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FOR A BETTER URBAN FUTURE



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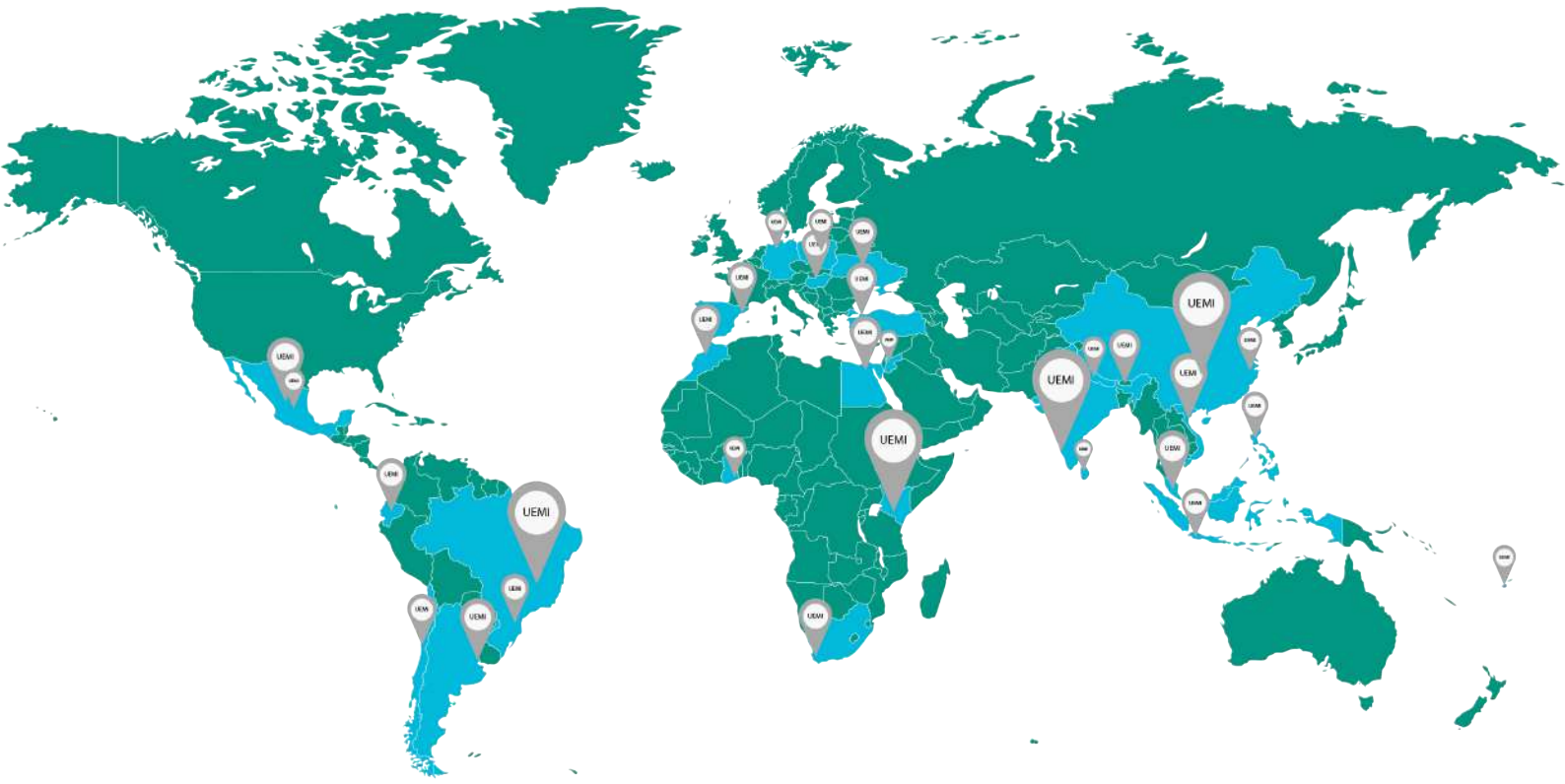
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# SOLUTIONS



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# UEMI SOLUTIONS COUNTRIES

# KEY FACTS & FIGURES

GDP 9,103 USD

QUITO

## CITY

The Metropolitan District of Quito, the capital of Ecuador, is an Andean city in South America located at 2,800 masl. Due to its important internal migration flows the city is at present the largest city in the country with an estimated population of 2.7 million inhabitants. Quito and Guayaquil, with a population similar to the one in Quito, concentrate together not only ca. 30% of the Ecuadorian population, but also ca. 50% of the GDP produced. Quito's GDP per capita is USD 9,103.01.

## CO2 EMISSIONS

In 2011, it generated 5,164,946 tCO<sub>2</sub>-eq, which per capita represent 2.55 tCO<sub>2</sub>-eq. Quito aims at reducing its ecological footprint in 5% every year, starting in 2019. Quito has very good indicators in terms of service provision and coverage, but it is just starting to introduce environmental-friendly practices in their collection and management.

Ecuador, responsible for 0.15% of the global emissions, intends to reduce its energy related GHG emissions in 20-25% by 2025 relative to the emissions of 2011. With the support of the international community Ecuador estimates a reduction of up to 45,8%.

Public transport: 52.2%; School and institutional buses: 9.3%; Private cars: 19.5%; Taxis: 3.3%; Walking: 15.3%; Cycling: 0.3%

0.3% of the trips are made by bikes

# UEMI



# SOLUTIONS



# URBAN TRANSPORT IN QUITO

Quito is the second city in Latin America to have implemented a BRT system, which has been expanded over time, serving a greater area and number of passengers. At present, the system is composed of 5 BRT lines, which cover 136 km with exclusive lanes that cross the city in a north-south direction, completing 887,000 trips every day (Barrera, 2013).

The first BRT line -Trolebús- was implemented in 1995 with 113 trolleybuses running on 37 km of exclusive lanes connected to the electricity grid. This is the only BRT line, which runs on electricity. However, the diesel engines supposed to be used only in case of emergency, were used more frequently than needed. Furthermore, due to the age of the trolleybuses running on this line many have been replaced by diesel buses. In the past 4 years, 80 biarticulate diesel buses were bought to replace some of the oldest buses and increase capacity.

Currently, the BRT system counts on 324 buses (feeder buses not included), from which 87 are 19 years old or older and 37 are 14 years old. These represent 38% of the total fleet of the BRT system (Secretaría de Movilidad, 2018).

In addition, the BRT system in Quito has already reached capacity, not been able to provide safe and comfortable travels to its passengers and generating an important shift towards private cars in the past years. Thus, in 2010 the municipality decided to build the first subway line. The works started in January 2016 and it is supposed to be ready by the end of 2019. It is a 23 km long line with 15 stops and will cost USD 2 billion. The line crosses the city from north to south, serving a similar route than the one done by the BRTs. However, the subway line is not planned to replace the BRT system, but to complement it. Accordingly, the whole public transportation system is being restructured to integrate the new subway line in the most efficient way possible.

Moreover, in October 2017 in a high-level event organized by C40, the mayor of Quito, Mauricio Rodas, committed to renew the bus fleet with electric buses until 2025 to achieve the goal of zero emissions by 2030 (El Comercio, 2017b). Thus, the first electric bus runs operative since November 2017 in one of the BRT lines and the bidding process to purchase the first 60 e-BRT buses was launched in February 2018 (EPMTP, 2018).

# COMPLEMENTARY MEASURES

The Historic Centre of Quito (HCQ) is a UNESCO World Heritage Site since 1978. It is known for being the largest and best-preserved historic centre in Latin America. Every day hundreds of tourists and locals walk on its narrow streets. As a result, the HCQ is one of the areas of the city with more pedestrian traffic.

Unlike tourists, locals visit the area because of its commercial character, which traces back to pre-Columbian times. The HCQ is known by locals because of its affordable prices and unique products.

The UNESCO logo consists of the word "UNESCO" in a bold, black, sans-serif font. It is positioned to the right of a vertical blue bar and is connected to the left by a thin horizontal blue line.

The aforementioned characteristics of the HCQ pose a series of challenges in terms of mobility and logistics. Accordingly, the municipality of Quito has started the implementation of a plan to turn the HCQ into a pedestrian area, which will be accessible only by public transport (electric and the subway), pedestrians and bicycles. The completion of this plan will provide the following benefits:

- Reduced air and noise pollution
- The reduced noise and vibrations in the area will contribute to a better preservation of historic buildings
- Increased safety and comfort of pedestrians and cyclists
- Improved walkability
- Enhanced public space
- Neighbourhood revitalisation

However, this plan would also require complementary measures in terms of mobility and logistics to cope with the changes. In terms of logistics, the HCQ has always faced important challenges, because of commercial character and narrow streets. Accordingly, the decarbonisation plan of the HCQ would definitely profit from the implementation of e-cargo bikes for the product distribution of goods within the area.



# POLICY

# ENVIRONMENT

## National Level

Fuels in Ecuador are highly subsidized. As a consequence, Ecuador is the eighth country in the world with the lowest fuel price and the first in Latin America (USD 0,39/l) (El telégrafo, 2017). The low price of fuel helps keep the prices of public transport (e.g. USD 0,25 per trip in Quito) and of food (transport of goods) accessible to the Ecuadorian population. However, it also makes more attractive the purchase of private cars as they also profit from the subsidies.

Subsidies –not only on fuel but also on natural gas (used for cooking and water heating)- represent a huge burden for the national budget. Thus, 8 hydroelectricity plants are being built, 3 of which

are already operating. These projects will add 2.832 MW to the Ecuadorian energy system with a planned investment of USD 4,7 billions and an emission reduction of 6,29 Gg CO<sub>2</sub>-eq. When this plan is fully completed, Ecuador aims at producing 84% of its energy based on renewable energy (80% hydropower). In this sense, the shift to electric mobility will contribute to reducing the burden of subsidy expenses of the Ecuadorian government.

Furthermore, in 2015 the national government started a tax reduction program to promote the commercialization and purchase of electric cars. Since then electric cars under USD 40.000 do not pay import tax and those under USD 35.000 pay neither VAT nor Tax on Special Items (ICE). Moreover, electric vehicles will have access to a reduced electricity price. Additionally, the national government will promote further incentives among municipalities. A pilot project in Cuenca has been launched, where electric vehicles pay less municipal taxes and parking fees (Araujo, 2015). However, the number of electric vehicles in the country is still very limited, due to the lack of infrastructure. Thus, only 240 vehicles were sold between 2015 and 2017. The number of hybrid vehicles were sold between 2007 and 2017 is 13.400 (Maldonado, 2018).

After signing an agreement with the Ministry of Industries and Productivity of Ecuador, the Chinese electric vehicle company, BYD, announced the investment of 60 million dollars in an assembly plant in the country. This assembly plant, which will be built in the Special Economic Development Zone (ZEDE) of Guayaquil, will produce articulated e-buses of 7, 12 and 18 meters, as well as electric trucks (El Comercio, 2017a). Several municipalities in Ecuador have already been approached by BYD to test electric buses on their public transport fleets. However, due to the fact that in smaller municipalities public transport is provided by private operators, the prices of e-buses in comparison to diesel ones are still unattractive to them. Moreover, the adaptation needs that will need to be made on the electricity grid to cope with the increased demand demotivate the municipalities.

Moreover, the Ministry of Transport and Public Works is currently developing a National Urban Mobility Plan (NUMP) for which the EUROCLIMA+ Programme awarded USD 500,000. One of the topics that will be regulated through this instrument is e-mobility. Accordingly, in September 2018 the Ministry together with the GIZ organised the first International E-Mobility Forum in Ecuador.



## NATIONAL LEVEL



## LOCAL LEVEL

In the past years, Quito has been engaged in international negotiations regarding climate change and the role that cities play in its mitigation and adaptation. For instance, in October of 2017, the Metropolitan District of Quito (DMQ) adhered to the C40 Fossil-Fuel-Free Streets Declaration. According to this Declaration, cities must generate a transition to reduce the use of fuels, by acquiring buses with zero emissions technology as of 2025 and ensuring that certain sectors of the cities are zero net carbon emissions by 2030.

Additionally, to reinforce this commitment, Quito also signed the C40 Commitment to plan Climate Action Deadline 2020: How Will Cities Get The Job Done, which aims at structuring a climate action plan (or a series of plans) that define a consistent and ambitious road map for a local contribution to the Paris Agreement. The aforementioned Plan must be elaborated and underway by 2020, achieve local carbon neutrality and climate resilience before 2050 and establish a goal to monitor these trajectories by 2030.

Moreover, Quito's Environmental Plan in its climate change mitigation section aims to contribute to the goal of reducing the 5% of the DMQ's carbon footprint in relation to its projected growth in the following sectors: sustainable mobility, sustainable construction, public services and compensation, and carbon footprint. With regard to sustainable mobility, the objective of the program is "Reducing the carbon footprint through the improvement of the Integrated Public Transport System, traffic management, and the promotion of alternative means of transport" (Secretaría de Movilidad, 2018).

In order to take concrete actions to implement the aforementioned international, national and local agreements and plans, the Secretariat of Mobility of the Municipality of Quito has developed an Ordinance Proposal on the "Gradual Decarbonisation of Transportation and Promotion of Clean Transportation in the Metropolitan District of Quito". It has already been socialised with the different stakeholders and it is ready to be approved by the Municipal Council. The following incentives and obligations are included in the Ordinance Proposal (Concejo Metropolitano, 2018):

## INCENTIVES

- Commercial, public and private transportation
  - o Exoneration on the annual Technical Vehicle Inspection rate;
  - o Preferential attention at the Technical Vehicle Inspection;
  - o Exemption from vehicle restriction measures (e.g. Odd-even rule)
- Public transport (buses)
  - o Priority attention in the granting of routes or areas of high demand circulation
- Commercial transport (taxis)
  - o In addition to the one established for public transport, priority attention in the location of parking lots and / or parking lots in areas of high demand traffic, sensitive areas, special tourist areas of the city and passenger transfer stations, according to their class of service.
  - o Exemption in mobile advertising rate
- o Authorizes the provision of commercial service by taxi, whether conventional or executive, without territorial restrictions within the Metropolitan District of Quito.
  - o Distinctive and differentiating strip colour for zero emission taxis.
    - Manufacture of vehicles with zero emissions technology:
      - o within the DMQ, the tax benefit will be a fifty per cent reduction in municipal rates and fees. This benefit has a duration of ten non-extendable years counted from the installation and operation of the same.
    - Financing: The Municipality of the Metropolitan District of Quito may promote public-private partnerships that allow public and commercial transport operators access financing mechanisms for the acquisition of vehicles with zero-emission technology.



#### Obligations for public transport

- The bus fleets of all BRT lines are required to include at least 10% of the total fleet is complied with, with vehicles with zero emissions technology.
- Operators authorized to provide public transport service including those operating in the

BRT corridors (exclusive lanes) must present the plans for vehicular renewal with the replacement of combustion units by electric units.

#### Climate Change Commitments

- Create the Inter-institutional Carbon and Sustainable Mobility Commission to generate an annual work agenda for the fulfilment of the Local Commitments on Climate Change, in terms of sustainable transport.
- Monitor the carbon footprint of the transport sector every two years, to generate the Carbon Footprint Inventory of the city and determine progress in meeting climate commitments
- A zero-emissions Historic Centre until 2020: The corridors of the Metropolitan Transportation System that circulate through the Historic Centre of Quito, will be the priority for the replacement of bus fleets with EV.

#### Battery disposal

Manufacturers, marketers, importers and / or distributors of electric vehicles and / or batteries for electric vehicles will have to present battery disposal plans under the principle of extended producer responsibility.



# POTENTIAL CONTRIBUTION

## SDG NUA CO2 EMISSION REDUCTION

The introduction of clean technologies in the transportation system of Quito is one of the first steps towards the decarbonisation goals agreed on the international commitments mentioned in the previous section. Electric vehicles do not emit GHG directly, but its cleanliness depends on the energy matrix to which they are connected. In the case of Ecuador, the energy matrix relies highly on renewable energy (mostly hydropower), which enhances the emissions reduction benefits that can be achieved through electric vehicles. These emissions reductions contribute both to the local goals, as well as to the national mitigation goals set in the NDC of Ecuador.

Moreover, promoting this transition towards cleaner mobility has significant positive effects on the achievement of several SDG targets.

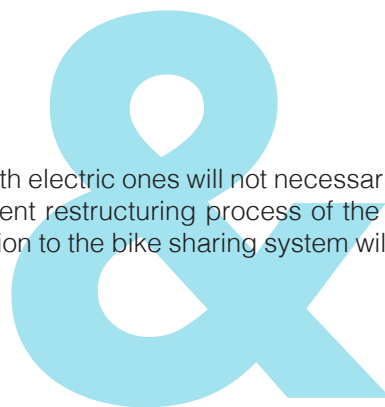
For instance:

- SDG 3: Reduce death of population (30-70 years) from chronic respiratory diseases, cancers
- SDG 7: Increase the percentage of electric vehicles in the public transport system
- SDG 11: Provide safe public transport system
- SDG 12: Reduce the consumption of fossil fuels in the total energy mix
- SDG 13: Take urgent action to combat climate change GHG emitted by the transport sector

Finally, in the NUA the signatories committed to “the generation and use of renewable and affordable energy and sustainable and efficient transport infrastructure and services, where possible, achieving the benefits of connectivity and reducing the financial, environmental and public health costs of inefficient mobility, congestion, air pollution, urban heat island effects and noise”. The implementation of the proposed measure will have direct effects on the public health costs, air pollution and noise.

## ACCESS

The replacement of the BRT diesel buses with electric ones will not necessarily increase the access and mobility of the inhabitants of Quito. Nevertheless, the current restructuring process of the public transportation system to integrate the first subway line, along with the connection to the bike sharing system will definitely have an impact on access and mobility, as well as on modal shift.



## MOBILITY

In 2015, the Metropolitan District of Quito registered a net emission of greenhouse gases of 5,759,189 tons of CO<sub>2</sub>-eq. The Transport sector, the higher emitter, generates 52%, followed by the energy sector with 35% of the city's emissions, and finally the waste sector which accounts for 13% of Quito's emissions. Among the transport sector, diesel vehicles (mostly buses and trucks) represent more than 30% of the sector's emissions (Secretaría de Movilidad, 2018).



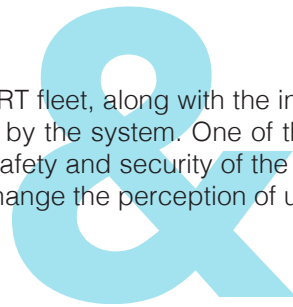
# CO2 EMISSION REDUCTION



Thus, the replacement of the old BRT fleet with electric buses will contribute to the reduction of transport-related GHG emissions. Nevertheless, it is important to mention that private cars represent 85% of the fleet in Quito.

# SAFETY

The lack of maintenance and the age of the BRT fleet, along with the increased demand, have definitely deteriorated the quality and safety of the service provided by the system. One of the reasons for modal shift towards private vehicles in the past years has been the lack of safety and security of the public transport in Quito. Thus, a renewal and increased capacity of the fleet will definitely change the perception of users.



# SECURITY

There are 3 geographical characteristics of Quito that contribute significantly to air pollution. For instance, the high levels of luminosity related to its position on the Equator increase the photochemical reactions that generate smog. Moreover, the smog cannot be easily released due to the lack of oxygen that arises from an average altitude of 2,800 masl, and the fact that the city is located in a valley surrounded by mountains. In this context, the replacement of the old, inefficient and high polluting fleet running on Quito's BRT corridors will contribute to a reduction of air pollution.

According to the information provided by the Research, Analysis and Monitoring Unit of the Secretariat of Environment of the Metropolitan District of Quito, during 2017, 88% of the time (measured in weeks), the air quality showed acceptable levels. Meanwhile, in the remaining 12%, it presented moderate levels of pollution, never reaching alarming pollution levels. However, it is worth noting that Quito's main air pollutants continues to be PM2.5 and PM10, pollutants emitted mainly by combustion sources such as automobiles, open burning, forest fires and industry and sedimentary particles, which are the principal cause of respiratory diseases (Secretaría de Movilidad, 2018).

Furthermore, the implementation of clean mobility projects generates additional benefits related to the reduction of noise emitted by mobile sources. In urban environments, one of the main sources of noise is the operation of the engine of fossil-fuelled vehicles, especially on high traffic density. Electric vehicles do not generate vibrations, which represents an improvement not only to the pedestrians, but also in terms of occupational safety and health to the people whose main economic activity is related to driving.

Thus, the proposed measure provides complementary benefits for the health of the citizens by reducing the incidence of cardiorespiratory and occupational diseases, as well as the pacification of streets caused by the reduction of vehicular noise.

# AIR

# QUALITY

# STEPS TOWARDS IMPLEMENTATION

The first phase of the measure is being financed by a direct loan with the provider. However, it is important to consider that because of the construction of the subway with a cost of USD 2 billion being financed by 4 multilateral banks, the acquisition of more debt might be dangerous for the sustainability of Quito's municipal finances. Other options such as grants, taxes, tariffs, PPPs, etc. need to be explored for the implementation of the decarbonisation plan.

## REQUIREMENTS PILOT PROJECT LEVEL

## FINANCING MECHANISM

The pilot project will be carried out in the Historic Centre of Quito, a UNESCO World Heritage Site, which aims at becoming a pedestrian area, which can only be accessed by public transport (only electric and the subway), pedestrians and bicycles. The first step towards the decarbonisation of the area, the closing of streets for motorized traffic, already started in 2017. By 2020, with the subway in operation, electric buses will be incorporated to feed the San Francisco station, a station in the heart of the HCQ. This should also include e-cargo bikes to transport goods within the area. For the implementation of the pilot in the period 2018 – 2020, year in which the HCQ should be turned into a zero-emissions area according to the Municipal Ordinance being approved, the following actions should be taken:

Activities	Estimated budget	Estimated timeframe	Status
Turned into pedestrian area	ND	2017 - 2020	On-going
Inauguration of subway station	Not part of this project	2019	Confirmed
Replacement of BRT buses circulating in the area with EV	USD 18 – 30 million	2018 - 2019	Being purchased
Implementation of the necessary charging infrastructure	ND	2020	Feasibility study needed
Inclusion of e-cargo bikes for goods distribution	ND	2020	Feasibility study needed
Replacement of regular buses circulating in the area	ND	2020	Planned. Feasibility study needed

# IMPLEMENTATION PROJECT

The municipality of Quito will require USD 18 to 30 million to buy the planned 60 electric buses. To buy the 60 electric buses for the BRT system the municipality of Quito is willing to take a direct loan with the bus producer. To replace all the buses older than 13 years, it will need an investment of USD 37 to 62 million. Thus, the replacement of the whole BRT fleet to be replaced until 2030 will cost between USD 97.2 million and 160 million. The plan will look as follows:

■ 30 MILLION USD

■ 60 ELECTRIC BUSES

Phase 1	Replacement of 60 buses 19 years old or older
	On-going
	Period: 2018 - 2019
Phase 2	Replacement of the 64 remaining buses older than 14 years old
	Planned
	Period: 2019 - 2020
Phase 3	Replacement of the remaining 200 BRT buses gradually according to their age
	Planned
	Period: 2020 - 2030
Phase 4	Replacement of the feeder buses fleet gradually
	Not initiated yet
	Period: 2020 - 2030
Phase 5	Replacement of the conventional bus fleet (private operators) gradually
	Not initiated yet
	Period: 2020 - 2030

In order to be successful, both the pilot and the concrete project need to be complemented with:

- Rigorous pre-feasibility and feasibility studies on all phases
- Implementation of adequate charging infrastructure
- Awareness and socialisation campaigns with stakeholders and civil society in general
- Policy advocacy campaigns
- Curricula development, training and capacity building
- Knowledge transfer
- Development (and control) of rigorous battery disposal plans
- Standardisation of charging stations and batteries

## Technology requirements

Charging infrastructure is key for the promotion of a long-term decarbonisation plan. However, appropriate infrastructure does not exist yet in Quito. There are some underlying issues that need to be considered:

- Not existing charging infrastructure for e-buses and EV
- The electricity system is based on 110V infrastructure, not the required 220V one. Thus several changes in the electricity grid might be required to bear a shift towards e-mobility
- Lack of skilled people for the maintenance of EV

Rigorous feasibility studies before the implementation and promotion of e-mobility, as well as a comprehensive long-term plan are required to address all the elements and challenges of such a project.

# ELECTRICITY MIX & RELIABILITY OF THE GRID

Ecuador has put most of its GHG emission reduction efforts on the energy generation sector. Accordingly, 8 hydroelectricity plants are being built, 3 of which are already operating. These projects will add 2,832 MW to the Ecuadorian energy system with an investment of USD 4.7 billions and an estimated emission reduction of 6.29 Gg CO<sub>2</sub>-eq. In 2015, 26,462 GWh of electricity were produced, from which 52% came from renewable sources, mainly from hydroelectric power plants, and the rest from thermoelectric power. The contribution of other renewable sources was very low with approximately 2%, from which the majority comes from biomass (MAE, 2017). The final outcome of Ecuador's plan, should be reflected in a significant change in the energy matrix producing 80% of electricity with hydropower, 16% with thermoelectricity and 4% with other renewable sources (MAE, 2017).





# POLICY & GOVERNANCE REQUIREMENTS

## SUPPORT FROM THE LOCAL, STATE AND NATIONAL POLICY LEVELS

The current mayor of Quito, Mauricio Rodas, has shown a great commitment in front of the international community towards achieving the goal of zero emissions by 2030. However, the elections for local authorities in Ecuador will take place in February 2019 and he will not run for the re-election. This means that the involvement of the new municipal authorities is necessary to pursue the initiated project. The political will and priorities of the new elected mayor will be crucial to push the project forward.

However, it is worth noting that the national government is currently developing a National Urban Mobility Plan (NUMP) supported by the European Union Programme EUROCLIMA+, in which the incentives and guidelines for the implementation of e-mobility in Ecuadorian cities will be included.



# KEY STAKEHOLDERS

In order to complete the project, the municipality has to include the private sector. Whereas the municipality will be in charge of the renewal of the BRT and feeder buses, the private transport cooperatives should be in charge of renovating their own fleet. Moreover, the implementation of e-cargo bikes and e-bike sharing systems in different areas of the city will not be possible without the participation of the private sector. However, due to the relatively high prices of electric vehicles, the appropriate incentives will be needed for their purchase.

Furthermore, the development of a comprehensive set of studies at the national and local levels in order to understand deeply all the necessary requirements of the implementation of such a technology are vital. In this sense, the technical support of national research institutes and universities will be crucial. An example will be the Public Research Institute of Renewable Energy (ENER by its Spanish acronym)

Finally, the participation of the electricity public enterprise of Quito (EEQ by its Spanish acronym), as well as the national authorities related to energy generation and distribution (e.g. Ministry of Electricity and Renewable Energy), who will be responsible for adapting the electricity network to the new generated needs, generating the adequate regulations and incentives for the sector and setting the fees.



# STEPS TOWARDS IMPLEM ENTATION

## FEASIBILITY OF THE IMPLEMENTATION

The interest and political will from the municipality and national government of Ecuador are there. However, at the technical level, more studies need to be conducted to generate the necessary inputs for implementation of a zero emissions long-term plan.

Due to the fact that most of the BRT corridors are operated by a public enterprise created for the purpose, the renewal of the operating buses with e-BRT buses is not as difficult as in cities, where the operators are private. However, when it comes to the long-term decarbonisation plan, they will have to negotiate with the private bus operators that circulate outside the BRT system. In this phase, the political process must become more complex if the economic incentives are not in place yet.

### Timeframe

The replacement of the 324 BRT buses will be a gradual process starting in 2018 and ending in 2030. The replacement of the feeder buses of the BRT system and regular diesel buses circulating outside of it will happen in parallel starting in 2020. By 2030, Quito will reach the goal of having decarbonised its public transport.

## SUMMARY

The current administration has shown a great interest at the international level in working on a decarbonisation plan for Quito that will start with the replacement of the BRT diesel fleet with electric buses. Some actions such as the ordinance project currently being discussed in the Municipal Council have been pursued towards concrete action. Moreover, the first e-BRT is already circulating in the city and 60 more are currently being purchased. The pilot project in the Historic Centre of Quito has already been defined. At the national level, a National Urban Mobility Plan (NUMP) is being developed, which will include guidelines and regulations related to e-mobility. Nevertheless, the mayor to be elected in 2019 might shift the political priorities, as the current mayor will not run for re-election. Finally, the feasibility studies required to guarantee the success of such a measure have not yet been conducted. Several changes in the electricity grid will have to be done for a successful shift to e-mobility.



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