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EV READI NESS ASSESSMENT



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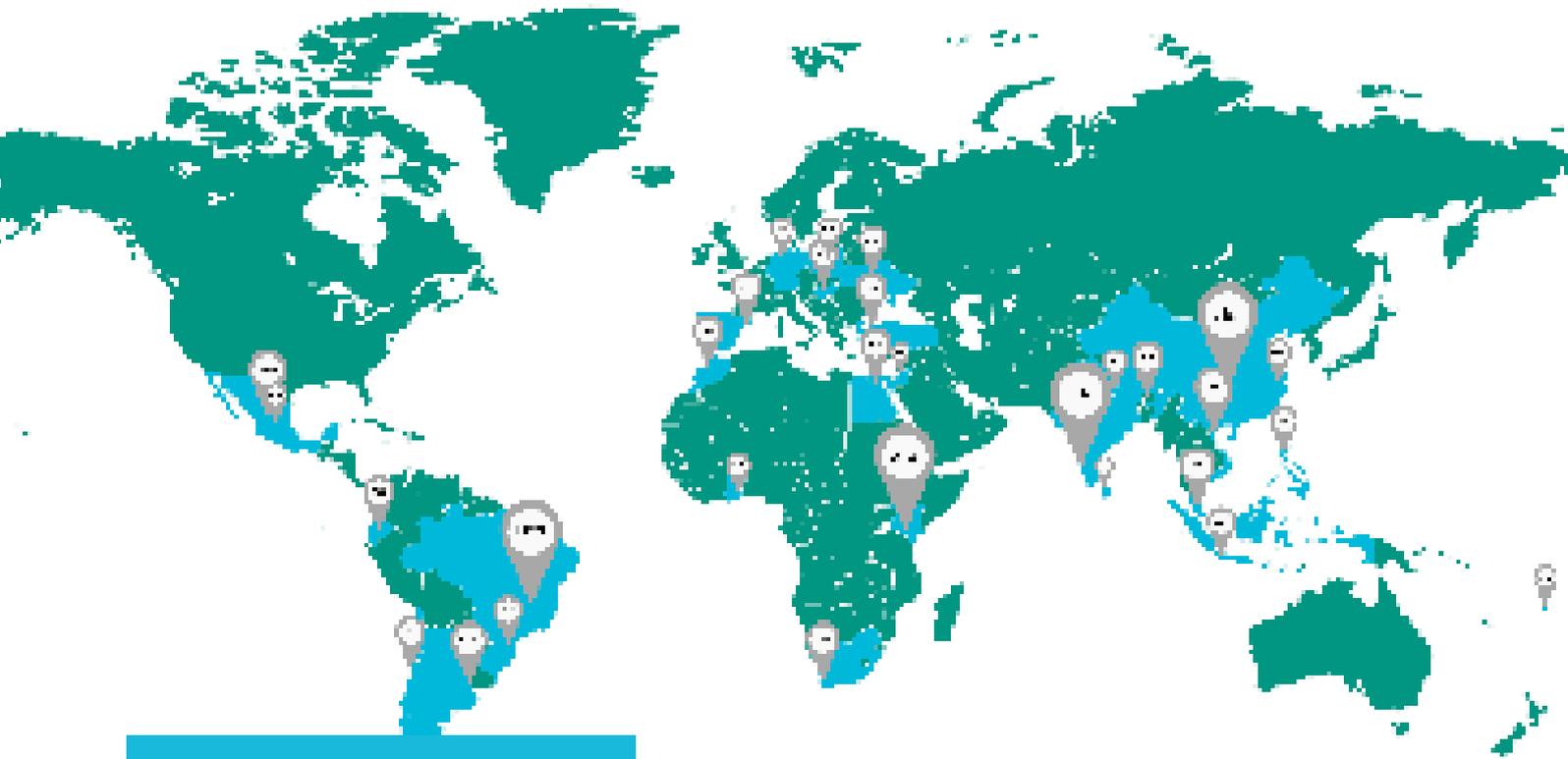
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KEY FACTS & FIGURES

CITY

IBAGUÈ

POPULATION
542,939

City: Ibagué
Population: 542,939 (2013)

GDP per capita: US\$ 5,868 (2012) Proxy Estimate for Tolima Department
CO₂ emissions (total and per capita):
Total: 368 Gg CO₂e/ year (Fuel Sale Method used)
Per Capita: 718 kg CO₂e/ person / year.

Ibagué city is the capital of Tolima (one of the 32 departments that constitute the Republic of Colombia) and has a surface area of 1,439 km². The city is the 7th most populous city in Colombia (Procolombia, 2018).

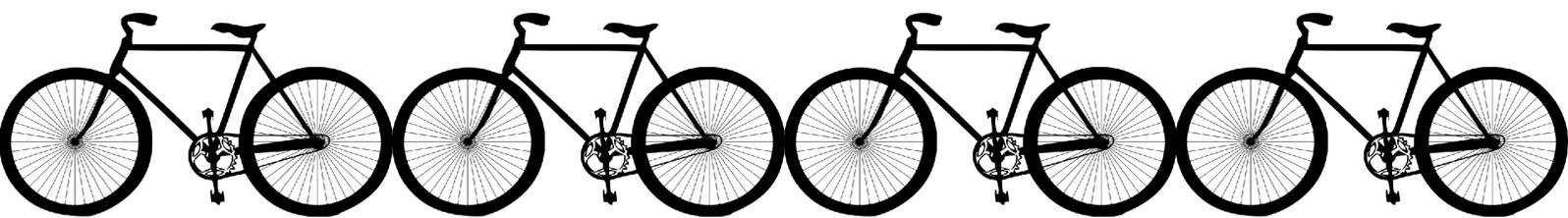
7TH MOST POPULOUS
CITY IN COLOMBIA

INTRO DUCT ION

Urban transport and mobility have over the years become an essential concern for city authorities and planners whose challenges have grown, especially towards improving sustainable transportation systems. With the advancement of electric mobility in transport, electric bicycles have also seen significant increase in usage many cities globally. A fact-finding mission by the Dutch Cycling Embassy on cycling in Colombia reported that there is a steady growth in biking in major Colombian cities with the popularity of e-bikes also increasing over time (Berenschot and Urbanos, 2015).

Efforts to expand cycling activities and promote the use of bicycles as an alternative transport mode in cities can potentially contribute to reducing the impacts of fossil-fuel dependent public transportation not only in Colombian cities, but also in urban areas around the world. This paper proceeds to review the potentials that exist in promoting e-bikes sharing systems in the Colombian city of Ibagué.

The paper presents a brief background on the city of Ibagué; describes electric bike sharing systems as a mode of public transport and its related environmental benefits; summarizes the policy environment on bike-sharing in Colombia; and highlights the key issues worth noting when developing e-bike sharing systems in the city of Ibagué.

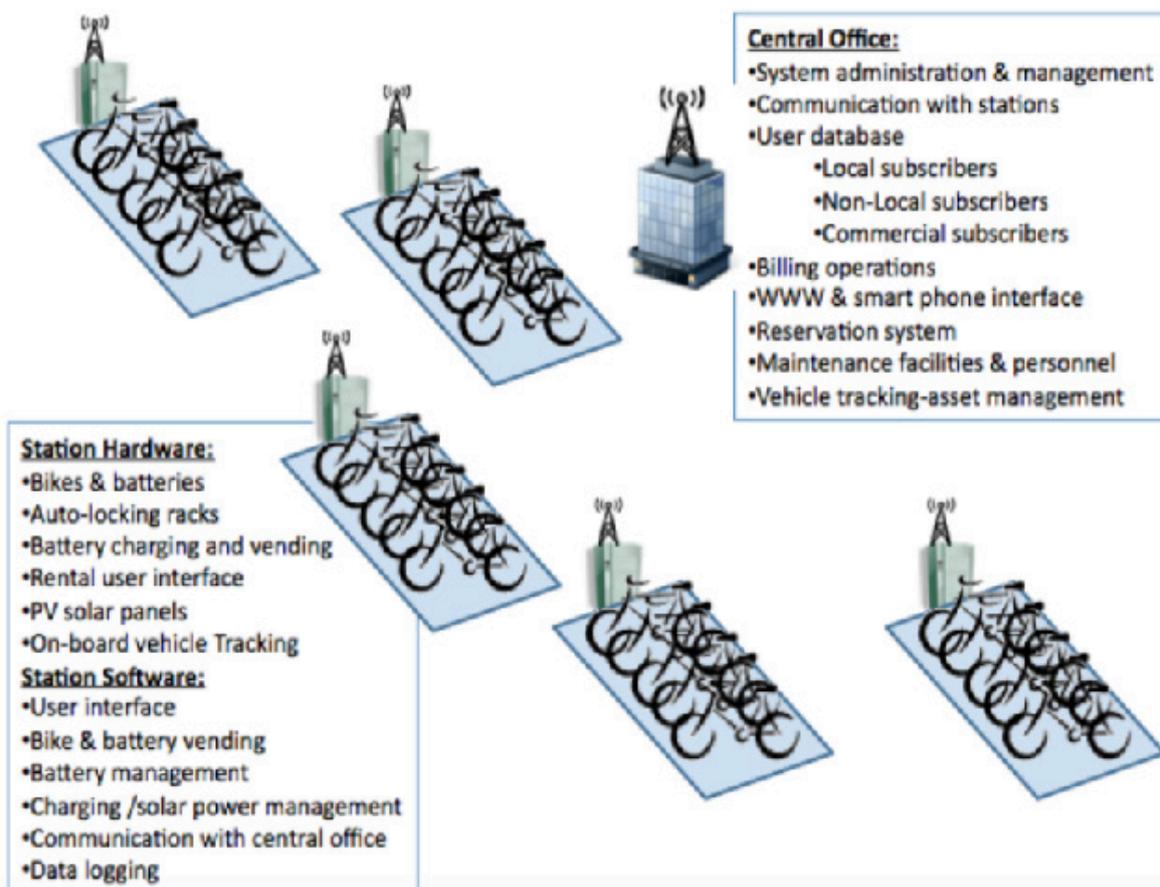


As an alternative public transport mode, bike-sharing according to Qiu and He (2018), has in recent times seen rapid growth in most cities of the world. Electric Bike sharing systems allow users to rent a bike at a self-service station and return the bike at any other station near the destination. The systems facilitate quick and convenient movement of users usually on short distances. Stratta, Panozzo, et al. (2017) noted that the implementation of a successful bike-sharing system is dependent on a strategic policy and regulatory framework through a well-planned, coordinated process that involves all necessary stakeholders.

SHORT DESCRIPTION OF THE MEASURES BEING CONSIDERED

Bike sharing, especially e-bike sharing is rapidly becoming a sustainable transport option with potential benefits of reducing traffic congestion, minimizing energy consumption and consequently reducing environmental pollution and improving the health of city dwellers (Qiu and He, 2018). Another benefit of bike sharing systems is that they are less expensive and quick to roll out (City of Wilmington, 2016). According to Cherry, Worley, et al. (2010), an e-bike sharing system characteristically comprises of electric bicycles, vending and charging station, and support systems. The figure below depicts the system components of an e-bike sharing system.

Cherry, Worley, et al. (2010) also noted that apart from battery charging management which is peculiar to e-bike sharing systems, other conventional bike-sharing systems have common operational features as those of e-bike sharing. Installing and maintaining charging infrastructure is therefore an important aspect when considering e-bike sharing projects. Again, some key elements in the implementation of a bike-sharing system include equipment, installation, maintenance and operation; where equipment comprises of bicycles, kiosks, docking pads and card readers; installation consists of a Radio Frequency Identification (RFID) system, card-wipe systems. Operation costs is made up of repair, redistribution and customer services (Heda, 2012).



POLICY PROCESS



IMPLEMENTATION PROCESS

A report by C40 in 2017 indicated that there has been an increase in stakeholder engagements in cycling initiatives in the city of Ibagué; such as critical mass riding events which are periodically organized to promote biking. These engagements have also manifested in the attention given to the development of non-motorised transport options such as bike-sharing in other Colombian cities, like Bogota and Medellin. (Cities Finance Facility, 2017).

Promoting non-motorized transport in Ibagué

In an attempt to promote urban mobility, the Colombian Ministry of Transport in 2016, initiated a pilot project to encourage bike-sharing in 23 cities in the country, among which was the city of Ibagué (World Resources Institute, 2017). The pilot project was intended to deliver bikes to the cities and offer technical assistance in the construction and monitoring of the bike-sharing systems. As a way of ensuring ownership, city administrations were expected to bear the operation and maintenance costs of the system (Colombia Ministry of Transport, 2016). Again, Berenschot and Urbanos (2015) reported that e-bikes are increasingly becoming popular in some Colombian cities, and that city dwellers are showing interest in cycling for recreational purposes as well as transporting people, goods and services. Evidently, the political support for the implementation of electric bike-sharing systems in Colombian cities is shown in the formulation and adoption of government policy actions and strategies which are further discussed in the section below.

The Colombian government's resolve to promote sustainable transport initiatives is enshrined in the country's National Development Plan (2014 – 2018) which clearly identifies non-motorised transport (such as bicycles and tricycles) as key to the improvement of transport systems in cities. The plan makes provision for the integration of non-motorised modes into the overall transportation systems in urban areas and at the national level. Also, the plan supports the development and use of electricity as alternative fuel source for vehicles (Republic of Colombia, 2015b). The support of the national government for the development of sustainable transport modes is also explicitly stated in measures such as; the establishment of tax and tariff systems by city authorities to minimize vehicular congestion and pollution. Funds accrued through the tax systems are expected to be channeled into financing road infrastructure and public transport projects that have environmental mitigation benefits. The plan aims to "implement clean technologies (hybrid vehicles run on gas or electricity) in public and private transportation vehicles and incorporate variables related to climate change within the structuring of projects" (Republic of Colombia,

POLICY ENVIRONMENT

2015b). Moreover, the plan encourages co-financing through public-private partnership as a means to deliver urban public transport services and projects (Republic of Colombia, 2015b). The existence of the Colombian National Urban Transport Policy is favorable for the deployment of e-bike sharing systems in the city of Ibagué. This policy was formulated to guide the development of urban transport in the country; promote the construction of bicycle infrastructure including well-connected bike lanes and bicycle parking areas in transport stations; encourage the implementation of public bike systems; and ensure the regulation and formalization of bike-taxi (Colombia Ministry of Transport, 2013).

Additionally, there exist other national policies and guidelines which encourage electric biking in Colombian cities. These include the following:

- Policy guideline titled "Guide for Cycle-Infrastructure for Colombian Cities" issued by Ministry of Transport in 2016 to guide policy makers and implementers in the design and execution of bicycle infrastructure projects in Colombian cities. The guideline was prepared through in-depth research and comprehensive consultation with bicycle users, civil society, experts and public stakeholder institutions and authorities in Colombia (World Bank, 2016).
- Colombia's INDCs communicated to the UNFCCC in 2015, identified the transport sector as one of its six priority sectors which are expected to integrate climate change mitigation and adaptation innovation in planning and implementation (Republic of Colombia, 2015a).
- The Colombian Ministry of Transport in its Sectorial Mitigation Action Plan (2014) for the transport sector, outlined several actions and programs to help promote sustainable transport. Notable among these are; the imposition of congestion and pollution charges in cities with population of more than 300,000; the promotion of quality vehicle fuel; and replacement of public and private transport fleets with electric technology (Colombia Ministry of Transport, 2013)

Potential contribution to SDGs, NUA and CO2 emission reductions

The implementation of bike-sharing systems in Colombian cities among other sustainable transport projects initiated by the Colombian government, is expected to contribute to the country's efforts to reduce greenhouse gas emissions by 20% compared to the business-as-usual scenario by 2030 (Cities Finance Facility, 2017). Also, in the Transport Sector Mitigation Action Plan (2014) the Ministry of Transport has projected that the implementation of public bicycle systems, especially in large cities in

Colombia, as well as the increased use in private bikes would contribute to a reduction of 13MtCO₂ emissions by 2040 (Colombia Ministry of Transport, 2013).

A Low-Carbon Development Strategy developed for Colombia in 2014 to assess Colombia's climate change and mitigation actions, estimates that investments into the expansion of non-motorised transport infrastructure in Colombian cities would reduce car use and congestion, increase bicycle trips and consequently lessen fossil fuel consumption thereby minimizing greenhouse gas

potentially reduce 13MtCO₂ emissions by 2040

emissions (Johnson and Fernandes, 2014). From the foregoing, it can be said that the execution of e-bike sharing systems as a more sustainable public transport option in Colombian cities including Ibagué would boost efforts in reducing adverse environmental impacts on city dwellers.

E-bike sharing could have a sustainable impact in Ibagué

Implementation partnership

Counterpart at the city level

- The Municipality of Ibagué
- The Colombia Ministry of Transport
- The Colombian Ministry of Mines and Energy

Potential finance partners

- National and Local Government Subsidies
- International institutions with low carbon focus such as C40's Cities Finance Facility (CFF)
- Multilateral Funds
- Bilateral Agreements
- Private Capital Markets
- International Carbon markets



Finance requirements

Pilot project level (10.000 – 100.000 EUR)

The major cost components in executing a bike sharing system according to Heda (2012) include the cost of equipment, installation and maintenance. The author estimated that the implementation of a typical bike sharing system costs about 30,000 EUR per station (20,000 EUR for equipment including 6 bikes and installation; 10,000 EUR for annual maintenance). With these cost elements in mind and considering that a pilot deployment of e-bike sharing system in the city of Ibagué will involve the procurement of e-bikes which are usually more expensive than the regular bicycle, the project can start with:

- The procurement of equipment including 20 e-bikes and installation of solar-powered charging infrastructure at 3 transport stations,
- Establishment of user information systems, and
- Technical capacity building for key stakeholders and operators of charging infrastructure.

Implementation project (3 – 300 million EUR)

The expansion of the system after a successful piloting phase can potentially include the following:

- Procurement of more e-bikes and setting up of more stations,
- Extension of solar-powered charging infrastructure for city-wide coverage, and
- Upgrading of user information systems to support the expanded city coverage.



Technology requirements

Technical barriers to the project

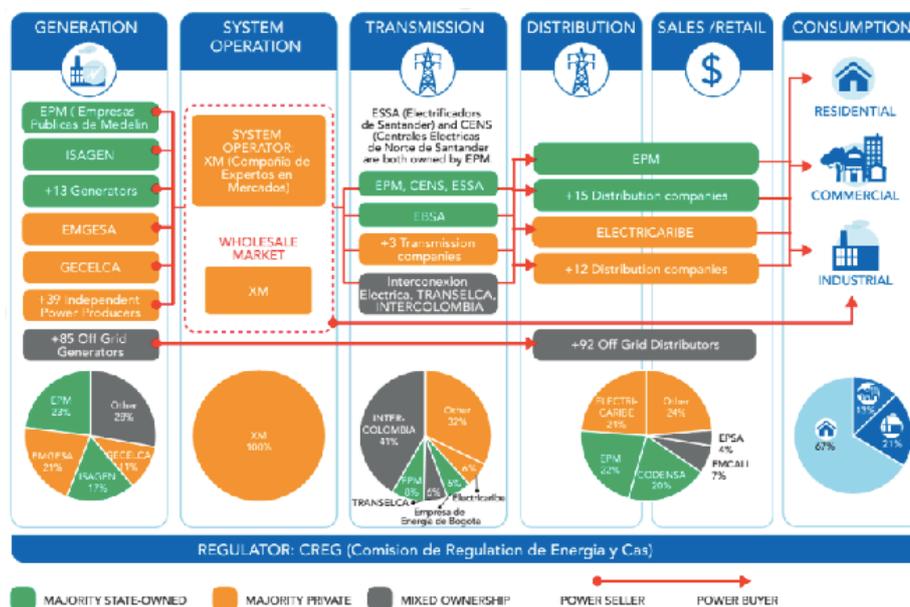
The deployment of e-bike sharing systems in the city of Ibagué can be hampered by some challenges. Some of these impediments are highlighted by Berenschot and Urbanos (2015) who presented an overview of biking situation in Colombia; these include the following:

- Inadequate bicycle parking facilities including public charging infrastructure for e-bikes,
- Multiple institutions and organisations involved in promoting cycling activities in Colombian cities; as such the level of coordination and collaboration is usually low, and
- Inadequate expertise in the management and operation of e-bike sharing systems especially at the city level.

Electricity mix and reliability of the grid

According to Martinez-Villegas (2018), the electricity mix in Colombia is composed of 66% hydro sources, 28% thermal and 6% self-generating plants. It is estimated that electricity generated from hydro sources during years of heavy rains constitutes about 80% of total generation; whilst a reverse situation occurs in drought years where 55% of total generation comes from thermal sources. In order to ensure stability in its electricity generation, the government of Colombia, through its Ministry of Mines and Energy, plans to increase the share of non-conventional renewable sources in its electricity mix (such as wind and solar) to 6.5% by 2020; and in the long-term achieve equal generation between hydro, thermal and non-conventional renewable sources (Roy, 2017, Martinez-Villegas, 2018).

The electricity sector in Colombia is unbundled into generation, transmission, distribution and commercialisation. The country's energy sector is regulated by national laws: - Public Services Law (142) and Electricity Law (143) which were promulgated in 1994. The Energy and Gas Regulatory Commission (CREG) is the national institution mandated to regulate activities within the sector (Colombia Ministry of Mines and Energy, 2018). The figure below illustrates the structure and key players in the electricity sector of Colombia.



Source: (Roy, 2017)

As at 2016, electricity coverage in Colombia's urban population is estimated to be 100% whilst 95.7% of the rural population had access to electricity (World Bank, 2018). Despite this wide coverage, Roy (2017) indicated that cities continue to experience frequent power outages, though the period of interruptions has been improving over time due to major government interventions such as: the introduction of reliability charges which encourage electricity generators to produce during times of resource scarcity (for example in drought seasons). Again, the Colombian government has also shown interest in developing smart grids to improve the electricity sector. Its 2030 smart grid vision, among other objectives, aims at establishing advanced metering infrastructure, modernising its automated distribution, and developing well-distributed energy systems for electric vehicles (Roy, 2017).

POLICY & GOVERNMENTS REQUIREMENTS

Support from the local, state and national policy levels



At the national level, the development of sustainable transport modes such as e-bike sharing is supported by the Colombian Department of National Planning. This institution incorporated the development of non-motorised transport in the formulation of its 2011-2014 plan as well as the 2014-2018 National Development plan. In addition, the Colombian Ministry of Transport issued, as part of its mandate, policy actions and guidelines to inform public transportation improvement and sustainability in

cities. In the case of e-bike sharing, the Ministry of Transport as well as the Ministry of Mines and Energy is further mandated to provide support in terms of technical guidance in the construction of bike parking facilities, public charging infrastructure and in the development of user information systems.

Local level support for the development of e-bike sharing systems will be expected from the municipality of Ibagué which is responsible for the delivery of services that promote social, economic, cultural, environmental and territorial development of areas under its jurisdiction (Ibagué Municipality, 2018). As a key stakeholder, the municipality can be instrumental in facilitating the initial consultations and engagements with other relevant stakeholders. Moreover, support activities including technical guidance and reports of preliminary feasibility studies for the project can be sought from the municipality.

Key Stakeholders

- A successful implementation of e-bike sharing systems in the city of Ibagué requires the involvement of several institutions including:
 - The Colombian Department of National Planning (Departamento Nacional de Planeación – DNP) which is mandated to prepare and issue national policies on sustainable development for all sectors of the economy, including sustainable transportation.
 - Colombian Ministry of Transport, which oversees the transport sector and is responsible for the formulation and adoption of transport policies, plans, programmes, projects and economic regulations. The ministry is also in charge of transit and highway infrastructure, maritime, fluvial, rail and air transport modes as well as issuance of technical regulation.
 - The Colombian Ministry of Mines and Energy which exists to “formulate and adopt policies aimed at the sustainable use of mining and energy resources to contribute to the economic and social development of the country” (Colombia Ministry of Mines and Energy, 2018). The ministry oversees the electricity sector.
 - The Colombian Energy and Gas Regulatory Commission (CREG) which is mandated to regulate the energy sector and perform functions such as controlling electricity prices.
 - Ibagué Municipality Administration which as part as part of its mission is committed to building a sustainable city through the preservation and protection of the environment; rational use of resources; and preventing pollution by complying with existing environmental legislations (Ibagué Municipality, 2018).
 - Bicycle user associations and individuals
 - Financial Institutions
 - Electric bicycle selling companies such as “E-legtric” which started distribution of electric bikes in the Colombian city of Medellín and have over the years expanded their distribution network to other cities in Colombia (Berenschot and Urbanos, 2015).
 - Private companies and institutions with interest in advancing the course of bike-sharing systems
 - Civil Society Organisations and Non-Governmental Organisations working to promote urban transport mobility solutions

STEPS TOWARDS IMPLEMENTATION

FEASIBILITY OF THE IMPLEMENTATION

Colombia's commitment to developing sustainable transportation as indicated in its INDCs to UNFCCC sets a positive tone for the implementation of e-bike sharing systems which are considered as environmentally sound transport innovative with benefits for enhancing mobility in urban areas. Establishing e-bikes sharing systems in Ibagué is therefore a feasible innovation as it fits into government's agenda on promoting climate change mitigation and adaptation measures (Republic of Colombia, 2015a). Since there already exists some level of engagements on biking activities as well as government-initiated projects to promote bike-sharing in the city of Ibagué as mentioned earlier in this paper, taking-off with e-bike sharing will only possibly involve the acquisition of e-bikes stock, installation of

charging infrastructure at strategic locations in transport stations, and developing user information for riders. Mobilisation of the necessary resources and engagements with key stakeholders can be done throughout 2019 whilst actual implementation involving the aforementioned actions can start by 2020.



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READINESS

CONCLUSION

- The availability of specific policy guidelines on the development of bicycle infrastructure such as the “Guide for Cycle-Infrastructure for Colombian Cities” issued by the Colombian Department of National Planning (Departamento Nacional de Planeación – DNP) and the Ministry of Transport, can guide potential investors and policy decision-makers and implementers in establishing the required and appropriate e-bike sharing systems in Ibagué.
- The desire to promote bicycle infrastructure development is also evident in Ibagué Municipality’s 2016-2019 Development Plan which acknowledges the need to develop bicycle infrastructure and promote biking as part of efforts to improve transport mobility and reduce the environmental effects of vehicular emissions (Ibagué Municipality, 2016).

- The deployment of e-bike sharing in the city of Ibagué must consider the establishment of the requisite facilities such as parking stations, public charging infrastructure and user information systems.
- The presence of e-bike selling companies in Colombia can facilitate the acquisition of e-bike stocks for the deployment of e-bike sharing system in the city of Ibagué.
- The Colombian government’s determination to promote renewable energy sources can be contributory to the development of solar powered installations to feed the charging facilities for e-bikes sharing projects. Also, the wide electricity coverage in Colombian cities and the vision for smart grid development present an opportunity for the expansion of charging infrastructure systems for e-bikes in Ibagué.
- The multiplicity of stakeholder institutions already involved in advancing bike riding activities may pose a challenge to the implementation of the e-bike sharing initiatives; hence efforts must be made to harmonise institutional engagements and possibly establish an institutional structure to run e-bike sharing systems.
- The existence of local financial institutions and international donors as well as organisations interested in promoting sustainable transport solutions, constitutes an opportunity for securing the necessary funding and investments to implement e-bike sharing projects in the city of Ibagué.
- The Colombian government’s commitment to reducing the negative impact of the country’s transport sector on the environment as indicated in the NDCs communicated to UNFCCC represents a major favorable policy direction for the development of environmentally sustainable transport means such as e-bikes. The deployment of e-bike sharing systems will therefore conform to the country’s drive to mitigate and adapt to the effects of greenhouse gas emissions and climate change; and ultimately improve the lives of the Colombian population especially the urban populace.

Andrade-Castañeda, H. J., Arteaga-Céspedes, C. C. and Segura-Madriral, M. A. 2017. Emisión de gases de efecto invernadero por uso de combustibles fósiles en Ibagué, Tolima (Colombia). *Corpoica Ciencia Y Tecnología Agropecuaria*, 18 (1), pp. 103-112.

Berenschot, N. P. and Urbanos, C. P., 2015. Cycling in Colombia Report of a fact finding mission by the Dutch Cycling Embassy. Available at: <https://www.rvo.nl/sites/default/files/2015/07/Cycling%20in%20Colombia.pdf> [Accessed 03-08-2018].

Cherry, C., Worley, S. and Jordan, D. 2010. Electric Bike Sharing - System Requirements and Operational Concepts. *Electric Bike Sharing--System Requirements and Operational Concepts*, .

Cities Finance Facility, 2017. Colombian cities innovating to provide cycling infrastructure for all. Available at: <https://www.c40cff.org/news-and-events/colombian-cities-innovating-to-provide-cycling-infrastructure-for-all> [Accessed 03-08-2018].

City of Wilmington, 2016. City of Wilmington - Bike Share Feasibility Analysis, Risks and Benefits of Bike Share. Available at: <https://www.wilmingtonde.gov/government/city-departments/planning-and-development/bike-wilmington/bike-share-feasibility-study> [Accessed 03-08-2018].

Colombia Ministry of Mines and Energy, 2018. Mission and Vision. Available at: <https://www.minminas.gov.co/mision-y-vision;jsessionid=PPLgfuOLy8xQ4J3RrgLiciX.portal2> [Accessed 05-08-2018].

Colombia Ministry of Transport, 2013. Sectorial Mitigation Action Plan (SMAP) For Transport Sector In Colombia. Available at: www4.unfccc.int/sites/nama/Lists/NAMA/Attachments/67/20140108%20Transport%20SMAP.docx [Accessed 04-08-2018].
Colombia Ministry of Transport, 2016. PILOTO BICILETAS PUBLICAS 2016. Available at: https://www.mintransporte.gov.co/Publicaciones/asuntos_ambientales/piloto_bicicletas_publicas_2016 [Accessed 03-08-2018].

Heda, A., 2012. Implementation of a Campus Bike Sharing Program for Washington University's Danforth Campus. *Washington University Parking and Transportation Services*. December, 7 pp. 2012.

Ibagué Municipality, 2016. Ibagué Plan de Desarrollo 2016 - 2019. Available at: <http://www.ibague.gov.co/portal/admin/archivos/publicaciones/2016/14981-PLA-20161104.pdf> [Accessed 05-08-2018].

Ibagué Municipality, 2018. Mission and Institutional Vision. Available at: <http://www.ibague.gov.co/portal/seccion/contenido/index.php?type=3&cnt=46> [Accessed 04-08-2018].

Johnson, T. and Fernandes, E. 2014. Low-carbon development for Colombia. Available at: https://www.researchgate.net/profile/Todd_Johnson11/publication/282136441_Low_Carbon_Development_for_Colombia/links/5604c7c808aea25fce31f0b0/Low-Carbon-Development-for-Colombia.pdf?origin=publication_detail [Accessed 04-08-2018].

Martinez-Villegas, A., 2018. Energy 2018 - Colombia. Available at: <https://www.globallegalinsights.com/practice-areas/energy-laws-and-regulations/colombia> [Accessed 04-08-2018].

Procolombia, 2018. Investment Opportunities in Ibagué - Tolima. Available at: <http://www.investincolombia.com.co/regional-information/ibague-tolima.html> [Accessed 2018].

Qiu, L. and He, L. 2018. Bike Sharing and the Economy, the Environment, and Health-Related Externalities. *Sustainability*, 10 (4), pp. 1145.

Republic of Colombia, 2015a. Colombia iNDC Unofficial translation English. Available at: <http://www4.unfccc.int/ndcregistry/PublishedDocuments/Colombia%20First/Colombia%20iNDC%20Unofficial%20translation%20Eng.pdf> [Accessed 04-08-2018].

Republic of Colombia, 2015b. Plan Nacional de Desarrollo 2014 -2018. Available at: <http://progresomicrofinanzas.org/en/colombian-national-development-plan-all-for-a-new-country/> [Accessed 04-08-2018].

Roy, P., 2017. Market Information Report: Colombia. Available at: https://www.marsdd.com/wp-content/uploads/2015/07/AEC_GG_COLOMBIA_2017_April_Final.pdf [Accessed 04-08-2018].
Stratta, P., Panozzo, N., Woolsgrove, C. and **Mayne, K., 2017.** Policy Framework for Smart Public-Use Bike Sharing. Available at: <https://ecf.com/system/files/Policy%20Framework%20SMART%20PBS%20v01Jul17.pdf> [Accessed 03-08-2018].

World Bank, 2016. Productive and Sustainable Cities Development Policy Loans. Available at: <http://documents.worldbank.org/curated/en/161371484078402830/pdf/ICR00003888-12192016.pdf> [Accessed 04-08-2018].

World Resources Institute, 2017. Workshop in Ibagué, Colombia Helps Cities Advance Bike-Sharing Projects. Available at: <https://wrirosscities.org/news/workshop-ibague-colombia-helps-cities-advance-bike-sharing-projects> [Accessed 03-08-2018].

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