus to reduce its annual greenhouse gas emissions by 10,000 tonnes of carbon dioxide equivalent, equivalent to the withdrawal of more than 2,900 light-duty vehicles from the roads. At the same time, the hospital is saving on energy costs.

Rio de Janeiro, Brazil

In a bid to restore the economy of Rio de Janeiro, the city has embarked on sustainable low carbon pathway that prioritizes both climate action and sustainable economic recovery aiming to be the green capital. Rio's has realized emissions reductions in the energy and waste/sanitation sectors, considering the challenges of increasing waste in the city and higher demand for energy. Waste treatment in the city has been a major source of emissions.

Rio de Janeiro is host to a significant oil and gas industry which brings to the forefront tensions between fossil fuel dependence and decarbonization. None the less, with support from the World Bank, the city has developed legislation on active transportation, provisions for developing low emissions districts and more broadly a municipal climate action plan to guide decarbonization of the transport and energy sector.

The city of Rio has a significant presence of informal settlements with very little green spaces. This coupled with the lack of urban forests, vulnerability towards flooding, landslides, and urban heat island effects is concerning. Favela residents typically marginalized racial and low-income households are the most affected. The city has been working with local NGOs in several favelas to pilot the concept of green communities. Planting of trees has been a major part of greening communities with the objective of restoring biodiversity, increasing tree cover across the city to act as carbon sink and most importantly to improve the microclimate of the favelas.

One of the major challenges facing the city of Rio de Janeiro is political will and commitment at the federal level. The city has in many ways taken the lead in accelerating climate action through legislation, mega environmental projects and partnering with key stakeholders. However, limited support from the federal government on climate action strains the possibilities that lie in strong inter-governmental relationships to advance the city's net zero and greenhouse gas emissions goals.



Waste and sanitation/Energy sector: Ecoparque's pilot project¹¹⁷



Innovative technology and collaboration with diverse stakeholders have been critical in the reductions of emissions in the city. In partnership with the Federal University of Minas Gerais, the city is piloting a technology that will produce fertilizer and natural gas from waste. Funded by the Brazilian Development Bank, the biogas plant can generate energy for over 1,000 houses and even power 1,000 cars.

Santiago, Chile

Approximately 40 percent of the Chilean population lives in the metropolitan region of Santiago. Santiago is one of the most unequal cities in Latin America, with a wide gap between the rich and poor with particular emphasis on housing and gender inequality. Spatial segregation and social inequality pose a significant challenge to the realization of equitable climate action.

An increase in population has led to uncoordinated urban sprawl and has led to the proliferation of low-income housing that are susceptible to flooding, rising temperatures and squalid waste and sanitation conditions. Santiago's challenge with water has been long standing as the country recorded the driest decade in history. This has particularly impacted the metropolitan region of Santiago. Reduced rainfall coupled with a high demand for water across multiple economic sectors, has put stress on the regions aquifers. On the other hand, rising temperatures are melting rich glacial reserves is affecting the regions potable water. The metropolitan region of Santiago recognizes the urgent need to effectively, coordinate and midwife a strong resilient plan to adapt and reduce the cities vulnerability. Leveraging innovation and technology can accelerate effort towards net zero in multiple sectors.

The city has made significant strides in decarbonizing the transport sector. Santiago boasts the largest fleet of electric buses in Latin America. The city hopes to leverage on successful greening of their public transport to increase zero emission buses that can resolve poor air quality that is of concern particularly during the winter periods. 60 percent of the city's metro is powered from renewable production - wind and solar power.¹¹⁸ The city remains a leading example of decarbonizing transport towards net zero.



Energy sector: Santiago bio-factory¹¹⁹



The city's three waste water plants have been turned into 'bio-factories' that convert waste water and sewer sludge into clean energy. The plants are zero waste, energy self-sufficient and aim to be carbon neutral by 2022.

The spillover effect from this bio-factory will also produce over 137,000 tonnes of biosolids that will be reused as fertilizer to grow food. The bio factories are anchored on a circular economy model that minimizes waste and pollution from waste water treatment processes. Waste water from urban and industrial environments consisting of sand is recycled for city construction projects.

City of Singapore

The City of Singapore's Climate Action Plan lays out strategies and targets to reduce GHG emissions by 2030. The city state aims to position itself a leader in green economic activities in industry, services, and finance capitalizing on the value proposition of a low carbon economy. The City of Singapore is host to a large logistics hub, a petrochemical industry, and a power generation industry. The city-state government has put in place a carbon tax to penalize polluting industries.

Considered one of the greenest cities in the world, the City of Singapore has taken lead towards decarbonizing the built environment leveraging on innovative solutions, architectural ingenuity, energy saving technologies, green roofs, and vertical gardens. The city has many high-rise buildings and is heavily densified, therefore the intentional approach to boost green infrastructure is necessary. The city is designed to cater for an integrated urban green walking network. 46.5 percent of land in the city state is covered in green space and a tree canopy of almost 30 percent.¹²⁰ The city's park connector network has been used as green mobility corridors supporting both walking and cycling.

Critical to the energy transition in the City of Singapore in the increase of renewable energy. Because of the limited land mass, the city-state imports natural gas from neighboring countries. Exploring low carbon technologies and such as the setting up of a hydrogen plant to drive its transition will be able to save up to 220,000 tons per year of CO2.

Seventy-five percent of the population uses mass transit due to the high costs associated with purchasing a private vehicle.¹²¹ To increase the uptake of electric vehicles the city state has put in place tax incentives for consumers and grants to operators of electric vehicle infrastructure. The city aims to ensure 60,000 charging points in the city by 2030. The city is aiming to deepen decarbonization of the transport sector by running trials and testing the viability of autonomous vehicles.



Waste and sanitation: Recycle Right citizens' workgroup¹²²



As part of the City of Singapore's Zero Waste Masterplan, the government has set up a recycle right citizens workgroup to co create solutions with the public on improving recycling in the home. The government opened a call for participation and selected a total of 48 citizens from diverse backgrounds. Over a period of 30 days, the selected citizens interact with waste and recycling experts to come up with key recommendations. The recommendations are submitted to the Ministry of Environment and Water Resources and developed into projects, one of which is developed and implemented. This innovative initiative puts public participation and citizen engagement at the core of climate action.

Sydney, Australia

The City of Sydney has a long and strong record of implementing climate action and has been implementing bold climate action informed by its Environmental Strategy 2021-2025.¹²³ In 2007 the city's operations were carbon neutral and in 2011, the city was the first local government in Australia certified as carbon neutral. In 2019, the City of Sydney declared a Climate Emergency reiterating the importance of accelerating climate action. Alongside is a complementary strategy, Sustainable Sydney 2030-2050, that aims to realize environmentally friendly concepts that will transform Sydney into a livable and sustainable city.

As the city continues to grow, Sydney is prioritizing waste and water management, improving energy efficiency in buildings through retrofits, and increasing the uptake of electric vehicles. In parallel, the Greater Sydney region is focusing on increasing the adoption of distributed energy resources and investing in infrastructure to accommodate the transition. Advocating for the acceleration of coal closures, electrifying public transport, and moving the built environment through net zero are also key priorities. The city has put in place regulations that will see development applications for new office buildings, hotels and shopping centers and major redevelopments of existing buildings complying with minimum energy ratings from January 2023 and achieve net zero energy use from 2026.

In the year 2020, the City of Sydney began using 100 percent renewables to meet its operational electricity needs. Another project, the Major Properties Efficiency Project (MPEP) targeting 14 of the city's highest energy and waste consuming sites through lighting upgrades, has been successful at delivering energy and water efficiency as well. In the transport sector the city is improving bike infrastructure and encouraging active transportation. The Cycling Strategy and Action Plan aims to increase ridership and provides free bicycle learning lessons to ensure that everyone can be part of the transition to zero emission transport.

With rising temperatures causing major heat waves the city is increasing accessibility to cool green public spaces. Alongside this is the expansion of canopy cover across the city. The transition to net zero in Sydney aims to leave no one behind. In this regard, the city has put in place the Equality Indicators framework to track, evaluate and act on ensuring equitable climate action.



Waste and sanitation: Food scraps recycling trial in apartment buildings¹²⁴



This innovative project aims to turn food scraps generated from densified apartment buildings into energy. A total of 1016 houses and 141 inner-city apartment blocks take part in a City of Sydney food scraps recycling trial. Kitchen scraps from up to 12,000 homes are being diverted from landfill and turned into green energy and plant fertilizer. The trial began in 2019 and the city has collected and recycled more than 500 tonnes of food scraps.

Tel Aviv-Yafo, Israel

Tel Aviv-Yafo is considered a magnet city with people within and beyond Israel making the city their home. This surge in population coupled with post COVID-19 tourism puts pressure on the already highly densified metropolitan area. Urban sprawl has particularly been a major source of stress for the city, leading to an increase in car dependence, more waste and increasingly high demand for energy. The city issued a climate adaptation plan in 2020 outlining the likely impact of climate change on the city and has announced plans to issue its net zero plan later this year. Such plan is meant to outline specific steps and programs to be implemented to realize net zero status by 2050.

Due to the increasing number of high rise commercial and residential buildings, the city has invested heavily in its efforts into ensure that only energy efficient buildings are constructed. Leading by example, all public buildings use solar power and new builds of four stories or more are being required to be constructed based on highly stringent and detailed green / energy efficient standards.

Due to the density of buildings and the Middle East climate with no rain for 6 months per year, heat waves are common and affect the most vulnerable in society. The poor quality of housing in some neighborhoods exacerbates the effects of the heat amongst low-income groups. To address this challenge, the city has begun to install a wide range of shading facilities in these areas to reduce the impact of heat waves and in general to encourage more walking.

Transportation and mobility is also a focus areas of the city, which aims to reduce private and polluting transportation with the specific goal of reducing private vehicles by 30 percent by 2030¹²⁵ and to prioritize the pedestrians within a sustainable transportation pyramid. The city provides variety of solutions such as paving bicycle lanes, currently 165km with a stated goal to reach 300km by 2030, placing cooperative transportation such as bicycles and e-scooters throughout the city, and regulating parking preference for cooperative vehicles. A long-awaited light rail project is expected to be completed within the next two years.

There are two challenges that impact the city's transition to net zero. Tel Aviv-Yafo is a densely populated city with limited green spaces with continuing pressure based on building demand to reduce these spaces in favor of more construction, mostly towers. The second challenge is the availability of climate and infrastructure related finance at the municipal level as most funds and services are financed by Israel's national government



Waste and sanitation: Ecodrum¹²⁶



The city of Tel Aviv-Yafo notes that the average waste produced per citizen is 2kg per day. This means that waste generated, coupled with a growing population will put pressure on landfills and contribute to an increase of greenhouse gas emissions in the waste sector. The city is leveraging on the power of strategic partnerships and collaboration to accelerate climate action in the sector.

Tel Aviv-Yafo's largest composter, an Ecodrum, aims to reduce methane gas and reduce the number of trips needed to transport waste to landfills. The partnership between the municipality of Tel Aviv-Yafo, a large supermarket chain Mega, an environmental non-governmental organization Tazlul and a private company called Eco City Green creates a platform for private companies and industry to turn their organic waste into compost. Wood chippings are provided by Tel Aviv-Yafo municipality. The linkage between, climate action, profit and public health is emphasized by the partners of the project.

Toronto, Canada

TransformTO is the main strategy informing net zero climate action in the city of Toronto. By 2030, the city aims to reduce emissions by 65 percent and arrive at net zero by 2040.¹²⁷ Toronto's approach to accelerating net zero is anchored on using new technologies and restructuring market and socio-economic systems towards a just transition. Through effective climate governance and partnerships, the city's 'ambition loop' leverages on critical relationships to advance climate action. The city has a wide range of initiative such as the net zero Existing Buildings Strategy, Green Wall Initiatives, BetterHomes TO and Home Energy Loans Programs, Active TO, all signaling the efforts towards arriving at net zero by 2040.

The City of Toronto has set up an innovate climate action fund supporting community led projects. This fund ensures that disadvantaged and marginalized communities are aware and engaged on climate action in the city. Through outreach and education, the fund supports climate action of community, grassroots groups, and leaders. The city has also put in place measures to ensure climate action addresses the needs of youth, isolated seniors, diverse linguistics communities and immigrants.

The Toronto Green Standard (TGS) is Toronto's sustainable design and performance requirements for new private and city-owned developments since 2010. Version 4 came into effect May 1, 2022 and includes three performance tiers for new planning applications. The TGS tier 3 Zero Emissions Buildings Framework, will result in greenhouse gas reductions of 30.6MtCO₂e by 2050, achieving zero emissions buildings by 2028, and Transform TO's reduction target of net zero operational carbon by 2040. Version 4 introduces tracking of embodied emissions in building materials used in construction. The second city in Canada to acknowledge embodied carbon an integrate it. Embodied carbon reductions of construction materials is anticipated to step up with each new release of TGS, recognized as a critical area for reducing carbon footprint collectively for the built environment.¹²⁸

The city is taking leadership on bold climate action by developing a model for urban decarbonization. Villiers Island is new climate positive development, where the city is testing several innovative solutions that will showcase sustainability, resilience, and net zero land use planning. Similarly, through a competition known as the deep retrofit challenge, the city aims to realize energy efficiency in existing buildings to help meet the ambitious goals of net zero emissions. This is of particular importance as buildings are the largest source of GHG emissions, approximately 57 percent of the city's total emissions mainly from the burning of natural gas for heating and hot water. Despite the ambitious action, Toronto faces several challenges centered around housing affordability and citizen engagement in net zero decision making.



Waste and sanitation: ReduceWasteTO program¹²⁹



Holding the business community responsible and bringing them along the net zero journey by providing businesses with different methods they can take up to eliminate the use of single- use and takeaway items. These methods include choosing reusables and foam free options amongst others. The city is host to several small and medium businesses that daily provide their customers with single use items.

The city currently manages approximately 900,000 tons of waste which is putting pressure on energy resource, capital, and clogging landfills. To move towards a circular economy, the city's long term development strategy is a road map that will improve waste management over the next 30-50 years.

Vancouver, Canada

The City of Vancouver has had a long history of climate action stemming back to the early 1990s. Dramatic changes in weather patterns, population increase, the COVID-19 pandemic led to the city of Vancouver has put in place a climate emergency action plan, 2020. The city's focus is to cut carbon pollution from transport sector (37 percent) and the buildings sector (57 percent).¹³⁰

The City of Vancouver has over the last year experienced an increase in flooding, rainfall, wild smoke, and other extreme weather events. These events damage critical urban infrastructure, puts stress on plants and trees and displaces vulnerable population such as the homeless, indigenous populations and low-income groups. For this reason, municipal insurance is of particular importance as loss and damage is a concern. The Municipal Insurance Association of British Columbia's major objective is to support local governments across the provinces pre, during and post catastrophic losses and damages caused by Climate adaptation is essential to the transition to net zero. The City of Vancouver's Climate Adaptation Strategy puts emphasis on improved data, strong climate governance, strengthened capacity and knowledge and effective mainstreaming across departments. To effectively manage climate risks and hazards, the city is focusing on climate robust infrastructure, climate resilient buildings, heat mapping, increasing green spaces, coastal preparedness, and community engagement.

The COVID-19 pandemic saw a migration of people from the city center to the suburbs and this has led to an increase the use of personal vehicles. Despite this, the province of British Columbia has the highest uptake of electric vehicles in North America. The city has also put in place adaptation measures in the transport sector such as introducing parking levies and congestion pricing to discourage user of personal vehicles



Energy sector: CleanBC indigenous community heat pump

The provincial government of British Columbia offers free energy coaching services to support Indigenous communities wanting to take advantage of the CleanBC Indigenous Community Heat Pump incentive and related energy efficiency offers.¹³¹ The fund which is accessible by all municipalities across the province including the City of Vancouver, caters for heat pump installations, fuel switching projects to cleaner energy where there is renewable electricity, covering capital and installation costs.

The city of Vancouver's energy supply is currently 31 percent renewable and with the renewable city strategy aims to accelerate renewable energy to 100 percent. The city notes that to meet this goal, plans, actions, and polices must be inclusive and equitable.

Vienna, Austria

Vienna, considered to be one of the most livable cities is implementing bold and innovative climate action. The city's Smart KLIMA City Wien¹³² aims to transition the city to net zero by 2040. Vienna has the lowest CO2 emissions per capita compared to other cities in Austria even though it is densely populated and small. Vienna's transition to net zero places significant emphasis on climate governance, in particular political strategies, technological innovation, and social justice with a focus on low-income groups, the elderly and other vulnerable persons.

Despite the low emissions profile of the city, the energy, mobility, and buildings sectors are key priorities for decarbonization. District heating and cooling are major areas where the city is implementing innovative initiatives to advance to a net zero status. Referred to as the Vienna Model, the city uses waste heat from generating stations to feed into the district heating network which leads to energy savings and is an environmentally friendly process.

Rising temperatures in the summer months have spurred innovation and ingenuity to enhance energy efficient cooling. Vienna's heat islands are caused by pollution, concrete, asphalt and human activities, driving up the temperatures. The city has implemented mobile fog shower sprays that release a fine mist into the air to cool down people and are placed in the warmest public spots, mainly spaces that have large concrete cover. Residents can also use an application to locate the coolest spots in the city.

In the transport sector, the city is expanding its public transport network and exploring the role and potential of autonomous vehicles in the transition to net zero. The city is enhancing and improving active transportation. In 2022, the city's cycling network covers over 1660km of routes with more than 56,000 bicycle parking spaces. A bike sharing system has also been established to further encourage clean mobility.

In the energy sector, the city is researching the potential of blockchain technology to simplify the handling of energy transactions with a pilot project in the VIERTEL ZWEI¹³³ urban development area in Vienna's Leopoldstadt. A highly participatory pilot project, customers can test the viability of innovative energy tariffs, imagine new business models for solar power by incorporating blockchain technology.



Mobility and connectivity: Hydrogen bus and charging station¹³⁴



As part of the city's transition to net zero mobility, the first hydrogen bus and charging station was launched. The partnership between the city owned energy supplier and the public transportation company is a joint effort in advancing deep decarbonization of the transport sector. The bus will be integrated into the city's public transport system and will be piloted to test the viability of the entire supply chain which includes storage, charging, pricing, and passenger and run efficiency. The city aims to introduce 10 additional hydrogen buses alongside a second charging station with the objective of becoming a central hub for green hydrogen.

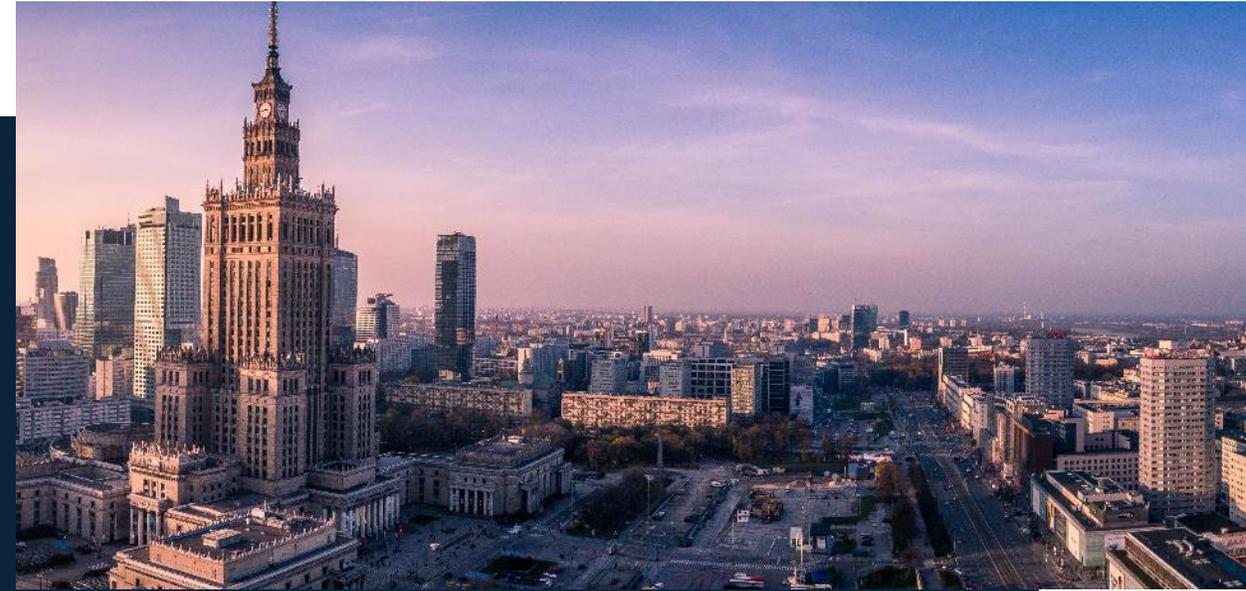
Warsaw, Poland

Warsaw's top emitters are mainly related to electricity generation, the heating and cooling of buildings and the transport sector.¹³⁵ Reducing energy consumption, heat lost in buildings and increasing the uptake of renewable energy are key priorities for the city. Warsaw's district heating was set up post Second World War and has one of the largest networks in Europe. The system has been upgraded and now provides efficient heating, reducing emissions from the built environment.

With the main source of green house gas emissions coming from the energy sector, due to the city's dependence on coal and gas, the city put in place the Sustainable Energy Action Plan for Warsaw 2020 and the Integrated Revitalization Program for the capital city of Warsaw. The city has focused on constructing and modernizing district heating networks to be energy efficient.

Sustainable mobility is a key priority for Warsaw. Plans to expand the public transport network to the suburban areas are in place. The city aims to have one third of buses in the city be electric or hybrid. The city's bike system is undergoing expansion as the city encourages and provides infrastructure for non-motorized transport. To discourage the use of cars within the core city, Warsaw has several park and ride car park systems in the outskirts near public transport hubs to encourage ridership, reducing emissions and air pollution from cars. Another initiative is a city led innovative retrofit of the Polczynska Park+Ride: Smart and Green Parking where investments have been made into the physical structures supporting transportation infrastructure, new buildings, and better energy efficiency.

Warsaw is the first city in Poland to join the European Bank for Reconstruction and Development (EBRD) Green Cities network, a flagship urban sustainability program, signaling the importance of regional partnership and collaboration towards net zero at the city level. The city is also part of C40's 'Private Building Efficiency Network' and 'Municipal Building Efficiency Network' strengthening city led efforts to reduce emissions from the buildings sector.¹³⁶



Mobility and connectivity: Veturilo city bicycle system¹³⁷



The Veturilo bike rental system is one of the largest in Europe. Cyclists have available over 300 stations and more than 4500 bicycles, plus several dozen stations and several hundred bikes funded by private partners. This system implemented by the city provides a user friendly website and mobile application that gives users choices for different types of bikes including electric bikes and bikes for children. The rental system is affordable with the first 20 minute free of charge.

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