December 2021

Pathways to Net Zero

Panama City Profile

Supported by FCDO and the British Embassy of Panama City

Foreign, Commonwealth & Development Office

British Embassy Panama City

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The authors would like to thank the following individuals and organisations for their valuable contributions to this report (errors or omissions remain the responsibility of the authors): Arturo Alarcón, Senior Energy Specialist, IDB; Mauricio Bayona Pulido, Sector Senior Specialist - Transport, IDB; Javier Diaz, Professor, International Maritime University of Panama; Arturo Dominici Arosemena, Director of the School of Marine and Environmental Resources, International Maritime University of Panama; Maricarmen Esquivel Gallegos, Climate Change Specialist, IDB; Alida Spadafora Mejía, Freelance National and International Consultant on Sustainable Development Issues (formerly Director for Zero Waste Programme, Alcaldía de Panamá); Alessandra Treuherz, Urban Development Consultant, World Bank; Manuel Trute, Independent Consultant (formerly Director of Urban Planning, Alcaldía de Panamá); Ervin Vargas, Director, International Maritime University of Panama.

Summary

This snapshot examines Panama City's potential to accelerate towards 'net zero', and the possible future contributions of UK-origin innovation to this progress.

It integrates international comparison, data and local insight, in order to map the particular pathways through which Panama City may decarbonise. It is not designed as a definitive audit of the viability of existing policies; it is instead an 'outside in' lens to illustrate what makes Panama City distinctive, and what specific innovation needs and partnership possibilities arise.

This snapshot assesses five key factors in turn:

1. How enabling is the city's current physical and economic endowment to decarbonise.
2. The scale of ambition and strategy for a low carbon future.
3. How broad the span of powers and influence are to drive decarbonisation initiatives.
4. The platforms and projects underway that can support a lower carbon future.
5. The investment and business innovation environment to foster a lower carbon path.

These 5 dimensions are explored in the summary statements below.

Summary and key findings

By global and regional standards, Panama City is:

Assets	**A Net Zero Reformist**: Moderate systems and assets to build on; new developments provide short to mid-term opportunities to reform infrastructure and accelerate to net zero.
Ambition	**Net Zero Championed**. Modest strategies among public entities so far mean internal and external champions can help raise the level of confidence and ambition in key sectors.
Powers	**A Net Zero Opportunist.** More distributed leadership to explore key opportunities to host and deliver innovations in a context where city government has limited leverage.
Projects	**Net Zero Purposeful.** Currently initiating a number of projects that can be leveraged for faster net zero with the right contributions.
Innovation	**Net Zero Invested:** Some promising evidence of private and public investment to unlock projects on renewables and circular economy; growing support of research and alliances.

Figure 1: Panama City's position within an emerging net zero typology

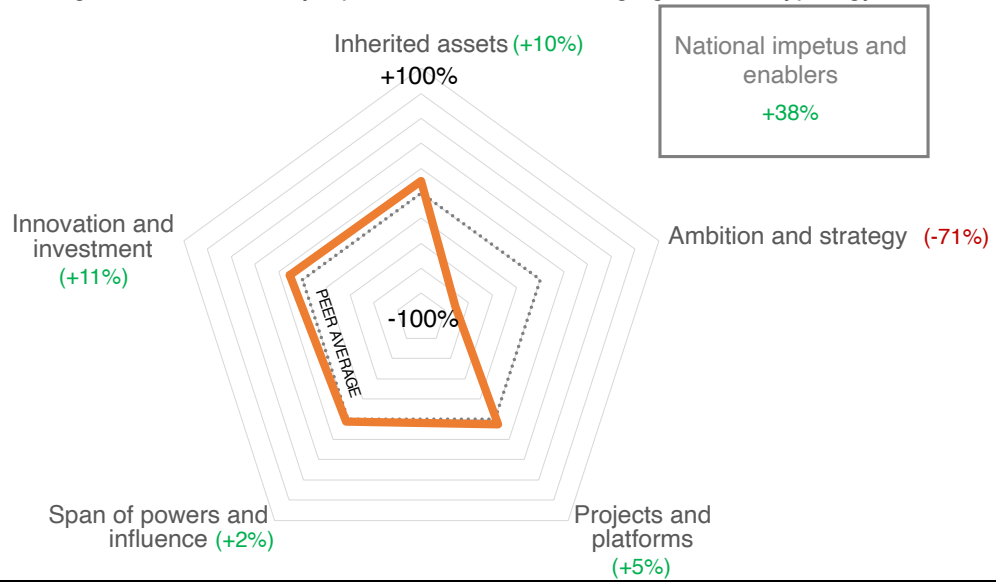

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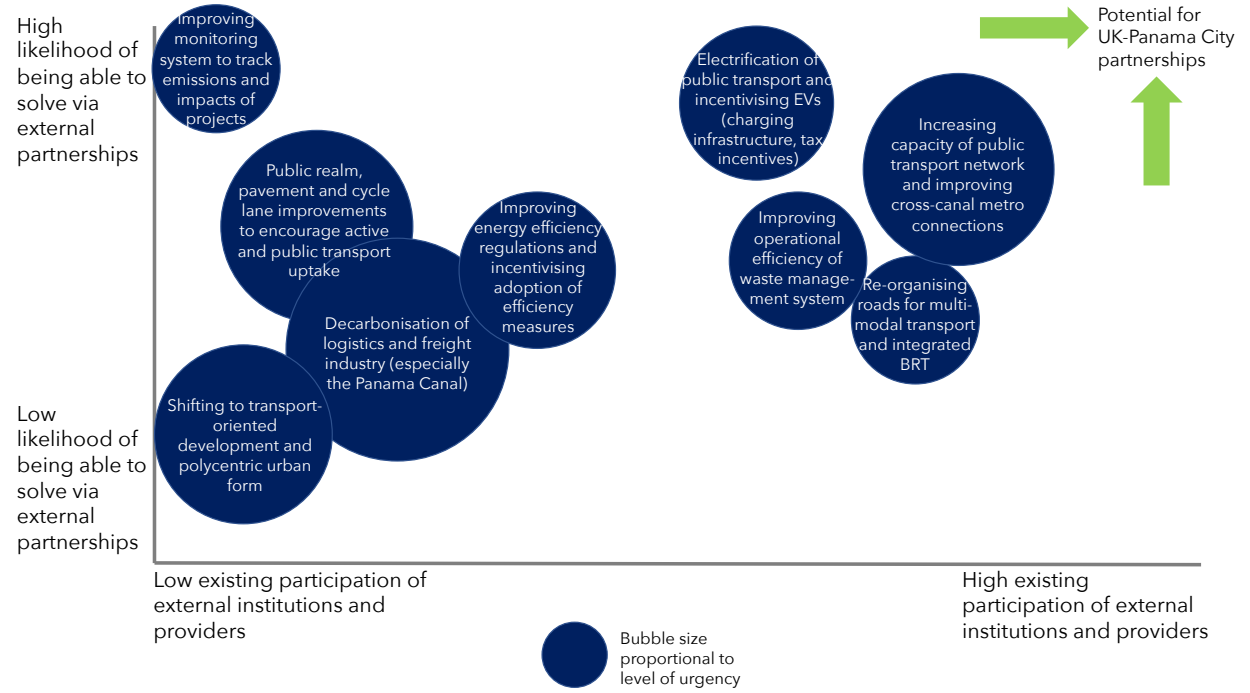
Figure 2: The main priorities facing Panama City in the journey to net zero



Based on the comparative data and observed insights from strategies and practitioners, there are opportunities for Panama City to accelerate decarbonisation in several areas. The most obvious opportunities appear to be around:

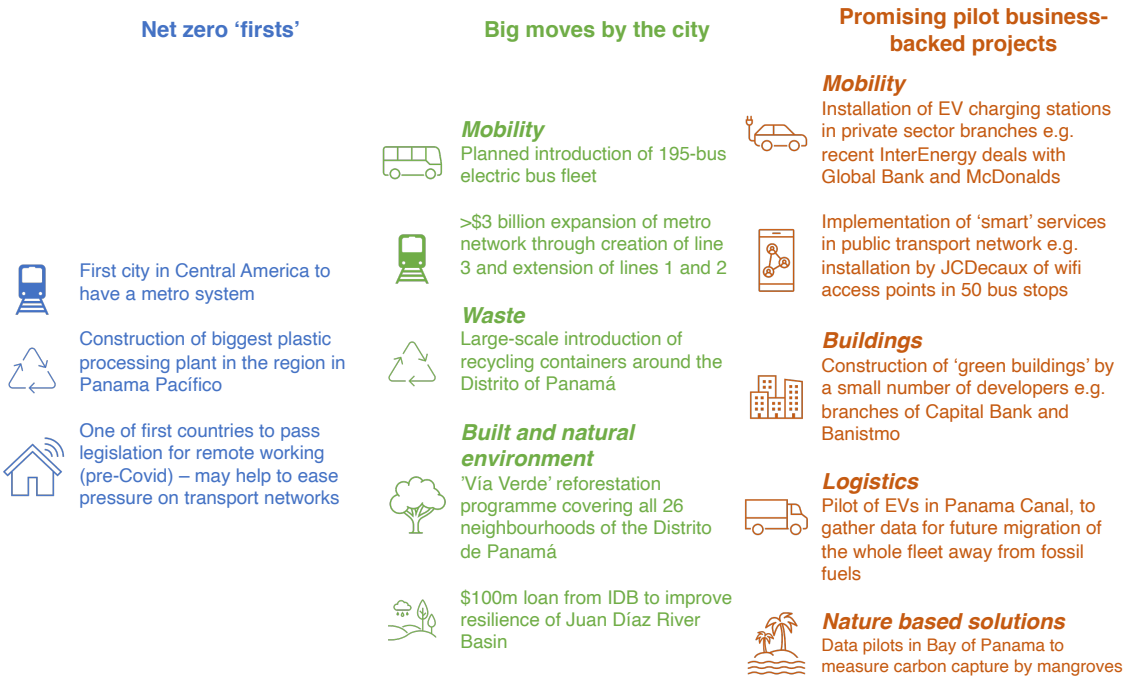
1. **The decarbonisation of Panama Canal operations and its logistics ecosystem**. Panama City is home to the world's most important trade junction, whose ambition to reach net zero by 2030 creates significant opportunities for staking out a leading position in hydrogen fuels, electric and sustainable fleets, and other scalable innovations. The Panama Canal Authority may be an important partner for piloting change, encouraging collaboration and demonstrating impacts regionally in the next cycle.
2. **Expanding low carbon metropolitan mobility systems** such as the metro system, and realising the opportunity to unlock new mixed-use neighbourhoods, promote transport-oriented development and create new employment hubs.
3. **Convening and mobilising the critical mass of thought leaders and global players.** Given its status as a preferred location for a large number of corporates and development agencies' regional offices, there are many opportunities for applied partnerships with organisations looking to work even more closely on issues relating to decarbonisation.

However, there are also several priority challenge areas that will require accelerated investment, reform and innovation. The most urgent challenges for Panama City appear to be around:

1. **Incentivising clean transport uptake** through efforts to upgrade pavements and pedestrianise the public realm, and create high quality multi-modal transport interchanges to leverage the forthcoming public transport dividend.
2. **Integrating existing emissions data** (e.g. from the Canal) and developing a robust city-wide monitoring system, particularly in order to forecast the impact of new infrastructure projects and strengthen the case for investment in clean growth technologies, innovations and pilots.

3. **Shifting to an efficient multi-centre urban form** through more strategic planning and visioning, coordination with real estate developers, and prioritising transport-oriented development in areas that will benefit from enhanced transport coverage (e.g. in the west of the region).

Figure 3: Panama City's net zero 'firsts', 'big moves' and promising pilots in the past 5 years



Given these imperatives, future UK contributions may be most salient in the city's transport and waste sectors, especially through:

1. **Transport authority expertise on how to sequence major transport developments with public realm improvements** and on new financial tools to finance public realm improvements, collect and monetise data, and transport-oriented development (e.g. TIF, land value capture, etc.)
2. **Market and incentive design, and policy guidance** on how to incentivise residents to adopt active transport (e.g. by linking to other agendas such as health and through low cost, tactical urbanism approaches that can help to create shade and improve pedestrian experience)
3. **Help convening thought leaders and research institutes** operating in the city with business, in order to assemble pilots of new technologies, especially around transport, freight and integrated nature-based solutions.

Compared to in other Latin American cities, there are more examples of early-stage pilot projects with the potential to be scaled, and more examples of projects that have so far been partially funded or delivered by businesses looking to deploy technology-led innovations (see also Section 5). This suggests that international partnerships might usefully focus both on direct provisions of hardware or technology-driven innovations in target sectors, as well as on capacity building and tactical and technical advice.

1. How well set up is Panama City to go net zero?

Table 1: Panama City's aggregate scores in terms of current endowment to shift to net zero

	Score relative to Latin America leader* (max = 1)	Latin American leader	Latin American laggard	Rank among Latin American cities
Track record of compact development	0.80	Bogota	Tijuana	10th / 52
Transport systems efficiency	0.65	Santiago	Grande Sao Luis	28th / 53
Urban canopy coverage and protection	0.72	Toluca de Lerdo	Tijuana	16th / 36

**Among all measured cities in Latin and Central America and the Caribbean. All indicators featured in each of the 3 main sub themes detailed in Appendix. Aggregate scores and ranks calculated using an ELO algorithm.*

Spatial form and compact development

Core City Population	0.8 million[1]
Wider Metropolitan Area Population	1.9 million[2]

Panama City is beginning to transition to a higher density development model, and there are big opportunities to retrofit the city's spatial form.[3] Since 2000 Panama City has been growing outwards only half as quickly as other Latin American cities and is densifying at a faster rate. However still only 2% of the city's buildings have more than 2 storeys, and finding more ways to connect people is key, requiring much better coordination between real estate companies and developers and the transport authority.[4] More decisive efforts will be needed to curb the risk of more sprawl.[5] The arrival of new infrastructure (see Mobility section) will need to be optimised by transport-oriented development.

Panama City is also still an unusually single-centre city, which creates specific decarbonisation challenges. Nearly 90% of jobs are located in two neighbourhoods in the District of Panama, which, due to the high reliance on the car, leads to major congestion along key arterial roads into the city.[6] Carbon emissions from stationary vehicles are high.[7] The 1997 Metropolitan Plan tried to shift to multiple job hubs, but lacked implementation power and an update is needed (see section on Ambition and Strategy).

Mobility

Decarbonising transport is a major priority for Panama City's journey to net zero. Transport accounts for nearly half of national emissions and is the main consumer of energy, with 60% of imported fuels derived from oil powering the transport sector.[8] Modal shift is essential: currently, 43% of travel within the city is by private transport modes – higher than in many other Latin American cities.[9] Despite progress, there is still a lot of potential to electrify the mobility platform, around the canal and in the urban centres. Larger pilots and the electrification of the public transport stock will become even more important for driving progress.

Efforts to expand the current metro system – Central America's first – need accompanying incentives to travel more sustainably. Plans to build a 3rd metro line extending to west of the canal, where around 300,000 people live, will help to significantly enhance east-west connectivity and expand metropolitan coverage. A 4th line is also planned, with the target to transport up to 40,000 people by metro transport per hour by 2035.[10] However, pavements in many parts of the city are of relatively poor quality, making walking both from A to B and to and from public transport stops difficult, and many of the more recent improvement projects funded by Metro de Panama have been limited to areas immediately around stations due to limited funding capacity.[11] Panama also has a more established culture of car ownership, where the warm climate means many citizens still see cycling as a sporting activity as opposed to a means of transport, and car-sharing is not yet common practice.

As a result, future progress may benefit from appetite to partner with international organisations with expertise in:

- Sequencing new major transport developments with integrated public realm improvements.
- Low cost, tactical urbanism approaches to create shade and improve pedestrian experience.
- Developing new financial tools for public realm improvements (e.g. TIF, land value capture etc.).
- Education and awareness raising about a need for the switch to more sustainable transport modes.
- Promotional tactics and other campaigns to shift behaviour and encourage citizens to see cycling as a way to improve health and reduce environmental impact (as opposed to an elite sport).

High reliance on informal bus services that are not yet officially linked into the network means creating an integrated BRT system is also a high priority for Panama City. Even once the metro system is expanded, official public transport services will be very sparse in some areas of the city – especially in the west and extreme north and east. In these areas, residents often rely on informal services unregulated by authorities to get around the city.[12] Re-organising roads to become multi-modal corridors capable of supporting cars, BRT, bicycles, pedestrians and other forms of shared mobility may be one possible solution for accelerating progress in this area.

Waste

Recent years have seen strong momentum towards improving the sustainability of waste management, but much more progress is possible. Initiatives such as the Basura Cero programme and the Recicla por tu futuro initiative have focused on installing recycling stations and educating residents on how to separate waste and use the containers via awareness campaigns and door-to-door visits.[13] Another promising innovation involves incentivising convicted criminals to collect solid waste in exchange for reduced sentences.[14] However, several challenges remain. Firstly, the containers currently do not allow for the recycling of organic waste, which some estimates peg at 50% of domestic waste consumption. Secondly, there is evidence of a culture of fly tipping and waste disposal in natural environments, suggesting a need to further increase environmental awareness and education. Finally, the waste management system faces operational and institutional challenges, deriving in part from centralised control. The local implementation of a comprehensive waste management system is complicated by national-level authority over waste, while a less well-developed institutional framework for protecting residents from potentially harmful gases means waste-to-energy plants have not yet been pursued.

Comparatively low levels of recycling in Panama City mean new innovations to solve waste management issues may be a key priority. As of 2015, 65% of the city's solid waste ended up in landfill, with only 2% of the city's solid waste being sorted and selected to be recycled.[15] Part of the challenge is that there is not yet an obvious market for recycled plastics. Development of a new waste sorting and treatment plant – currently in the pre-feasibility stages – therefore appears to be a key opportunity. New legislation to encourage producers to take extended responsibility for products, establishing an economically sustainable pricing structure for waste services and incorporating costs and income from waste management may all also be important for creating a more vibrant circular economy.

Energy

Accounting for nearly half of the country's population, Panama City will be more reliant on national level energy diversification and regulation than some other Latin American cities. Although over 60% of the country's energy comes from hydropower, wind and solar, the current long-term national plan for energy transition is more focused on replacing heavy fuels (coal, oil) with natural gas than on growing wind and solar.[16] Panama City's ability to decarbonise its energy sector will therefore depend on how quickly the nation can pivot from gas to more renewable energy sources. Lobbying national government to streamline national regulations for energy efficiency may also be important for accelerating progress: between 2010 and 2015, annual residential electricity consumption in the Panama Metropolitan Area increased by more

than 7%.[17] This might include building on work already done by platforms such as the Association of Large Electrical Consumers, a non-profit association representing large electricity consumers that promotes the development of new regulatory frameworks for sustainable decision making.

Nature-based solutions

Panama's natural assets and base of highly capable and committed environmental research institutions mean the city can become a leader for integrated nature-based solutions. Urban expansion has continued to deforest protected areas, with more than 26,000ha of forest having been destroyed in the past 30 years.[18] Research institutions are leading efforts to integrate nature-based solutions to help tackle deforestation and protect other forms of vegetation (e.g. mangroves) to sequester carbon. As the City looks to develop an integrated strategy for nature-based solutions, there seems to be a lot of potential for partnerships focused around incorporating nature-based solutions into public space projects – especially along the waterfront.

Logistics and freight

Home to the world's most important trade junction, any route to net zero in Panama City must take into account the Panama Canal. On one hand, canal operations are highly energy intensive. Over 14,000 vessels pass through the Canal each year, many transporting oil and gas related goods.[19] The Canal also splits the metropolitan area, with the city centre to its east but significant portions living on the western side of the canal. This poses difficulties for the integration of the city's mobility platform that will be needed to pursue net zero (see also Mobility). On the other hand, the canal also provides an opportunity, to benefit from new pilot technologies and become a regional leader in decarbonising the maritime, shipping, freight and logistics industries. The Panama Canal Authority has set ambitious targets to reach net zero by 2030, is leading several projects to reduce emissions and is convening global research efforts for the maritime and freight industry (see Ambition and Strategy).[20]

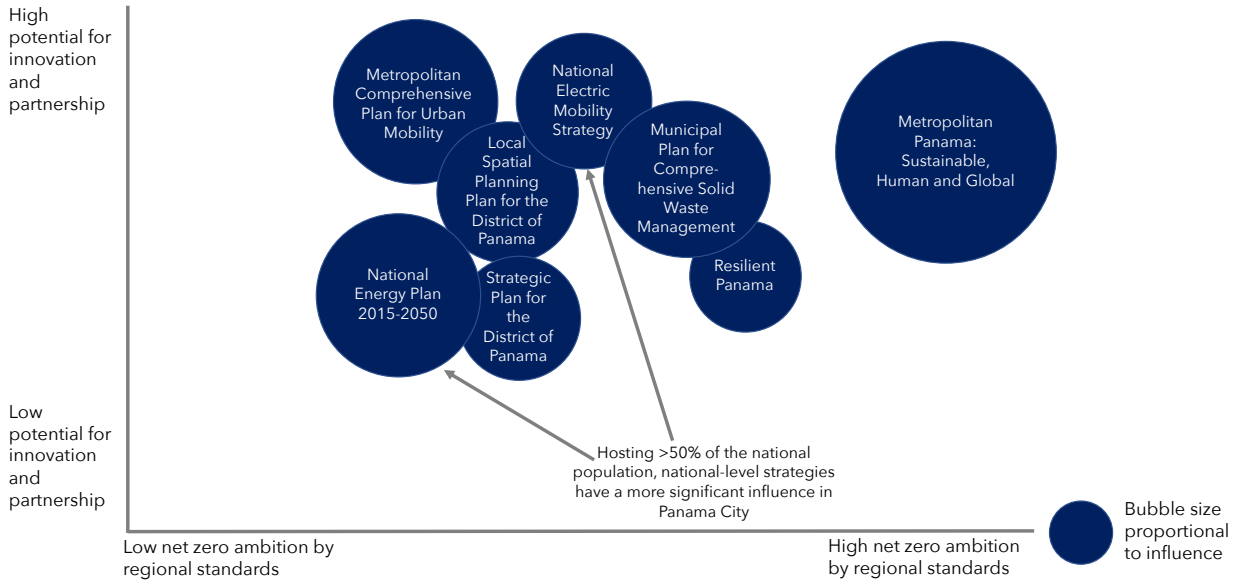
Table 2: Panama City's performance versus Latin American cities across key net zero endowment metrics

		Panama City performance	Average among Latin American cities*	Latin American leader	Latin American laggard	Rank
Track record of compact development	Wider urban area density[21]	7,400 / sq. km	6,500 / sq. km	18,300 / sq. km (Bogotá)	1,000 / sq. km (San Juan)	13th / 53
	Built-up area expansion rate, 2000-2015[22] (wider metro area)	+5.0%	+8%	+1.2% (Kingston)	+83.8% (Toluca de Lerdo)	23rd / 53
Efficiency of mobility platform	% of people living within 100m of car-free zones in the wider metro area[23]	19%	24%	60% (Bogotá)	4% (Valencia)	26th / 50
	% of people living within walking distance of education/medical facilities in the wider metro area[24]	29%	49%	86% (Grande Vitoria)	12% (La Laguna)	38th / 50
	Coverage and uptake of high-capacity public transport within wider metro area (relative to leader = 100%)[25]	51%	18%	100% (Santiago)	0% (Multiple)	6th / 51
Urban canopy coverage	Tree canopy coverage per person (m^2)[26]	213.4	202.7	678.6 (Asuncion)	0.3 (Lima)	6th / 17

2. Ambition and strategy to become net zero: where might innovation and co-ordination be required?

No single city-wide strategy to decarbonise, but multiple plans at both the city and metro level to pursue clean growth in net zero related sectors

Figure 4: Illustrative chart to show the landscape of Panama City's current net zero strategies



**Based on review of strategy content, comparative objectives, presence of innovation initiatives, and scope for partner delivery.*

The 2015 Metropolitan Panama climate action plan is the most comprehensive whole-city decarbonisation endeavour to date.[27] Developed by city government and the IDB, it acts as an umbrella plan for municipal level land use and solid waste management plans and targets a reduction of 6m tonnes of CO_2 emissions by 2050. However, despite many initiatives being successfully implemented, such as the Basura Cero Programme, the fact that the plan is not legally binding and has been launched in the context of a complex decentralisation process, means much of the plan has not been implemented.

Panama City has recently adopted an ambitious and legally binding land use plan to shift to a compact and multi-centre urban form.[28] There are not yet large-scale efforts to densify informal settlements. But the new plan establishes territorial boundaries for urban growth and protected areas, and identifies and properly regulates risk areas. It also includes extensive programmes that span nature-based solutions for polluted rivers, and a conceptual waterfront development plan. Unlike some other sectors such as waste management, the city has authority to implement it. However, there is a priority to create a spatial plan for the metropolitan area.

Other plans developed by Panama City to drive long-term change in key net zero sectors focus on:

Encouraging more sustainable and multi-modal transport. The Comprehensive Metropolitan Sustainable Urban Mobility Plan focuses on reorganising roads to provide space for new BRT and prioritising cyclists and pedestrians, plus implementation of a new bike lane Master Plan.[29]	**Integrated waste management and environmental education**, for example through the Municipal Plan for Comprehensive Solid Waste Management which was created with participation from the Universitat de Vic in Catalunya, Spain.[30]	**Reforestation, mangrove protection and mobility electrification**, for example via the Strategic Plan for the District of Panama.[31]

Unlike some other Latin American cities, Panama City does not yet have a robust emissions monitoring framework. This limits the ability to evaluate the impact of new infrastructure projects, and makes evaluating progress, creating transparency and encouraging investment difficult. However, there may be potential to partner with the Panama Canal Authority, which has already developed robust emissions monitoring and management systems for ships and has set an ambitious target to become net zero by 2030, 20 years ahead of the national target (see below). Efforts to adopt data-driven approaches are also being led by national government. The 'Reduce su huella' programme is a first-of-its-kind voluntary state programme that establishes a standardised process to identify, calculate and verify carbon footprints, while the national-level Platform for Climate Transparency is helping to open up climate change data to universities, NGOs and civil society.[32]

The Panama Canal Authority can help to act as a trendsetter for the city. It is leading global efforts to decarbonise the shipping and freight industry, which provides significant opportunities to pilot and scale change and encourage collaboration with those invested in the canal. Alongside its emissions calculator, the authority is collaborating closely with the Maritime Technology Cooperation Centre, set up by the International Maritime Organisation, to lead data-driven approaches for increasing energy efficiency; piloting and researching new technologies, such as electric vehicles for operations and new vessel sizes that can reduce the number of journeys needed. It is also cooperating with the IDB to develop a hydrogen strategy, create a local market for hydrogen products and centre Panama in global hydrogen supply chains.

With the city yet to establish a formal department for climate change, institutional capacity to drive decarbonisation is not as strong as in some other Latin American cities. Ongoing governance challenges have limited the ability of the city to create and implement comprehensive investment and action plans. For example, the municipal government is no longer in direct authority over formal waste management (see Span of Powers section), meaning the efforts of the Municipal Plan for Comprehensive Solid Waste Management will likely be focused around awareness and education for the next cycle. There is also a big opportunity for wider metropolitan coordination to overcome fragmented subnational governance and drive wider regional progress towards net zero.

Panama City is already actively prioritising efforts to leverage international expertise and financial assistance in its journey to net zero, and its status as a major hub for thought leaders and industry experts means it has potential to scale these efforts further. In 2015, the city worked with **UN-Habitat** to create Partial Land Management Plans for 4 districts, and the UN is now currently piloting new technologies in the city such as solar water heating systems under the Termosolar Panama project.[33] The city has also worked with **CAF,** who provided theoretical designs for the new sustainable tram system to connect Panama's historic district with the city centre and current and future metro lines, and is currently collaborating with the **IDB** to develop a strategy to incentivise a shift to hydrogen transportation.

There is also potential to expand the strong track record of partnerships between Panama and the UK, with several UK partners and businesses already active in Panama. These include **Biwater**, who built the $35m Laguna Alta Water Treatment Plant in 2020 to serve 300,000 Panamanian residents, and **Solarcentury**, who recently built one of Panama's first grid-connected solar farms.[34] **Defra** are also supporting a US$3.2m initiative to preserve and rebuild mangroves and wetlands.[35] Other collaborations from the past decade that suggest potential for deeper partnerships in the coming years include:

- The **British Embassy Panama**'s yearly Panama Programme Fund, which provides grants for non-profit, civic and multilateral organisations focusing on adaptive, small and short-term projects promoting sustainability, particularly solid waste management and recycling as well as capacity building.[36]
- **UK Export Finance's** new partnership with the Central American Bank for Economic Integration, to jointly finance projects in Central America that focus on clean energy and UK exports. The agreement makes £2.5bn available for new business in Panama.[37]
- The UK government's **eco.business Fund,** set up to incentivise financial institutions to introduce sustainability and climate change criteria into their decisions when choosing to invest in Panama. To date, almost £33bn has been spent as part of this sustainable finance initiative across Central America.[38]

3. What is Panama City's span of powers and influence to shift to net zero?

Table 3: Panama City's performance across key metrics relating to the city's span of net zero powers

	Score relative to Latin America leader* (max = 1)	Rank among Latin American cities
Metropolitan-level governance coordination	0.39	36th / 54
City-wide spending capability**	0.49	9th / 44

**Among all measured cities in Latin and Central America and the Caribbean. **Relative to city size. Full details of the individual metrics comprising each indicator provided in Appendix.*

In the current cycle, efforts to decarbonise the city are occurring within a context of decentralisation, with more autonomy being transferred from the national to city -level. The City government is active in developing strategies and initiatives to increase sustainability and reduce emissions in the city (see Ambition and Strategy). This, combined with recent efforts to decentralise power via the Law of Municipal Decentralisation, means the city government has increased authority to implement changes across many areas previously controlled by national government. As a result, new offices were created at the city level, notably including Urban Planning and Environment Management, increasing the institutional capacity of the government to implement change.

But Panama is still a highly centralised country, meaning Panama City's journey to net zero will depend more on the actions of the national government than in other Latin American cities. On one hand, it is the national government that has been at the helm of some of the major efforts to pursue more sustainable policies. These include a recent law passed before Covid-19 to encourage remote working and reduce transport-related emissions, and its involvement in the city-level Recicla por tu futuro programme.[39]

On the other hand, the more active role of national-level ministries in key sectors such as solid waste management and transport means city level entities have a more limited ability to implement plans related to net zero**.** One example relates to waste management. After years of alternating authority, the Panama City government no longer controls solid waste management. Instead, this is controlled nationally by the Autoridad de Aseo Urbano y Domiciliario. Therefore, despite ambition from the city government to improve and decarbonise waste management plans (see Ambition and Strategy), city level actors do not yet have a strong ability to implement waste management programmes. Overall, this means that leadership to explore key opportunities to deliver net zero innovations is more distributed in Panama City than in other cities.

The next cycle of Panama City's decarbonisation progress will therefore likely depend on expanding and strengthening existing involvement of business and other actors. Businesses and civic organisations are already active partners in several sectors (see also Sections 4 and 5). In the building sector, 90% of recent renovation efforts in the Old Quarter have been undertaken by private companies.[40] Meanwhile there are also several promising initiatives in areas such as the provision of smart services in public transport and e-mobility. This suggests there is a clear opportunity for businesses and civic organisations to become even more involved in Panama City's decarbonisation efforts, in particular in the fields of energy and transport electrification. For sectors with less business involvement to date, including waste, leveraging overseas businesses to invest in cross-municipality projects and to provide strategic advice about how to strengthen capacity may be an important driver of progress.

The next cycle of progress may also rely on efforts to strengthen metropolitan-level governance coordination in the city. The metropolitan area crosses 4 different districts within two separate provinces. Although some efforts have been made to establish a metropolitan approach, e.g. through the formulation of metropolitan level mobility plans (see Ambition and Strategy section), the number of authorities involved in the provision of transport, waste management and other services have made the implementation of integrated, metropolitan wide responses difficult.[41]

CP: Current Performance (1 = poor, 2 = limited, 3 = modest, 4 = promising, 5 = good)
*AI: Ability to influence (1 = low, 2 = limited, 3 = moderate, 4 = higher, 5 = very high)**

	CP	AI	Key notes	Key local stakeholders**	Current and potential UK contributions
Transport	2	4	Public transport is controlled by National Government through Metro de Panamá & the Authority for Traffic and Land Transport (ATTT)[42]. National Government also controls medium- and long-distance transport inc. rail, roads and ports (although main ports are franchised). Informal bus services operate at high levels in metropolitan area neighbourhoods that are less-connected to formal networks. The Metro network has been financed by international partners e.g. IDB, European Investment Bank, CAF etc. Responsibility for pavements is shared by the municipality, utility companies, Ministry for Public Works and the Authority for Utilities, making change difficult.	Metro de Panamá ATTT National Government Ministry for Public Works National Maritime Authority Various franchises	Transport authority expertise on how to sequence major transport developments with public realm improvements. Market design, policy guidance and tactical advice on how to incentivise residents to adopt active transport. New financial tools for TOD and public realm improvements. SME-developed EV software for new bus fleets. SME-developed smart traffic management systems.
Energy	2	3	Authority for energy policy lies with the National Office for Energy, and control and auditing of electricity provision with National Authority for Public Services. In 2020, the National Government published Strategic Guidelines for the Energy Transition Agenda, including the creation of a consultory National Board for Energy Transition to target changes in behaviour, increase accountability and introduce energy efficient measures (see below in Building section).[43] Various energy companies provide energy in different areas of Panama City.	National Office for Energy National Authority for Public Services EDEMET ENSA	City-led expertise in encouraging carbon literacy among citizens. SME-developed solar technologies to increase renewable energy mix in public and residential buildings.
Building	3	2	40% of settlements in the metro area are informal.[44] Real estate companies have been central to driving high levels of urban sprawl in recent decades. The Law of Municipal Decentralisation (2006) established a new framework and transferred some responsibility for urban planning from national to local government, e.g., developing local urban plans. 2018 Eco Protocolo classification by the City of Panama and Panama Green Building Council created a local sustainability classification for buildings, including energy efficiency, water storage, waste management.[45] The National Government's Strategic Guidelines for the Energy Transition Agenda (see above) also includes Energy Efficiency Regulations to target new developments in the residential sector.	Dirección de Planificación Urbana	Integrated master planning approaches to align land-use plans with sustainability targets. Construction firm expertise on green construction techniques for developers, designers, occupiers and policy makers. Deployment of digital technology to provide analytical insights and monitor energy efficiency in the built environment.
Waste	2	3	Authority over solid waste management has alternated between city and national control. It is currently controlled by the national Urban and Household Cleaning Authority of Panama, decided by the previous national administration. In the wider metro area, municipalities are responsible for waste collection and give concessions to the private sector, e.g. Aseo Capital in Arraijan district.[46] Recycling is driven by numerous partners e.g. current Recicla por tu futuro initiative is an alliance of national Ministry of Environment, Panama City Government, National Association for the Conservation of Nature.[47]	National Autoridad De Aseo Urbano y Domiciliario National Ministry of Environment National Association for the Conservation of Nature	Expertise on whole life cycle approaches for construction waste, waste facilities and recycling chains. Academic R&D expertise in the circular economy.
Water and sewage	3	2	Panama has a very high daily consumption rate (275L/capita) and 57% of water is not accounted for due to leakages, high water pressures, etc.[48] Water for 1.4m in metro area is provided by Institute for National Aqueducts and Sewage Systems (IDAAN), planned by the National Ministry of Health (MINSA) and managed by the National Ministry of Environment (MIAMBIENTE).[49] Sewage is also managed by IDAAN.[50] Rainwater drainage and sewage/wastewater drainage form one drainage network but are under different authorities, making coordination difficult.	IDAAN MINSA ASEP MIAMBIENTE National Ministry of Public Works	SME-developed data analytics to track leakages in water network. City-led expertise on improving citizen awareness of consumption behaviour.
Logistics and Freight	3	2	Panama Canal Authority is responsible for managing and operating the Canal. The Maritime Technology Cooperation Centre was set up at the UMIP to support transition to low-carbon tech and operations in maritime transport.	Panama Canal Authority Maritime Technology Cooperation Centre	SME-developed e-freight & EV technologies. University research into hydrogen technologies for transport.
Nature based solutions	3	3	The Municipality of Panama has not to date been strongly involved in the development of nature-based solutions. Forest levels are protected by a 1997 law, but urban expansion has meant areas protected by the law have been partially deforested.[51]	Research institutions	AI, drones and data analytics for nature-based solutions. Expertise convening thought leaders and research institutes.

*Based on insights from desk research and interviews. **In addition to the City Government.*

4. What are the platforms and projects to catalyse net zero? Who are the potential investment and innovation partners?

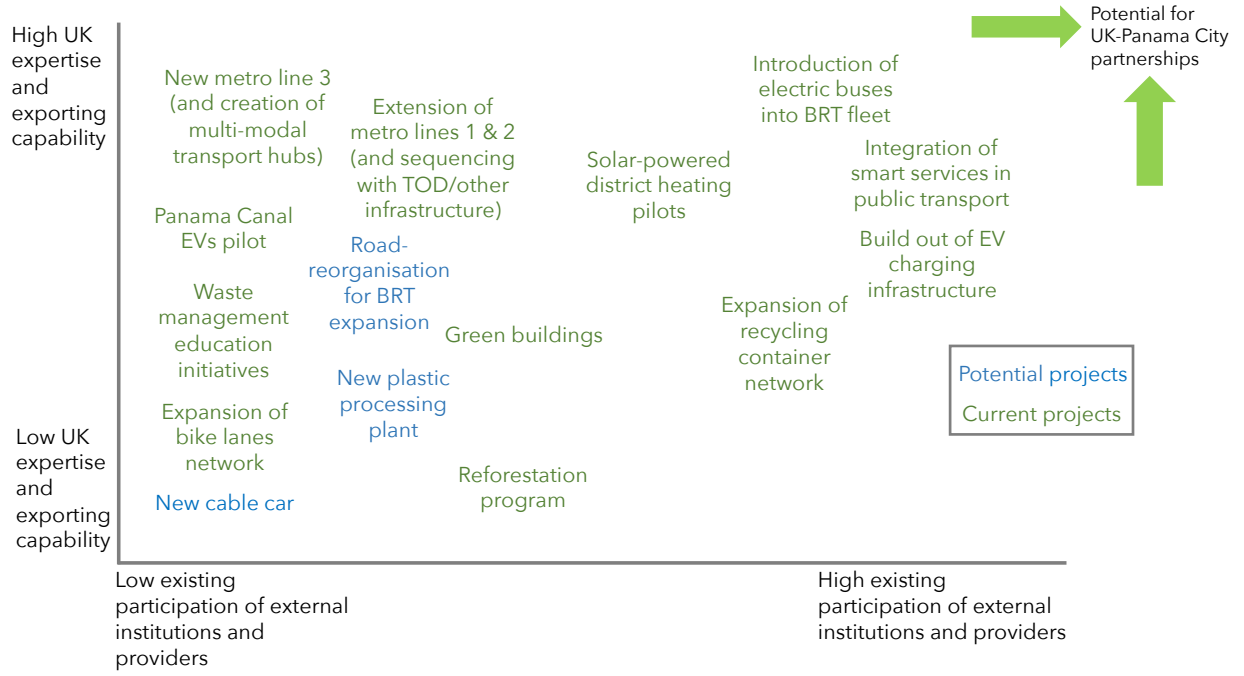
Panama City has made steady progress decarbonising its economy over the past decade, supported by flagship projects particularly focused around transport and mobility. In the current cycle of projects, the main area of focus is mobility, with key areas of intervention relating to the expansion of the city's public transport system; the redevelopment of streets, roads, pavements and public spaces; and the integration of new technologies – to enhance uptake of more sustainable modes of travel. In particular, priorities revolve around:

- Extensive expansion of the metro network and bike lanes network.
- The integration of smart services to make the public transport experience safer, more secure and more enjoyable.
- The re-organisation of roads to favour BRT systems and the development of multi-modal transport corridors and hubs.

Other key areas of focus include the promotion of eMobility (via build out of EV charging infrastructure, EV pilots for freight and the electrification of the BRT network) and a shift towards more sustainable waste management (through expanding the recycling container network and scaling educational initiatives).

The projects mapped in the table on the next page and in the conceptual diagram below have different levels of participation among external institutions and providers, and different levels of suitability for UK expertise and exporting capability (see diagram below).

Figure 5: Map of current and potential net zero projects in Panama City



Compared to other Latin American cities, there are more examples of early stage pilot projects with the potential to be scaled, and more examples of projects that have so far been partially funded or delivered by businesses looking to deploy technology-led innovations (see also Section 5). This suggests that there is

an emerging appetite for international partnerships that involve both direct provisions of hardware or technology-driven innovations in target sectors and partnerships that leverage capacity building and tactical advice.

PROJECT TO CATALYSE NET ZERO	SIZE	TIME FRAME	POTENTIAL INVESTMENT AND INNOVATION PARTNERS
WASTE			
Expansion of 'Recicla por tu futuro' **recycling containers network** to four new neighbourhoods of Distrito de Panamá by 2023, began 2020.	Scaled	Medium	National organisations[52] City Government The Coca Cola Company
Construction in Panama Pacífico of **biggest plastic processing plant in the region**; plastic used for building materials for low-income people all over region.	Project	Short	Panama Pacífico Fundación Botellas de Amor
Development of **educational programmes on sustainable waste management** across metro area e.g. 'Programa Agentes Basura Cero'.	Scaled	Ongoing	City Government's Department of Environmental Education
TRANSPORT ELECTRIFICATION			
US $35m planned introduction of **195-bus electric bus fleet** into Metrobús BRT system following an one-year pilot of two buses freely supplied by Chinese company BYD and operated by research group Smarts-E. Potential to be funded by Green Climate Fund/IDB.[53]	Scaled	Short	National Government MiBus BYD Ensa Servicios Smarts-E
Installation of **EV charging stations** by private companies throughout city, e.g. InterEnergy 2021 deals with Global Bank and McDonalds.[54]	Scaled	Short	InterEnergy Global bank
Pilot of four **electric vehicles by Panama Canal Authority** to gather data for future migration of Canal's whole fleet away from fossil fuel dependence.[55]	Pilot		Panama Canal Authority
ACTIVE TRANSPORT AND MOBILITY			
$3bn construction of 14 station **line 3 of Panama metro** to connect the west of the metro area to Panama City; for 160,000 people daily, to decrease the average journey by 45 minutes. 3 stations will include intermodal transit facilities.[56]	Scaled	Long	Metro de Panamá National Government
$300m **extension of lines 1 and 2 of Panama metro**, including to connect to Panama airport.[57]	Project	Medium	Metro de Panamá National Government
Construction of **bike lanes** throughout metro area, including to connect to key metro stations e.g. in Vista Alegre.	Scaled	Short	National Ministry of Public Works
Installation of **'smart' services in public transport network** for increased use, e.g. 2017 installation of wifi access points at 50 city bus stops so commuters can access real-time transport information.[58]	Pilot	Short	City of Panama JCDecaux Wigo
Promotion of **transport 4.0 technologies** by Sonda – e.g. recent creation of an app to locate payment and customer service points to top-up payment cards, plans for smart route management technologies etc.[59]	Pilot	Ongoing	Metro de Panamá MiBus Sonda
Planned creation of **BRT system** in central area of the city.	Plan		National Ministry of Public Works MiBus
Planned $120m construction of 8km **cable car** ('Metrocable') system to link areas in San Miguelito with limited formal transport connectivity or high levels of congestion to key metro stations.[60]	Plan	Medium	Metro de Panamá
BUILDINGS			
Construction of '**green buildings'** by various developers e.g. branches of Capital Bank and Banistmo.	Project	Long	Various companies
'Vía Verde' **reforestation programme** covering all the Distrito Capital's 26 neighbourhoods - goal of reducing the city's carbon footprint and improving the built environment.	Scaled	Short	City Government Moviendo Vidas Foundation
ENERGY			
Termosolar Panamá **solar-powered heating project** including pilots throughout Panama City e.g. Los Años Dorados retirement home - will lead to 100,000 tonne reduction in CO2.[61]	Pilot	Short	National Secretary of Energy City of Panama UN

5. Investment and business environment to support decarbonisation: Who are the potential investment and innovation partners?

Compared to other cities in Latin America, there is a stronger culture of business leadership on net zero. Relative to other cities, there is a more visible track record of distributed project management and of both large corporate and smaller firm involvement in key projects relating to decarbonisation. The culture of public sector entities working with business and civic organisations to pilot, deploy and scale disruptive and transformational innovations is also more widely visible. In the coming years, finding ways to strengthen and scale these B2B and B2G partnerships – in areas such as smart technology integration in public transport and the provision of nature-based solutions – may help to accelerate progress even further.

In particular, there are many platforms that can be leveraged to accelerate the decarbonisation of the business/commercial sector. These include:

- **Panama National Chamber of Commerce:** Representing over 1,600 businesses from 15 sectors including industry, energy, construction and real estate, IT, transport and logistics, the Chamber organises international business missions and has launched a Centre for Professional Training and Commercial Development which will partially target sustainable development.
- **Association of Business Executives from Panama:** A non-profit entity pursuing national economic development, with a commission for the Environment and Natural Resources promoting sustainable business practices and raising awareness among business executives on recycling, clean energy, etc.
- **Fundacion Imaginari:** A NGO based in Panama City comprised of experts in many sectors to promote the need for sustainability in the business sector to promote a low-carbon economy, by helping businesses navigate sustainability issues and convening technical advice for businesses. It has set up the Nuestra Huella initiative with the International Centre for Sustainable Development and CAF to exchange information on reducing environmental footprints.
- **Panamanian Chamber of Solar Energy:** a non-profit entity formed by industrial and commercial businesses and international organisations to promote and develop solar energy across Panama. It provides technical assistance, convenes investment vehicles with Panama-based businesses and encourages government regulators to promote solar energy projects for business.

The City also hosts a strong research culture that can underpin more decisive efforts in the next cycle. Several platforms currently seem to have the potential to play a fundamental role – especially in the areas of nature-based solutions, carbon storage and sequestration, and sustainable freight. These include:

The City of Knowledge: A campus 15 minutes from the city centre to promote collaborative initiatives towards social and environmental change amongst universities, entrepreneurs, community leaders, NGOs and government. It is developing policies centred on sustainable building, mobility, waste management, water and energy.	**University of Panama**: leads in climate research and nature based-solutions for adaptation and mitigation.[62] It also promotes sustainable development in the city, encouraging citizen awareness and participation and monitoring progress towards the SDGs.	**Technical University of Panama:** researching the potential for carbon sequestration in Panama alongside the TOTH research centre, e.g. by installing a data tower in the Bay of Panama to measure carbon levels.[63]	**Maritime Technology Cooperation Centre for Latin America:** working alongside the Panama Canal Authority and Panama Ports Authority to decarbonise the logistics and freight industry and convenes researchers and thought leaders through webinars on how to promote an energy-efficient freight sector through digitalisation.

Appendix

Net Zero Typology – Terms and Criteria

	Assets	
	Impaired	Strongly negative score (<-20%) or limited evidence of efforts to diversify/improve systems
	Challenger	Negative score for assets, but evidence of efforts to diversify economy and invest in underlying systems
	Reformist	Marginal score for assets, no other defining features
	Guardian	Marginal score for assets, presence of natural assets is defining feature
	Equipped	Positive score, evidence of leadership on one of the agendas (e.g. public transport/density etc.)
	Ambitions	
	Constrained	Negative score for ambition and strategy, limited ambition of public sector ambition plus limited evidence of role of civic leaders, platforms and others in supporting ambitions
	Championed	Negative score for ambition and strategy, but strong evidence of role of civic leaders, platforms and others in supporting ambitions
	Cautious	Negative score for ambition and strategy, but some evidence of emerging public sector ambition.
	Enthusiast	-15% to +15% for ambition and strategy, plus evidence of willingness to accelerate in next cycle.
	Trailblazer	Highly positive score for ambition and strategy.
	Powers	
	Reliant	Marginal score overall, plus evidence of strength in integration measures but majority of projects/systems overseen by private sector actors
	Opportunist	Positive score for powers and influence, evidence of civic leadership and/or non-gov platforms to build on
	Functional	Negative score for powers and influence, no real signs of strength for governance integration or financial/fiscal powers
	Change-maker	Positive score for powers and influence, not as strong for governance integration (outside top 25%) but strong for financial/fiscal powers
	Commander	Positive score for powers and influence, top 25% for governance integration
	Projects	
	Steady	More projects in pipeline than underway, strongly negative score (e.g. -20% or lower) for projects and platforms.
	Standby	Moderately negative score for projects and platforms (-10 to -20%), platforms stronger than projects.
	Accelerator	More projects in pipeline than currently underway, signs of acceleration, marginal score (-5% to +5%) for projects and platforms.
	Purposeful	Positive score (+5% to +15%) for projects and platforms, without transformational scale or impact.
	Pathfinder	Very positive score (>25% or higher) for projects + platforms, demonstrative of pace of change and appetite to deliver.
	Innovation	
	Unsigned	Strongly negative score for innovation and investment, limited and sporadic observable relationships with MNDBs or other partners and platforms.
	Cushioned	Strongly negative score for innovation and investment, yet some evidence of observable relationships with capital suppliers and other civic or business enablers to fall back on.
	Experimenter	Marginal score for innovation and investment, with strong evidence of leverageable relationships with big capital and other actors and appetite to pilot & demonstrate.
	Invested	Positive score. Stronger evidence of multi-sector leadership, more established track record of scaling pilots.
	Pioneer	Strongly positive score. Established track record of scaling city-wide projects, supportive universities, dynamic green innovation ecosystem.

The list of indicators for summary Spidergram is provided below. NOTE: not all cities are included in all indicators. Final scores are calculated according to an aggregate of each city's position across all measures, using an ELO algorithm. The Business of Cities' ELO algorithm computes the overall performance of each city relative to all other cities on aggregate across multiple benchmarks and datasets. The Elo algorithm rates cities or regions by comparing their

performance in every possible permutation against a list of other cities/regions. The system produces the most accurate comparative assessment of city/region performance, as it accounts for the fact that some cities/regions appear in more benchmarks and datasets than do others, and that each dataset measures a different number of cities.

Systems and Assets

Track record of compact development

- Core urban area population density (Demographia)
- Built-up area expansion rate, 2000-2015 (OECD)
- Per capita built-up area expansion rate, 2000-2015 (OECD)
- Weighted population density (ITDP)

Urban canopy coverage and protection

- Urban green coverage as share of metropolitan area (OECD)
- Change in urban green coverage as share of metropolitan area, 1992-2018 (OECD)

Transport and infrastructure systems efficiency

- % of population living within 500m of frequent public transport service (ITDP)
- % of population living within walking distance of healthcare and education services (ITDP)
- % of population living within 500m of a car-free zone (ITDP)
- Per capita length of high-capacity public transport: BRT, light rail/tram and metro/subway (multiple sources)
- Aggregate score across all publicly available global benchmarks of public transport systems performance (multiple sources)
- Size of electric vehicle fleet (C40)
- Sustainable modal share (C40)
- Per capita public transport uptake (University of Rosario)
- Sewer coverage (University of Rosario)
- Electric power coverage (University of Rosario)
- UN Habitat Colombian Urban Connectivity Index

Span of Powers and Influence

- No. of municipalities per 100,000 people in the metropolitan area (OECD)
- Size of core city vs. metropolitan area (multiple sources)
- Extent of metropolitan level government coordination (multiple sources)
- City level spending capability: absolute capital budget of city government plus per capita capital budget (multiple sources)
- No. of modes of transport the main transport authority has authority over (multiple sources)
- % of modes of transport the main transport authority has authority over, relative to the number of modes of transport that exist within the city (multiple sources)
- Transport authority spending capability: absolute budget of main transport authority plus per capita budget (multiple sources)
- Level of fiscal autonomy (University of Rosario)
- Local budgetary collection capacity (University of Rosario)
- Municipal risk management index (University of Rosario)

Innovation and Investment Environment

- No. and % of local tech-enabled firm HQs specialising in sectors directly allied to net zero (Crunchbase)
- No. and % of local tech-enabled firm HQs specialising in sectors indirectly allied to net zero (Crunchbase)
- Presence, extent and maturity of open data platform (multiple sources)
- Presence of universities capable of leading the charge on the urban SDGs (Times Higher Education Impact Rankings 2021):
    - Affordable and clean energy
    - Industry, innovation and infrastructure
    - Climate action
    - Sustainable production and consumption

Ambition and Strategy

- Presence, scale and timespan of climate action plan (multiple sources)
- Presence and scale of climate emergency declaration (multiple sources)
- Scope of planned climate actions (multi sector vs. single sector) (multiple sources)
- Presence and timespan of city-level target for net zero (multiple sources)
- Implied carbon reduction momentum (multiple sources)
- Presence and maturity of standardised emissions reporting mechanism and carbon emissions disclosure practices (CDP)
- Consistency of current targets with Paris Agreement goals (C40)

Projects and platforms

- Aggregate project size and status (according to size of investment and current status: plan/ambition, pilot, project, or city-wide scaled project)
- Average number of sources of leadership in decarbonisation projects in the city (city/regional government, national government, business, multi-national organisations, universities and civic groups)
- Number of pilot and demonstration projects with high potential to scale
- Presence of independent civic organisation for city and track record of thought leadership or activity on issues relating to decarbonisation
- Number and visibility of non-governmental platforms:
    - Visibility on social media websites
    - Visibility in global media sources
    - Number of mentions in relation to decarbonisation

National level impetus and enablers

- Presence and timespan of national net zero ambition / target (World Economic Forum)
- Climate Change Performance Index score (New Climate Foundation)
- KPMG Climate Change Readiness Report 2019:
    - Enterprise capability
    - Government capability
    - Societal capability
- Presence, scope and timespan of national emissions reduction target (multiple sources)
- Implied carbon reduction momentum (multiple sources)
- National renewable energy share for electricity output (World Bank)
- National level CO2 emissions per capita (World Bank)
- National level GDP per capita (World Bank)

Indicators used to calculate metropolitan-level governance coordination score (p. 6): no. of municipalities per 100,000 people in the metropolitan area; size of core city vs. metropolitan area; extent of metropolitan-level government coordination
Indicators used to calculate city-wide spending capability score (p. 6): absolute capital budget of city government plus per capita capital budget

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