



This project has received funding from the European Union Horizon 2020 research and innovation programme under grant agreement No. 875041

solutions
plus



User Needs Assessments

Hamburg, Madrid, Quito, Montevideo, Pasig,
Hanoi, Kathmandu, Kigali, Dar es Salaam

Imprint

Title

User Needs Assessment

Cities

Hamburg, Madrid, Quito, Montevideo, Pasig, Hanoi, Kathmandu, Kigali, Dar es Salaam

Cover picture:

© pixabay

This document is issued under the SOLUTIONSplus project, which is funded by the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 875041.

This document reflects only the author's view and the Agency is not responsible for any use that may be made of the information it contains. This document and its content are the property of the SOLUTIONSplus Consortium. The content of this document can be used and distributed provided that the SOLUTIONSplus project and the document are properly referenced.

Each SOLUTIONSplus partner may use this document in conformity with the SOLUTIONSplus Consortium Grant Agreement provisions.

Project Partners



Contents

User Needs Assessment - City Report: Hamburg.....	1
User Needs Assessment - City Report: Madrid	10
User Needs Assessment - City Report: Quito.....	20
User Needs Assessment - City Report: Montevideo	36
User Needs Assessment - City Report: Pasig	74
User Needs Assessment - City Report: Hanoi.....	91
User Needs Assessment - City Report: Kathmandu.....	100
User Needs Assessment - City Report: Kigali.....	115
User Needs Assessment - City Report: Dar es Salaam	133

User Needs Assessment – City Report

City: *Hamburg*

1 Approach

This user needs assessment builds upon (1) an online survey to assess city aims, implementation aspects, and key barriers and limitations to e-mobility solutions and (2) a set of stakeholder interviews. The interviews were carried out by Wuppertal Institute, UITP and Virtual Vehicle between November 11, 2020 and December 14, 2020. Interviewees represented the following stakeholder groups:

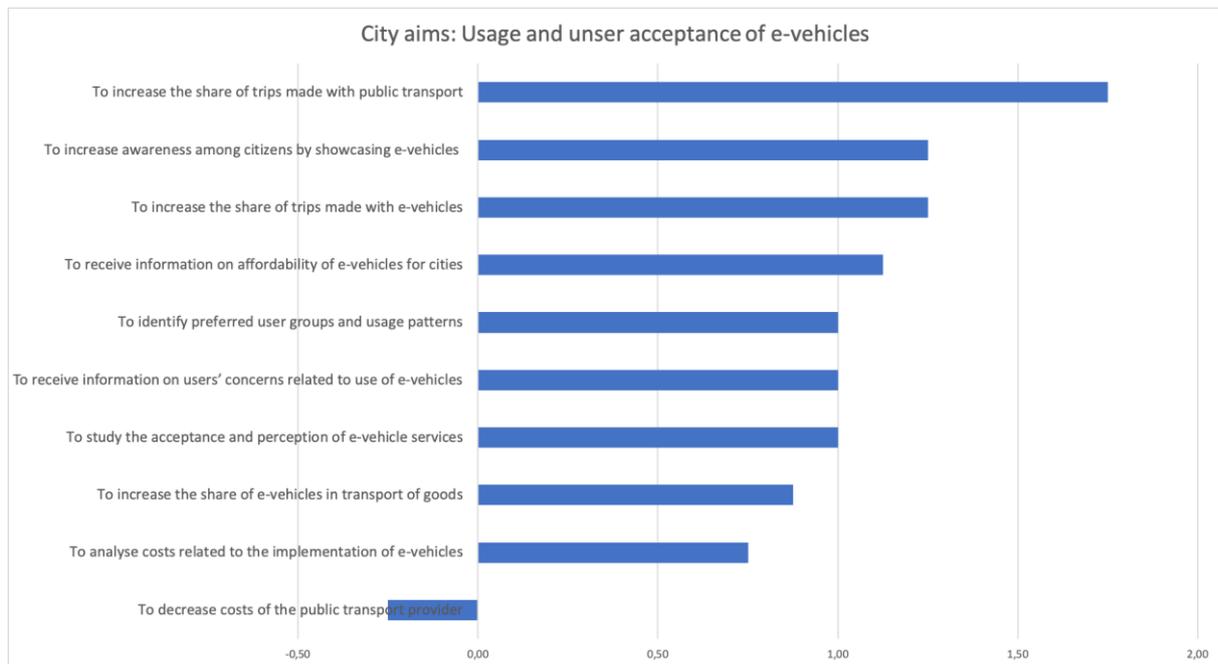
Stakeholder Group	Company / Institution	Number of interviewees
Public transport operator	Hamburger Hochbahn AG, department for Change and innovation	2
	Hamburger Hochbahn AG, ITS department	2
City administration	Department for Transport and Mobility Transition	1
	Department for Economy and Innovation Hamburg (BWI)	1
Mobility provider	Ioki	1
Implementation agency	hySOLUTIONS GmbH	1
Charging provider	T-Systems	1

The user needs assessment is an ongoing process. Further interviews will be conducted as the demo project evolves and additional relevant stakeholders become visible and/or available. These include providers of new mobility solutions, passenger associations, academia and research projects, or the environmental administration. Findings will continuously be integrated into this working document.

2 Results – Survey

This section outlines the most important findings of the online survey. We received 8 responses, mostly from public transport operators. Respondents were asked to evaluate the importance of city the following aspects, using a scale from -2 (not important at all) to +2 (very important).

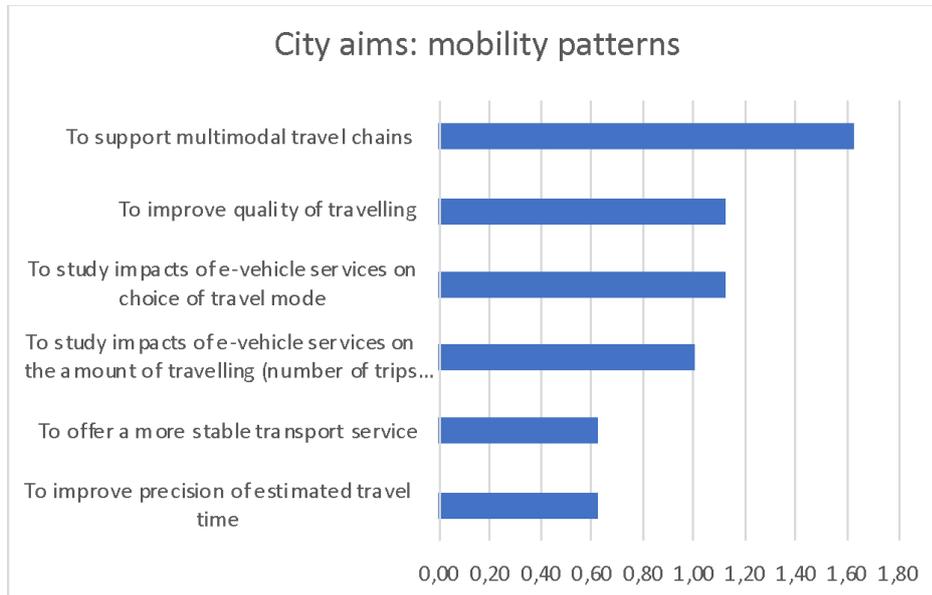
City aims- Usage and user acceptance of e-vehicles



Regarding the usage and acceptance of e-vehicles, respondents rated the feeder function for public transport highest (score 1.75 out of 2). The increase of awareness among citizens and the increase of e-vehicle trips were also considered important city aims, but achieved a lower rating. This suggests that the demo project should be considered as a building block to the entire public transport system (ensuring first and last mile connectivity of mass transport systems) rather than an individual transport option on its own.

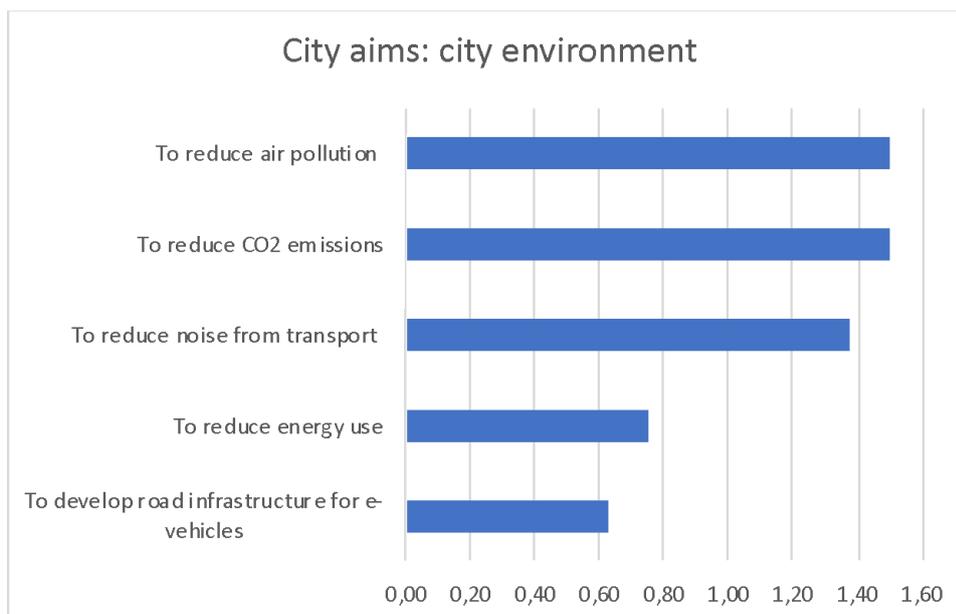
Gaining a better understanding of affordability, user groups and usage patterns, user concerns, and acceptance of e-mobility solutions were also considered important aspects and achieved a positive rating between 1,25 and 1. Decreasing the costs for the public transport operator was the only category that received a negative rating (=not important).

City aims: mobility patterns



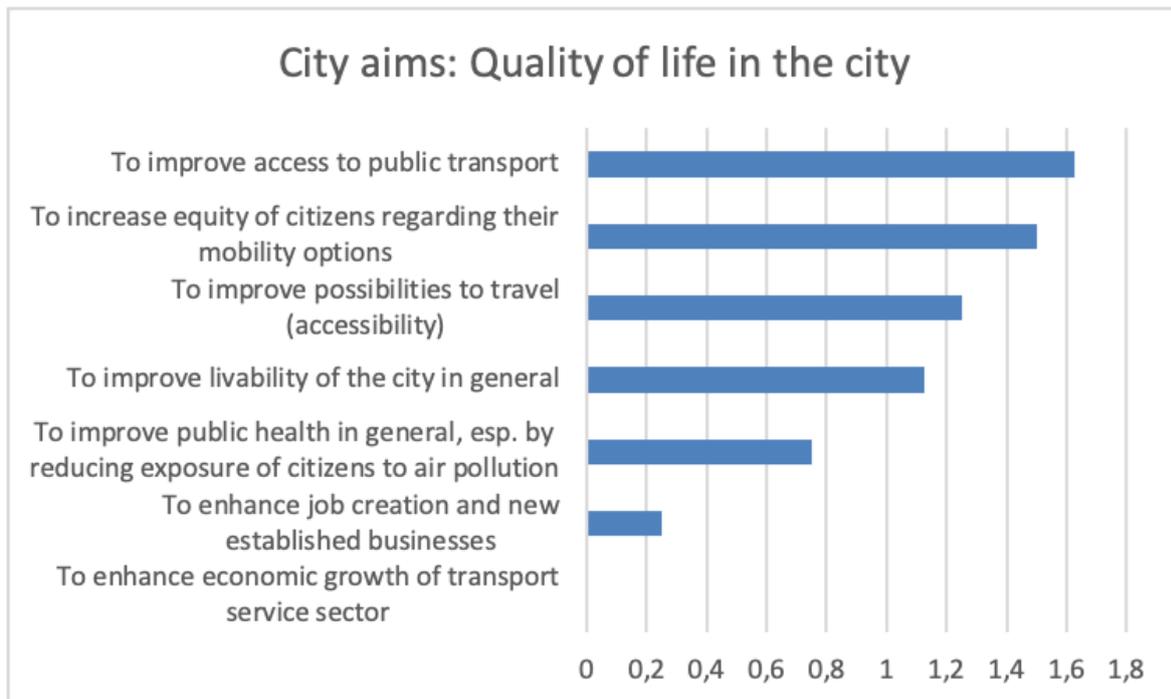
The focus on multi-modality and the service function of the demo project for the entire public transport system – as identified in the question above – was confirmed in this question: supporting multimodal travel chains was considered most important (score: 1.75 out of 2). Improving the quality of travelling and studying the impacts of e-vehicle services on the choice of travel modes also received high ratings (1.13). The stability of transport service and improving the precision of estimated travel time was considered less important, though still with a positive rating.

City aims: city environment



Concerning the environmental dimension, the reduction of air pollution, CO2 emissions and noise were rated very important (rating between 1.38 and 1.5 out of 2). Reducing energy consumption and the development of charging infrastructure was also considered relevant, albeit with lower ratings (<1).

City aims: quality of life in the city



Here again, the contribution to the public transport system was highlighted: improving access to public transport and equal mobility options for all received the highest rating. Job creation and economic growth opportunities were considered less relevant.

Implementation and obstacles, limitations and barriers

Regarding the implementation (questions 12-17), the most important findings are:

- 7 out of 8 respondents rated transport of people as most relevant use case for Hamburg's e-mobility solution.
- Suburban areas (7/8) and the city centre (6/8) were identified as the venues where the e-vehicles will be used.
- Main target groups of e-vehicles in Hamburg are 'all citizens' (6/8) Three out of eight respondents also mentioned each 'commuters' and 'young people'.
- E-vehicles may be used most for commuting (7/8), followed by trips related to leisure (6/8) and other job-related trips (5/8). Shopping (4/8) and school trips (2/8) were mentioned less frequently.
- For transport of goods, e-vehicles received low ratings between 4 (City and private companies) and 1 (other entrepreneurs).

The most challenging factors for successfully implementing the e-mobility solution were: investment need for the infrastructure (6/8), a lack of financial resources (4/8) and a low user acceptance (4/8). Other barriers were considered less important.

3 Results – Expert Interviews

3.1 Aims of the city and Expectations of Stakeholders

Window of opportunity and positioning as a role model for innovative transport system

Overall, interview partners used a very positive and innovation-oriented framing of e-mobility solutions in Hamburg (rather than a problem-driven perspective). They perceived a window of opportunity for changing citizen’s mobility behaviour towards multi-modality and public transport: while elder population groups tend to use their private cars, the increasing share of younger people in the city is considered to be more open for innovative solutions, to be more flexible in their mobility behaviour, and to be more willing to use multimodal transport options and sharing systems.

These circumstances are perceived as an opportunity for the city to become a role model for innovative transport system (ITS) cities with a future proof mobility system. Interviewees from the public transport provider compared solutions in Hamburg to the performance of other German municipalities (e.g. compared to Berlin for an integrated mobility app; or to Munich in relation to e-charging infrastructure), which implies a perceived ‘race to the top’ for the most innovative mobility solutions between German cities.

Interviewees agreed that their most important objective was to push the mobility transition, to implement and to test new solutions and to work towards Hamburg’s image as role model for future mobility. One focal point that was mentioned by several stakeholders is the upcoming *Intelligent Transport Systems Congress*, which is scheduled to take place in Hamburg in October 2021.

Venue for new mobility solutions

One interviewee mentioned the absence of major car industry in the city as an asset: Being a “user-venue” and not a “manufacturer location” allowed to test and to validate a variety of new mobility solutions, without the pressure to accommodate the concerns of local car manufacturers. As a result, a range of e-mobility services are being implemented in Hamburg: These include Volkswagen’s ridesharing service MOIA, which uses exclusively e-mini buses and currently operates under an experimentation license; and the ridesharing service IOKI, which is a subsidiary of the major German railway company (Deutsche Bahn). Other than MOIA, IOKI operates under a line concession for the regional transport organisation, serving a route with fixed start and destination points but with flexible stops along the route. Moreover, several e-scooter providers are active mostly in the city centre, but tending to expand their area of operation towards the outskirts.

The regional transport organisation HVV has recently implemented a **mobility app** which allows an integrated booking of mobility services. The app currently includes the public transport operators HVV and Hochbahn AG (which operates the subway and large parts of the city bus system), but also the private ride sharing operator MOIA. An integration of further car- and bike-sharing providers (ShareNow, Cambio and StadtRAD) is planned for the future. In context of Hamburg’s demo project, the E-scooter provider TIER Mobility should be integrated in the mobility app. Still, interviewees mentioned that the payment for private operators takes place via their individual apps; a deeper integration that also includes a payment functionality will be explored in the future. The development of the app was funded through the city administration and using federal funds.

Implementation of the ‘Hamburg Takt’

Multimodal public transport should become more attractive and the ‘natural choice’ for mobility options in the city. Getting citizens out of their private car and into public transport required the provision of new solutions specifically outside the city centre: By 2030, the city aims at providing access to a transport service within 5 minutes for all citizens in the entire urban area. The realisation of this “*Hamburg Takt*” requires the integration of on-demand mobility solutions with traditional public transport. Some mobility hubs that facilitate multimodality and combine public transport with shared mobility offers already exist in the city.

Environmental Concerns

Beyond the innovation side, most interviewees also stressed the need to reduce greenhouse gas emissions, as stated in Hamburg’s *climate protection plan*. The plan foresees the reduction of CO₂-emissions by 55% until 2030 and by 75% by 2050 (compared to 1990 levels). The sectoral target for the mobility sector is -45% by 2030. The city’s updated climate protection plan explicitly mentions measures such as ‘linking the traditional public transport with sharing and on-demand services’ and the provision of multimodal mobility offers in residential areas as contributions to achieve the city’s climate targets.

Expected insights from the demo project

Regarding the insights they hoped to gain from the demo project, most interviewees conceived the demo as one – rather small – building block to make public transport more attractive and accessible.

Concerning the **operational aspects**, interviewees expected to better understand whether the operation is financially viable, how e-scooters can be integrated into a high quality and broadly accepted public multimodality offer, and how potential users could be incentivized to use shared electric scooters as first- and last mile services. This also relates to the specification of the scheme, for example whether the system should be station-based or free-floating (with defined return-zones around public transport stops).

Other stakeholders were interested in **measuring impacts**, i.e. whether the demo contributes to a shift from private car use to public transport, and which means of transport are being replaced (car, walking, cycling, bus). Participants also indicated interest in the average length of trips and how many person-km are being replaced, also in relation to trip distances in the city centre, which are rather short.

3.2 Regulation

The regulative environment was considered suitable for the implementation of the demo project. No stakeholder raised concerns about regulative barriers for the demo project or the upscaling. The 2019 ‘Personal Light Electric Vehicles Regulations’ approved and regulates the use of e-scooters in public areas. Interviewees stressed that free-floating sharing systems do not require an official permission; and the on-going operation of e-scooter providers in the city centre proved that using and sharing e-scooters was legally allowed.

The low legal requirements, in turn, led to the concern that the city might lack the means to effectively regulate the operations of e-scooter sharing providers. Up until now, the city used Memorandums of Understanding (MoU) to influence the operations of scooter providers. MoUs include the consent not

to exceed the maximum number of 1,000 e-scooters per provider, the establishment of a complaints management system, or the provision of mobility data. Moreover, the city has the competence to remove improperly parked scooters. While MoUs were considered relatively effective in such respects, they could not be used to force providers to expand their operation area beyond the city centre.

3.3 Obstacles, limitations, barriers

Interviewees identified the general **public opinion** towards e-scooters as a potential barrier to the demo project: Scooters tended to be considered as ‘urban pollution’ – specifically if they block sidewalks – or as vehicles for tourists rather than as a genuine means of transport. One interviewee raised concern that weather conditions in winter might reduce the demand for shared scooters.

Some interviewees raised concerns that the designation of **physical parking and return zones** around public transport stations required the consent of the land owners. This might prove difficult in cases where the ground is not owned by Hochbahn AG and/or when city districts might be reluctant to dedicate scarce public space. Still, other stakeholders pointed to the general willingness of city districts to support the mobility transition and to reduce car traffic, to the relatively minor space requirement of e-scooters and charging solutions compared to e-cars and e-buses; others suggested to define virtual return zones rather than physical zones around public transport stations.

Finally, some interviewees pointed to the **logistics behind** the sharing systems: relocation, charging, and servicing of the scooters was still carried out with diesel vans. They raised concerns that this might reduce public acceptance and compromise the environmental performance of the sharing system.

The **political environment** was considered extremely supportive. Specifically, the entry of the Green Party into a government coalition was conceived as a facilitating factor for e-mobility projects, the extension of the public transport offer, and pedestrianisation of inner-city areas. The relevant **administrative departments** and city districts were also considered to play a supportive role. The former Department for Economy, Transport and Innovation was split up and a new Department for Transport and Mobility Transition was founded in 2020. E-mobility and the development of public and private charging infrastructure remained under the responsibility of the Department for Economy and Innovation. Despite split competencies and partly diverging objectives (i.e. the reduction of private motorised mobility vs. electrification of public and private mobility), interviewees from both departments mentioned a high level of exchange on the operational level between the two entities.

3.4 Sustainability of the e-Mobility solutions to be implemented

Social dimension:

During the interviews, **E-mobility in general** was positively correlated with healthier cities and higher life expectancy. Still, the socially unjust distribution of scarce urban space in favour of motorized individual transport could not be solved through electrifying private cars but required a profound change of the mobility system.

Regarding the **individual demo project**, the dimension of accessibility was stressed by most participants. This was mostly related to the ‘Hamburg-Takt’ which requires that by 2030, each citizen should have a mobility service available within a 5 minutes reach. Solving low accessibility issues – specifically in suburbs and in the southern city area – required the integration of flexible public transport options. Some interviewees also stressed that public transport offer needs to remain affordable and potential additional costs should not be passed on to passengers. Other interviewees

mentioned that scooters parked on sidewalks or knocked over could be a dangerous obstacle for elderly or visually impaired persons.

Interestingly, the useability of e-scooters for elder or young people (below the admission age of the scooter providers), for people with disabilities, or for people with small children was not questioned during the interviews.

Ecological dimension:

Participants noted a positive contribution of the (electrified) **public transport system** on the emission of greenhouse gases and air pollutants. Since Hamburg exceeded European air pollution limits, the city has imposed transit bans on some streets for diesel fuelled vehicles. Interviewees agreed that shared scooters could support the modal shift towards public transport and thus contribute to reducing transport related environmental problems. Still, the ecological benefits of the **demo project in isolation** were critically questioned:

- Interviewees mentioned that e-scooters had a short service life expectancy (due to their technical lifetime but also to vandalism) which leads to a high level of resource use.
- The energy provision needed to be based on renewable energies; and the collection, servicing, and relocation of e-scooters still was done with diesel fuelled vans (though one interviewee mentioned that the MoUs asked for using emission free vehicles and renewable energy).
- Other interviewees were concerned about the substitution of walking / cycling or public transport rather than replacing private car use. Some stakeholders mentioned that the use of scooters should be 'fun', implying that the distance would normally not go beyond the way to next public transport stop.

Economic dimension:

Stakeholders from the implementation agency and the mobility provider stressed that mobility offers needed to be economically viable over the long-term, specifically for private operators. However, they also noted that new solutions often required support for the initial operation period and for upfront investments in vehicles or charging infrastructure. For example, a representative of an implementation agency claimed that e-buses were more expensive to purchase than diesel fuelled, but achieved lower total cost of ownership over the entire life-cycle. Financial support could be provided through national funding programmes or in the framework of research projects.

On the other hand, representatives of public transport operators expected that due to the low transport demand in sub-urban areas, new mobility services required continuous financial support.

In a broader economic sense, the demo was considered as one building block to the City's aim of becoming a role model for ITS innovations and future mobility systems and thus a potentially positive contribution of future economic development.

3.5 Impact on existing business models

The impact of the demo project on the existing mobility service sector was considered minor, due to the small size of the demo. Other interviewees claimed that scooter trips ('not further than to the next public transport station') were too short to be profitable for taxi drivers. Since no other mobility services were active in the demo areas, interviewees expected no impact on existing business models.

3.6 Implications for Planning and Urban Development

Mobility Planning:

Getting people out of their private car and into public transport requires a convenient, easy to access, and reliable public transport offer. Some interviewees stressed that the transfer from one means of transport to another should be easy. Multimodality required integrated thinking and should be facilitated through physical exchange hubs and IT solutions (such as an integrated app).

Urban Planning:

Interviewees saw the most important implications for urban planning in the local impacts on the urban streetscape around mobility hubs: planners need to provide parking and charging infrastructure in densely populated districts with competition for scarce urban space. Experiences gained from demo projects (what works / what does not) could be used to design new urban developments in a way to discourage private car use. Successful examples from previous experiments that were replicated comprised the provision of car sharing stations in residential districts. Moreover, some interviewees mentioned the importance of integrated planning and of a public participation process.

Energy Planning:

Due to the small scale of the demo project and the decentralised charging of e-scooter batteries, no major impact on the energy grid was expected and no need for an exchange with grid operator was needed at that stage. Most interviewees expected that a broader electrification of the mobility system, including private cars and buses, will impact the electricity network in the long-term. A profound change of the fuel base – from oil to electricity – could lead to a 40% increase in peak loads and required the digitalization grid connection points.

User Needs Assessment – City Report

City: Madrid

Project SOLUTIONS+

Provided by WP1 team, responsible: DLR / Mirko Goletz, mirko.goletz@dlr.de

Version: 12.10.2020

This document complements the User Needs Assessment Guideline.

https://drive.google.com/file/d/12F3_C5g0doKrdDYdzgLQKFHj1c8VLbqV/view?usp=sharing

1 Approach

The User Needs Assessment (UNA) has been carried out by Wuppertal Institute (Stefan Werland), UITP (Michele Tozzi) and VIRTUAL VEHICLE RESEARCH GMBH (Alois Steiner), as project partners members of the Madrid city teams, with the support of EMT (EMPRESA MUNICIPAL DE TRANSPORTES DE MADRID SA) as the leader of the S+ demo in Madrid. This task was kicked off in November 2020 with the identification of stakeholders active in the city/region of Madrid and relevant for the topic the city demo is addressing, i.e. smart charging for e-buses and promotion of e-mobility in the taxi, car-sharing and – potentially – last-mile delivery sector, by promoting easy access to new charging infrastructure. The full list of stakeholders identified is reported in Table 1, grouped by target group according to the approach defined by WP1 and in line with the user-definition in SOLUTIONS+. All selected stakeholders have been contacted and invited to contribute to the task according to their expertise and knowledge of the Madrid demo.

Table 1 – List of stakeholders identified as relevant for the Madrid UNA

Target group	Stakeholder
Public Transport Companies	EMPRESA MUNICIPAL DE TRANSPORTES DE MADRID SA – EMT
National / Regional / Local Authorities	Madrid City Council
	CONSORCIO REGIONAL DE TRANSPORTES DE MADRID - CRTM
E-Vehicle OEMs	BYD
	Irizar
Private Transport companies/ mobility providers	SHARE-NOW
	CityLogin
Electricity and charging infrastructure companies	ABB
	IBERDROLA

The majority of the stakeholders identified expressed their interest and availability in contributing to the User Needs Assessment activity and the findings are reported in this document. However, the UNA is an ongoing process and further interviews will be conducted as the demo project evolves and additional relevant stakeholders become visible and/or available. These might include car-sharing, taxi or logistic operator as well as passenger association and academia. Findings will continuously be integrated into this working document.

The UNA is to be performed via 2 activities: (i) an on-line survey and (ii) a set of stakeholder and expert interviews. Both are designed to grasp the perspective of local decision makers, operators and relevant stakeholders with respect to e-mobility and therefore investigate the suitability of the e-mobility solutions to be tested in Madrid vis-à-vis their needs and requirements as well as local barriers and opportunities.

- I. The online survey has been considered suitable only for the stakeholders fully informed about the design and implementation of the Madrid demo. Overall, 3 responses have been totalised.
- II. On the contrary, all the stakeholders listed in Table 1 have been invited to take part in the expert interviews. Overall, 7 interviews have been conducted, totalising 9 experts, as reported in Table 2.

Table 2 – Stakeholders interviewed for the Madrid UNA

Stakeholder Group	Stakeholder name	Stakeholder abbrev.	Method (Interview, Survey, KPI)	Date
Public Transport Companies	EMT	A1	Interview, KPI	19/11/2020
Regional / Local Authorities	CRTM	B1	Interview, KPI	2/12/2020
	Madrid City Council	B2	Interview, KPI	4/12/2020
E-Vehicle OEMs	BYD Europe	C1	Interview	6/01/2021
	Irizar e-mobility	C2	Interview, KPI	10/01/2021
Electricity and charging infrastructure companies	ABB	D1	KPI	12/01/2021
	Iberdrola	D2	Interview, KPI	9/12/2020

2 Results – Survey

The survey data was collected by using a self-completion online questionnaire consisting of twenty-four items measured using five-point Likert scale from -2 “not at all important” to 2 “very important”, multiple-choice questions and open questions. The survey included five major sections: city identification (Question 1), city aims (Questions 4 to 11), implementation (Questions 12 to 18),

obstacles, limitations and barriers (Questions 19 to 21), and finally, background questions (Questions 22 to 26).

As already stressed, for the case of Madrid the online survey was considered suitable only for the stakeholders fully informed about the design and implementation of the SOLUTIONS+ demo. Overall, 3 responses have been gathered, all representing the stakeholder A1. Due to the low number of responses, only some qualitative conclusions are reported in the present document, while the full analysis is available in the project on-line repository.

Regarding the City Aims (Questions 4 to 11), according to stakeholder A1 the priority for the usage and acceptance of e-vehicles is “To decrease costs of the public transport provider”, which got the maximum degree of importance (2.0), followed by “To increase the share of trips made with public transport”. The latter is in line with the mobility patterns aims, where “To support multimodal travel chain”, “To study impacts of e-vehicle services on choice of travel mode” and “To improve quality of travelling” have been identified as the most relevant ones. Overall, e-mobility solutions seem to be conceived as a factor to improve the supply of public transport services in the city and eventually modify the modal shift towards more sustainable mobility behaviours.

Fleets renewal to support the decarbonization of transport is a key objective for the Region of Madrid (see 3.4) and the local public transport operators. This is confirmed in the question on the city environment where the “To reduce CO2 emissions” and “To reduce pollution (NOX, CO, PM10, PM2.5, VOC)” are rated as the top priorities (scored 2.0). Indeed, electric vehicles are also able “To reduce noise in road transport and living areas” which have been scored 1.67 out of 2.00.

The focus on the potential benefits of e-mobility for the citizens’ wellbeing is again confirmed by the quality of life aims, being “To improve public health in general, esp. by reducing exposure of citizens to air pollution” (2.0) and “To improve livability of the city in general” (1.67) and “To enhance economic growth of transport service sector” (1.67), have received the higher scores. The physical wellbeing is therefore combined with the economic one.

Regarding the Implementation section (Questions 12 to 18), Madrid e-mobility solutions are primarily designed for the mobility of people across the city centre for all type of trips, from commuting to leisure and shopping. The stakeholders involved in providing and operating the services are the City together with public and private operators.

The main challenges to face for a successful implementation of the e-mobility solutions in Madrid (Questions 19 to 21), are respectively “Lack of money / financial resources” (3/3) and “Investments in the infrastructure needed” (3/3), followed by “Organizational issues” (2/3) and “Lack of service operators / people to operate the e-vehicle service” (1/3). Regulations are not seen as a main barrier, according to the comments of the respondents:

- “Existing legislation does not preclude the implementation and deployment of electric vehicles”, and
- “In principle, current regulations are quite favourable to electric mobility. It is rather a matter of financial constraints, electricity supply, availability of charging infrastructure and the lack of vehicle models that can compete in terms of price with the current ICE ones (despite the financial support for their acquisition provided by different administrations)”.

While the availability of financial resources is again confirmed as the main barrier:

- “The main barrier is economic. The transition to electric mobility won’t be possible until the vehicles’ prices become competitive with those of ICE vehicles”, and
- “For private users, in addition to the above, there is also the perception that an electric vehicle cannot compare to an ICE in terms of range, which is still true, although there are more and more new models with higher ranges. But this means that outside the urban environment e-vehicles are still seen as a second car option, for example”.

3 Results – Expert Interviews

3.1 Aims of the city and Expectations of Stakeholders

Questions related to the city’s goals and the local stakeholders’ expectations have been addressed to all the experts interviewed.

From a public transport operator’s perspective, testing in real-life charging solutions for e-vehicles is key. Providing an efficient charging system and charging strategy to a continuously growing e-fleet is one of the main challenges stakeholder A1 is facing. Since the early 2000s, Madrid has been testing different types of electric and hybrid buses. Currently 83% of the stakeholder A1 bus fleet is clean or low-emitting. This is complemented by a fleet of over 2,500 pedelecs distributed across the 258 stations of BICIMAD, Madrid’s bike sharing system. Beyond the services operated by stakeholder A1, the mobility ecosystem is quite active in Madrid, with taxi, ride-hailing and a wide number of shared mobility companies operating around 14,000 shared electric vehicles among cars, motorbikes, and e-scooters.

S+ demo is for stakeholder A1 an opportunity of testing new charging solutions and infrastructures, improve their expertise for the upscaling of the electric fleet from an operational perspective (e.g. upgrading their facilities) as well as for the definition of requirements for future tenders.

The Madrid demo seems to be fully in line with the goal of the City Council and the regional public transport authority. Different fleets (buses, scooters, taxis, bikes, trucks for last-mile delivery or waste collection) are currently experimenting or looking at e-mobility in the Madrid region. This is also the result of the ambitious goals set-up by the City Council in its Sustainability Strategy “Madrid360”, among them reaching a network of 150 fast charging points by 2023 and reaching an electric bus fleet of 668 buses (out of 2003) by 2027. Recently, the City has also announced the goal to have a bus fleet diesel-free in 2023. A tender for more than 100 fully electric buses has been already published.

Local decision makers have expressed the need to gain knowledge from real-life tests on the technical and financial feasibility of smart charging solutions when applied to several fleets of different vehicles with different operational needs. This knowledge will guide, for instance, the future tenders for the renewal of the bus fleets in the whole Madrid region. By the end of 2024, new tenders will be published with higher requirement in terms of clean vehicles, being today 20% of fleet the target to meet.

For an OEM, a demo project is where their clients (e.g. public transport operators or logistic operators) want to verify the capabilities of the vehicles, their technological features, and their driving capacity. With the present electric vehicles and technology, stakeholder C1 is looking in the near future at how to implement these technologies especially into the ‘last-mile’ solutions. The flexibility of charging and

medium driving range allows the vehicles with the current technology to run for long hours in urban environment.

Continuous investments are expected in public transportation, and that means more electric buses will be in operation within cities, providing benefits to the passengers and residents, due to the reduction in sound and air pollution. Stakeholder C1, as a world leader in new energy vehicles, and the forerunner of battery technology, has the longest operational experience in electric buses in the world. They believe that a growth in e-mobility will be seen in other transport sectors, such as the logistic sector. Here the attention is mainly on electric trucks for the last-mile, being the technology already available to start operating, as the range of electric truck models recently launched seems to confirm.

Stakeholder C2 sees electromobility in urban areas as a trend “that came to stay”. Cities are aware of the importance of air quality and wants to grow in a sustainable way; to do so, it is necessary to implement “mobility policies that bet on the environment”. In addition to the shift of traditional public transport services to e-mobility (like buses), the last 5 years many solutions have appeared in cities, such as Madrid, which combine a clean propulsion technology with the sharing concept, like electric bikes, electric skates or electric scooter, since younger generations have not the purchasing power as their parents. New technologies and business models open the way to sustainable ways of travelling in cities.

Finally, the city’s goals and the local stakeholders’ expectations have been discussed with stakeholder D2, a global energy leader, the number one producer of wind power, and one of the world's biggest electricity utilities in terms of market capitalization. Even though D2 is not a partner of the S+ Madrid demo, they are in the process of collaborating with the City of Madrid to find good solutions to make the charging services of e-fleets more efficient and provide tailored services for different vehicles. Also, they are the energy provider of city public transport operator and an agreement has been recently signed to work together on the electrification of the urban bus network of Madrid, with the aim of consolidating sustainable mobility as an alternative to traditional transport. Therefore, stakeholder D2 shares the same objectives of the S+ Madrid demo and they are highly interested in its outcomes and the potential for the upscale of the project.

3.2 Regulation

The current national and regional regulation addresses several aspects related to the implementation of e-mobility in Madrid, however the expert interviews have pointed out, on one hand, the need to include in the regulations all the elements involved in e-mobility (from the funding instruments to the installation of charging infrastructure in public or private building, to the governance of e-micromobility) and on the other hand, specific aspects that still need to be properly addressed.

Stakeholder A1, for instance, reported the need to adapt the existing regulations of low voltage applied to buildings.

For stakeholder B2 one key aspect is that new solutions, such as some fast-charging technologies, still lack appropriate regulations on safety and security which are normally addressed at national level. This seems to be due to the novelty of the solutions and the lack of information on the field: it is not yet clear what needs to be covered by the regulations in such a multidisciplinary environment. There is the need to prove that new solutions and regulations comply with the national safety and security requirements, e.g. to ensure safety in relation to charging or the operation of clean vehicles. For

instance, gas-fuelled vehicles are not allowed in some in-door public transport interchange infrastructures in Madrid.

Looking at the smart charging to be tested in Madrid, one element to be considered for the upscale of the project is certainly developing clear guidelines and instructions for the installation of fast charging solutions, such as pantographs, in public spaces. This aspect was stressed by both stakeholder B1 the B2. In fact, the installation of charging infrastructure might require licenses released by different authorities at municipal, regional or national level. A simpler regulative framework is needed to integrate all different stakeholders and reduce the barriers for the implementation.

From an operational perspective, there is the need to adapt regulations dealing with taxi (existing regulation seems to not respond anymore to the changing urban mobility ecosystem) and micromobility as well as in a scenario of continuously growing e-fleets there is the need to investigate the access to charging infrastructure for fleets of private vehicles.

Stakeholder D2, as a member of the Spanish association for electro-mobility (AEDIVE, <https://aedive.es/>) is actively working to lobby on regulations that could help developing e-mobility in Spain. In their view, regulations on e-mobility in Spain have been improving significantly in the last years and overall they are on the good path. Aspects that need further deployment are:

- Administrative barriers for the legalisation of charging solutions. Current processes, often very long and time consuming, need to be reviewed and discussed with local, regional and central authorities.
- Role of private and public actors in e-mobility. Public administrations have a key active role in the promotion of e-mobility. EU regulations establishes that charging services are to be provided by private operators. Public Administrations should facilitate the access of private operators in the market and allow the private sector developing business models to facilitate efficiency and increase competitiveness.

3.3 Obstacles, limitations, barriers

Stakeholder A1 sees as the main challenge to face for the operation of e-buses in Madrid the power supply, since in the areas where the facilities are located (and the buses have to be charged) the power that can be supplied by the electricity company has been almost reached, as well as in other areas across the city centre. For an upscale of the SOL+ demonstration, beyond the project lifetime and scope, there is the need to investigate the quality and the capacity of the electricity distribution network and assure the possibility to supply enough energy in key locations across the city. The same point was also raised by stakeholder B2, who is aware that additional power infrastructure might be necessary for the deployment. The challenge, as stressed by stakeholder D2, is to provide the power needed when the whole bus fleet operated by the city operator will be electric and make it available at facilities (bus depots) located within a city like Madrid.

This is a multidisciplinary environment and requires the involvement of several expertise (e.g. energy provider, energy distribution company, public transport and mobility operator, OEMs, ITS providers) as well as multiple levels of public administrations. The commitment and the involvement from early stage of all the actors involved in the electrification of mobility in cities has been mentioned as critical by almost all the experts interviewed. This should lead to the definition of a roadmap, where potential

obstacles, like compliance of the e-components to existing regulations as well upfront costs, are timely addressed.

In addition to the collaboration between the private and public administrations, stakeholder C2 pointed out the need to further investments in R&D.

According to stakeholder C1, one of the biggest challenges to the deployment of electric vehicles is dealing with autonomy and mileage. Apart from improving charging power technology, if charging stations can be built as many as the gas stations, more and more customers would choose electric vehicles, also thanks to the support of big data and cloud service to provide smart charging management. Electric vehicles have the potential to realize more applications and support the shift to autonomous driving, thus electric vehicles will eventually replace gas-powered vehicles as smart phones replace traditional phones.

Additionally, as of today there is an absence of charging infrastructure dedicated to electric trucks in the EU. So far, the European Commission has set infrastructure deployment targets (Directive 2014/94/EU), but these only apply to filling stations / charging points for cars and vans – not those for heavy-duty vehicles. This sets a really big setback in rolling out trucks since customers will not want to invest in a transport solution without the right infrastructure.

Stakeholder C1 pointed out the need to adapt the market conditions in Europe to foster international green cooperation. Cooperation already exists between European countries and international stakeholders, however greater transparency and fairer market conditions in Europe – an environment where international businesses are encouraged to compete on a level playing field, are seen as key to boost the deployment for both demo and scale-up projects.

There is a clear need for greater policy support in Europe, especially for international companies wishing to export New Energy products and services. This support should come from governments and it includes funding, as financial help is essential for multiple industries; not only passenger cars, but also public transport and the logistic sector which seems to lack a detailed policy support strategy.

3.4 Sustainability of the e-Mobility solutions to be implemented

Investigating and testing in real-life the feasibility of smart charging solutions for electric vehicles is considered key by all the local stakeholders interviewed in the process of making urban mobility more sustainable in Madrid. In fact, electric mobility is a pillar of several strategic plans at national, regional and municipal level which set ambitious sustainable goals for the coming years. Among them:

- the first Climate Change and Energy Transition Law to achieve emissions neutrality by 2050, aligned with the EU Green Deal, recently drafted (May 2020) by the Spanish Government.
- the Air Quality and Climate Change Strategy of Madrid Region, so-called “Plan Azul +”, in line with the Sustainable Development Goals set by the European Union, provides funding for fleet renewal, among others, with the goal to help the decarbonization of transport.
- the new sustainability strategy “Madrid360” of Madrid City, launched in September 2019, which sets specific target for electric mobility (see 3.1) and air quality (e.g. reducing the nitrogen oxide emissions by 20% until 2023).

Stakeholder B1 sees the opportunity to capitalize on the findings of the S+ demo to guide the renewal of the bus fleets in operation not only in the city of Madrid but also in the suburbs and the surroundings, where a significant mobility demand can be met within a relatively small distance, with a potential target of 1M people living in an area up to 10km far from the city. To achieve environmental goals, it is important to have electric vehicles implemented in the whole Madrid region and - at the same time - focus on green energy and therefore work on the energy sources used to meet the energy needs. The less noise associated to e-buses in comparison with traditional buses is seen as a positive factor not only as a benefit for the city, due to its impact on the noise pollution, but also to improve the working conditions of bus drivers. In a social sense, the shift to e-buses is not expected to produce any relevant impact, as for the goal of the regional transport authority is actually to provide at least the same service which is today provided with traditionally fuelled buses so that the users will not perceive a discontinuity.

From a wider perspective, supporting the deployment of electric technology and e-mobility services is seen as an opportunity to boost the economy, by developing new business opportunities based on emerging technologies. Sharing services, that are taking advantage of the electric revolution, are also associated to accessibility and social inclusiveness concerns.

For stakeholder C1, COVID-19 has led to de-globalisation and businesses have suffered as a result. The climate challenge, however, is ever-present, and it affects us all. We must re-engage with one another – internationally – to underline the urgent need to reduce our carbon footprint. We must all adopt a sustainable ‘mindset’, where all parties work in harmony to create a total solution to efficient transportation with continuous technological innovation.

3.5 Impact on existing business models

From the perspective of the bus operator, the business model is not significantly impacted by the shift to electricity, as operations with e-buses and with diesel-fuelled buses are carried out in a similar way, taking into account the difference in terms of performances.

It is expected that the multiple business sectors related to fossil fuels will progressively adapt to the new scenario, where the request for new propulsion technologies will increase at the expense of fossil fuels. This process is already on-going.

According to stakeholder D2, the development of successful business models and opportunities is possible only if public administrations recognize the role of the private sector in the process of electrifying mobility in cities and allow private partners to step in.

Technology is advancing very fast and electro-mobility is a sector of future growth, therefore the OEMs that are betting and investing in electro-mobility solutions are already adapting their business model to this new scenario.

There is need for vehicle manufacturers to control and understand the entire electric motor and technology, from the drive axle, the electric motor, the design of the electric systems to the power supply. Stakeholder C1 is an example of an OEM who has a unified technology development for passenger cars and commercial vehicles which gives the company a complete understanding of how

the electric vehicles work, from the raw materials to the final product. This approach simplifies the life of the customers, as the OEM serves as a one-stop shop.

This shift in the business model is already being implemented by OEMs worldwide.

Partnerships is also identified as a strategic factor for OEMS to face the transition to electric vehicles. As an international player, stakeholder C1 recognizes partnership as a key value. One of the first examples includes the partnership with Daimler AG to develop electric vehicles since 2010 and partnering with Alexander Dennis Limited (ADL), the largest bus producer in the UK since 2015.

In Europe, stakeholder C1 is committed to “Made in Europe for Europe” development concept. With their local R&D center based in the Netherlands and two factories in France and Hungary, they aim to cooperate locally, nurture local businesses, engage with universities and start-ups and create job opportunities. In this sense, partnership to promote e-mobility ensure benefits for multiple stakeholders.

Finally, it was pointed out that the deployment of e-mobility on a large scale asks for employees with the needed expertise for both operators and industries. Trainings and new curricula are needed to re-train the current employees and form the future workforce. This can certainly have an impact on academia and research business.

3.6 Implications for Planning and Urban Development

In the deployment of the Madrid e-mobility solutions urban planning goes hand-in-hand with the planning of the transport and the energy network. It is well-know, for instance, that the deployment of e-buses requires adaptations to the urban spatial planning. Key factors are, among others, the location and distribution of bus hubs, availability of space at bus stops for opportunity charging facilities, bus stop and bus bays design (position of the bus vs the charging technology), re-design of the bus depot to house the necessary charging infrastructure.

Stakeholder B2 sees e-mobility as one of the tools to reduce the use of private cars in the coming years by offering a wider offer of mobility services. Madrid is already a demo city for e-sharing services, such as electric car and motorbike sharing, and the local authorities are willing to further support the deployment of such services as a complement to traditional public transport. This implies policies to supply parking and charging facilities both in dedicated areas (e.g. public transport operator parking facilities) and on-street. For the time being the charging points are not enough and are mainly located in the city centre. Actions are needed to supply specific charging points for sharing services and deploy them in a bigger area to extend the services outside the city centre. Plans exist to offer electric solutions and infrastructure also for the logistic and last-mile delivery sector. These initiatives are already part of the overall urban transformation and are complementary to solutions to further support sustainable mobility behaviours such as increasing pedestrian areas and bike lanes. Also they are key element of new urban development patterns to reduce the use of private cars.

Fleets of electric buses in operation in the city require dedicated charging infrastructure as well. Stakeholder B1 commented on the difficulty to build such infrastructure which are very often not seen positively by local administrations. Charging solutions and strategies might need to adapt accordingly. Also, bigger bus depots equipped with powerful electric supply are needed. The lack of such infrastructure within cities might slow down the shift to e-mobility.

Planning implications for the transport system include the design of the routes and the operation of the fleets to be adapted to the electricity scenario. For instance, regional bus routes are very dynamic with routes and schedule changing very frequently. Opportunity charging would not be an option in this case. Potentially a different design of the network might come up with a backbone of main routes (no change in the route nor schedule) and feeder flexible routes.

According to stakeholder A1, the city of Madrid is already actively adapting its urban planning to a scenario where e-mobility will have a bigger role. For instance, by deploying charging infrastructure with public access across the city, forcing to install charging facilities at public underground parkings, setting incentives for electric vehicles and restrictions for those more pollutant in terms of dedicated infrastructure and accessibility. As already stressed by stakeholder B2, the implications of e-mobility on urban planning and development are complementary to the overall plan to make the urban environment more livable by promoting sustainable mobility behaviors, like walking and cycling, and offering a diverse and integrated offer of mobility services.

As an operator, stakeholder A1 is aware that working with electric vehicles requires a change in the way of operating the fleets, as a new technology perform well only if deployed in its best operational conditions. The designing of the whole transport system is affected, from the vehicle to the infrastructure (bus stops, bus depots, dedicated lanes, charging facilities) to the operational dimension (network and route design, fleet management, maintenance and depot operations, workforce skills and training, investment and tendering). In fact, any change derived from the introduction of e-buses must be able to ensure safe and reliable operation, offering service excellence without compromising the versatility and flexibility of bus operations. Finally, the adaptation of the energy network (grid supply) requires investment and timely planning, also considering the impact that this might have in terms of public works.

According to the stakeholder D2, the challenge to face is to meet the power needs of a growing and diversified electric fleet. Buses, taxi, last-mile delivery trucks, motorbikes, bikes, private cars, car sharing, etc. All of them need to be charged and this requires an accurate planning of the needed electricity power in order to optimize the power availability. Optimization might include a strategy time-based, where some vehicles are charged over-night (e.g; buses at the depots) and others are charged at daytime.

User Needs Assessment – City Report

City: Quito

Project SOLUTIONS+

Provided by WP1 team, responsible: DLR / Mirko Goletz, mirko.goletz@dlr.de

Version: 04.12.2020

This document complements the User Needs Assessment Guideline.

https://drive.google.com/file/d/12F3_C5g0doKrdDYdzgLQKFHj1c8VLbqV/view?usp=sharing

1 Approach

Quito, Ecuador's capital, aims to develop demonstration actions directing to improve passenger connectivity and last mile deliveries by implementing small electric vehicles (2-, 3-, and 4-wheelers) in the Historic Center of Quito (HCQ) to become a low- emission zone (LEZ). The user needs assessment (UNA) for the city of Quito is carried out to identify the user needs, expectations and preferences that must be taken into account to assist the city ambitions directing to improve passenger connectivity and last mile deliveries by implementing small electric vehicles (2-, 3-, and 4-wheelers) in the Historic Center of Quito (HCQ), which aims to become a low- emission zone (LEZ). Therefore, information was gathered on the city's background, current mobility situation and to ascertain the desired solutions as well as available options to support decision making. For this purpose, two qualitative methods were applied: online survey and interviews.

1.1. City report objectives

The main objective of this city report is to present the user needs methodology approach implemented for Quito by identifying the steps undertaken and the team involved. In addition, this report presents an overview of the user needs findings and self-reported responses covering the topics pre-defined by the project SOLUTIONSplus consortium team of Work Package 1, (DLR and VTT, 2020).

This report is organized as follows. The first section presents the key stakeholders whose perspectives, experiences and strategies were the basis to conduct the UNA. Section 2 presents the responses collected through the online survey. Section 3 presents the results of stakeholders' interviews.

1.2. User needs assessment steps and team involvement

The UNA research approach consisted of an online survey and semi-structured interviews involving key stakeholders for Quito municipality and was conducted according to the instructions on the SOLUTIONSplus project user needs assessment (DLR and VTT, 2020).

Quito's city team involved with the UNA activities consisted of the following partners: city representatives, WP1 representatives (VTT) and WP4 representatives (WI and UEMI).

The activities undertaken for the UNA implementation involved three major steps with the contribution of city teams as summarized below.

- First, key stakeholders were identified by the city representatives with the support of the WP4 representatives.
- Second, an online survey and interviews were conducted by the city representatives with the support of the WP4 representatives.
- Third and last, results of the UNA were documented and reported by WP1 (VTT) and WP4 (WI and UEMI) partners.

Table 1 identifies targeted stakeholders and the corresponding group that were selected to carry out the UNA with the application of an online survey and semi-structured qualitative interviews. Based on the stakeholder relevance for Quito’s e-mobility solutions matter, stakeholders were invited to participate in both online survey and interview, whereas others were invited to participate in the online survey only which link was sent by the City Teams by email. For those stakeholders taken part in both methods (online survey and interview), the survey was filled in during the schedule allocated to conduct the interview.

TABLE 1: Selected stakeholders and applied research methods for Quito’s UNA.

Stakeholder		Method and Sample Size	
Stakeholder group	Organisation Name	Online Survey (N)	Interviews (N)
National / regional / local authorities	Mobility Secretariat	3	1
	Environment Secretariat	3	1
	Territory Habitat and Housing Secretariat (STHV)	1	1
	Urban Planning Metropolitan Institute (IMPU)	1	
	Central District Administration (CDA)	1	1
	Metropolitan Control Agency (AMC)	1	
	C40	1	
Public transport company	Metropolitan Public Transportation Company (EPMPTQ)	1	1
Passenger / individual traveller / consumer	Historic Centred Buró (HCB)	1	1
Original equipment manufacturers (OEMs)	SIDERTECH	1	1
Service providers (delivery services) ()	Bixi Mensajería Tulcán y Bixi Cargo Ecuador	1	1
Electricity and charging infrastructure companies	ABB Ecuador	1	1
Academia/ Research	Institute for Innovation in Logistics and Productivity (CATENA-USFQ)	1	1
	International University of Ecuador (UIDE)	1	

In total, 14 key stakeholders were involved in the UNA for the city of Quito leading to the completion of 19 online surveys and the selection of four interviews that were selected for presentation in this city report. Those stakeholders represent different participants groups, such as National and local authorities, public transport companies, service providers and academia and research. The online survey and interviews were conducted between November and December 2020.

2 Results – Survey

The survey data was collected by using a self-completion online questionnaire consisting of twenty-four items measured using five-point Likert scale from -2 “not at all important” to 2 “very important”, multiple-choice questions and open questions. The survey included five major sections: city identification (Question 1), city aims (Questions 4 to 11), implementation (Questions 12 to 18),

obstacles, limitations and barriers (Questions 19 to 21), and finally, background questions (Questions 22 to 26).

Quito’s online survey responses were gathered across 19 key stakeholders representing the six participant's group previously identified in Table 1. The participant's ages ranged from 29 to 52 years (M=38,54 yr , SD ±7,80). A copy of Quito’s online survey responses can be accessed here [Online Survey QUITO responses040121.xlsx](#) .

2.1 Quito city aims

For city aims questions (items 4 to 11), using five-point Likert scale, the importance rating assigned by stakeholders was computed based on the counts of each point Likert scale (e.g. stakeholder response “-2”) and its corresponding weighting factor (e.g. “-2” for point scale “-2”) as presented in the equation below. An overview of the online survey responses and importance assigned by stakeholders with respect to city aims are presented through Figure 1 to Figure 4.

$$Importance\ Rating = \frac{[Count("-2") * (-2) + Count("-1") * (-1) + Count("0") * (0) + Count("1") * (1) + Count("2") * (2)]}{Number\ of\ responses}$$

The most important aim for the city is “To analyse costs related to the implementation of e-vehicles” with importance assigned by stakeholders of 1,68, as shown in Figure 1.

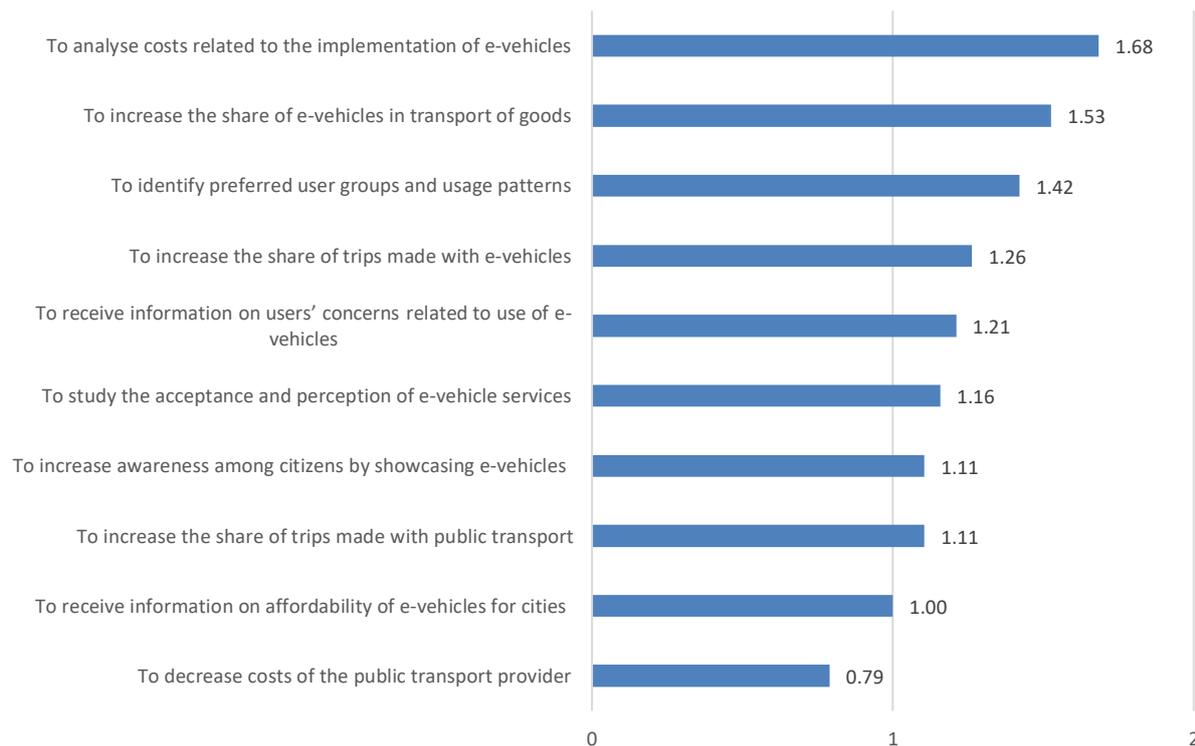


Figure 1: City aims related to usage and user acceptance of e-vehicles and importance assigned by stakeholders (Likert scale -2 “not at all important” to 2 “very important”).

Other important aims regarding usage and user acceptance referred by the stakeholders (accordingly to the open question 5) are summarised as follows:

- To identify the user's perception of change, what benefits the user receives when using electric vehicles;

- To generate passenger connectivity and last-mile logistics efficiency in pedestrianized areas;
- To identify the importance of sustainable urban mobility as a mechanism for economic reactivation; mitigation of environmental impacts and strengthening of the social fabric;
- To determine what the mobility needs are in the Historic Center (e.g. commerce, tourism);
- And to collect information on the purchasing power of the user to electric vehicles.

For the city mobility patterns, the most important aim is *“To support multimodal travel chains”* (1,59), in Figure 2.

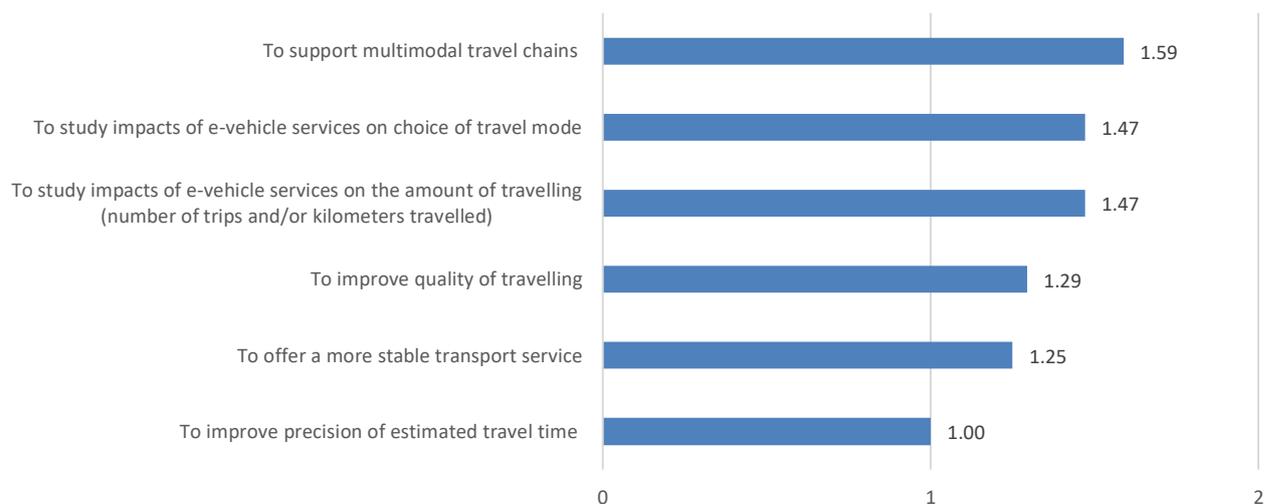


Figure 2: Mobility patterns aims and importance assigned by stakeholders (Likert scale -2 “not at all important” to 2 “very important”).

Other mobility aims identified by Quito’s stakeholders are (accordingly to the open question 7):

- To create solutions for last mile for LEZ;
- Facilitate access to the historical centre of the city;
- And study the need for incentives that could promote these mobility solutions.

For the city environment, the two most important aims are *“To reduce pollution”* and *“To reduce CO2 emissions”* (1,94), as shown in Figure 3.

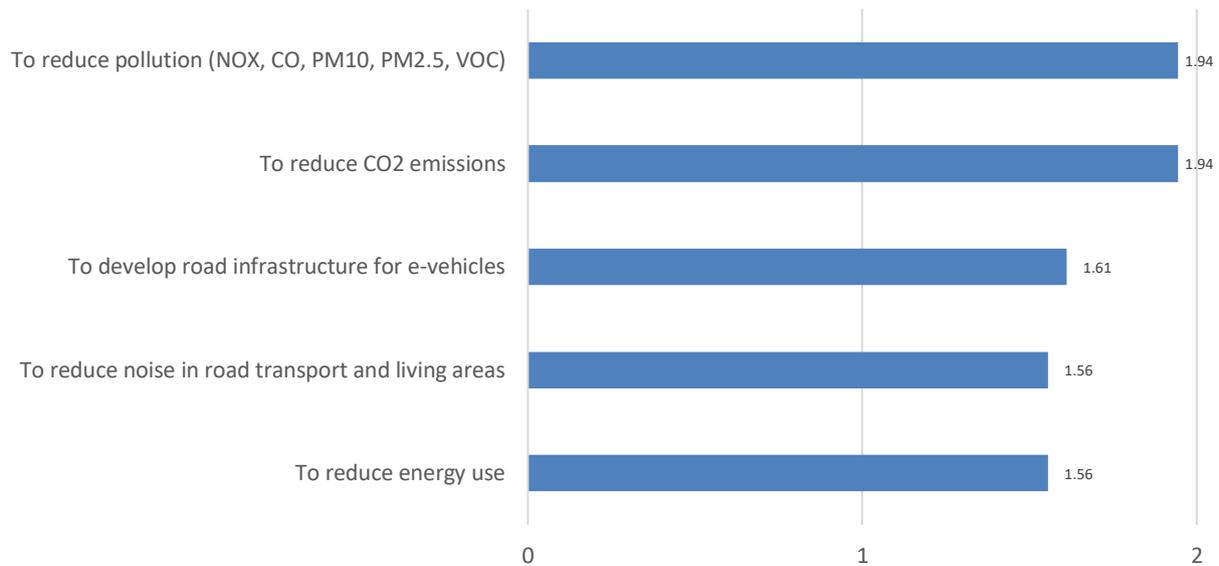


Figure 3: City environment aims and importance assigned by stakeholders (Likert scale -2 “not at all important” to 2 “very important”).

Other city environment aims include:

- To promote environmental education and public awareness;
- And to improve “public distribution” by increasing the space allocated to non-motorized transport vehicles or motor vehicles with better sustainability.

For the quality of life in the city, the most important aim is “*To improve public health in general, esp. by reducing exposure of citizens to air pollution*” (1,72), in Figure 4. In addition, “*To enhance job creation*” was also considered very important (1,56).

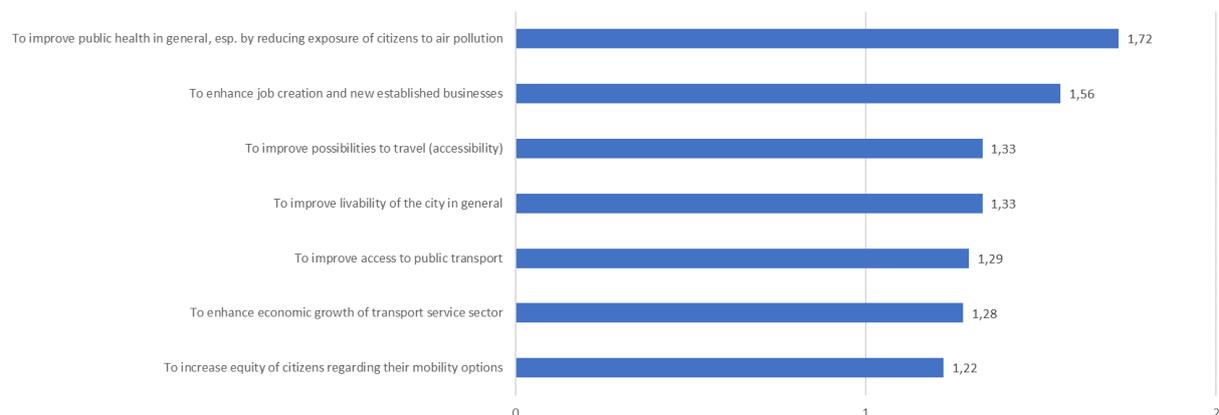


Figure 4: Quality of life in the city aims and importance assigned by stakeholders (Likert scale -2 “not at all important” to 2 “very important”).

Other city environment aims include:

- To increase coexistence between users of different modes of transport;
- To boost the economy of the transport sector and other sectors in the CHQ through the generation of green jobs.
- And contribute to the generation of new business models.

2.2 Implementation

For implementation questions (items 12 to 18), the results are presented based on the counts for each multiple-choice question options. An overview of stakeholder’s responses with respect to the city e-vehicles implementation is presented next. For the targeted use cases for e-vehicles in Quito city, last/first mile delivery was identified by 18/19 stakeholders, followed by the transport of people (16/19) (Figure A, in the Appendix).

Other targeted use cases include recollection of wastes, maintenance and food truck and cleaning parks, botanical gardens and tourism.

All the responders (19/19) identified “*Transport of people / delivery of goods in city centre*” as an area where e-vehicles will be used, (Figure B, in the Appendix).

In the transport of people, all citizens were the targeted user group of the e-vehicles with more relevance identified by stakeholders (11/19), followed by people with disabilities and senior citizens (6/19), in Figure 5. Other user groups were: pregnant women; families, logistics and tourism.

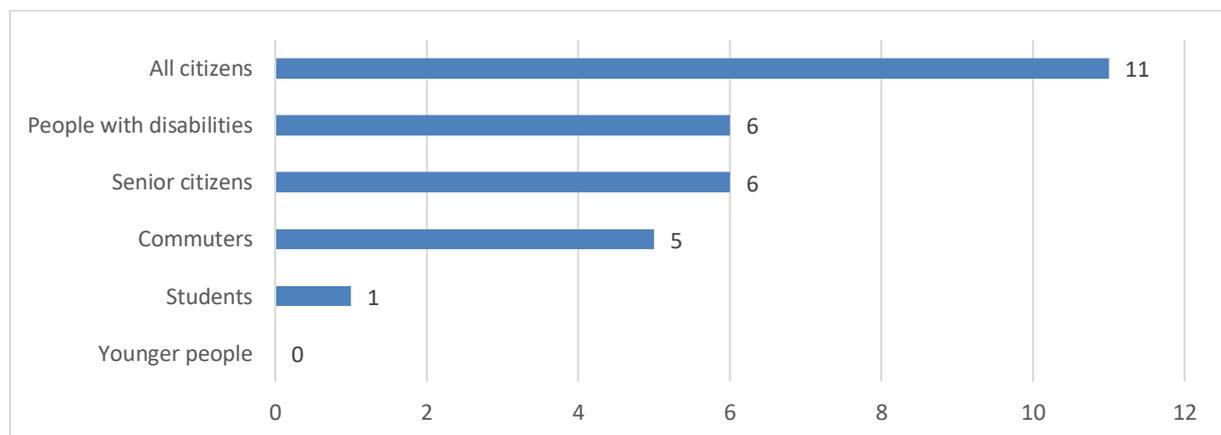


Figure 5: Targeted user groups of the e-vehicles for the transport of people (N=19).

E-vehicles may be used most for commuting (15/19), followed by shopping (11/19) and other job related trips (10/19), as shown in Figure 6.

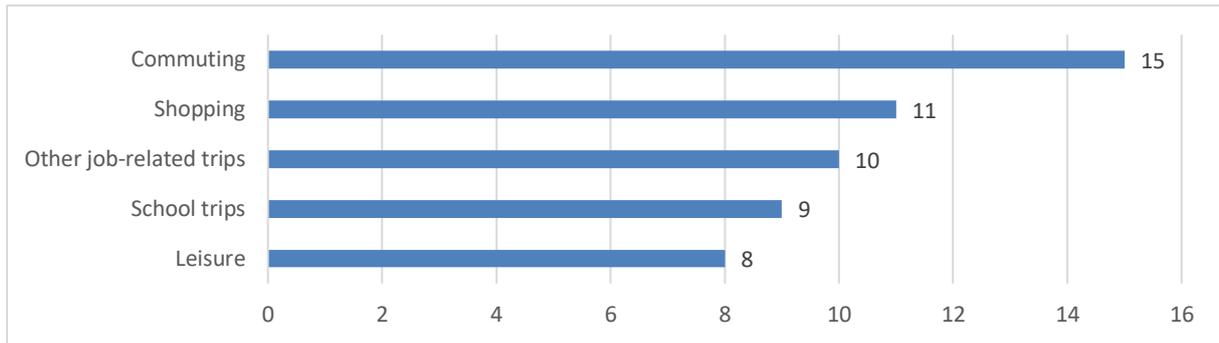


Figure 6: Potential trips that people will make in Quito using the e-vehicles (N=19).

Other possible uses include intermodal transport and tourism.

In the transport of goods, stakeholders expected that e-vehicles may be used most by medium or small private companies (15/19), followed by shops (14/19) and other entrepreneurs (13/19), in Figure 7.

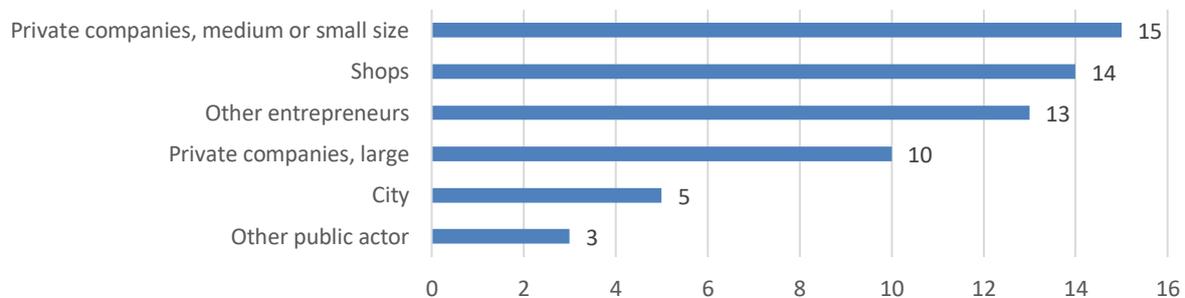


Figure 7: E-vehicles use for the transport of goods (N=19).

Based on the stakeholders' opinion, the main service operator for the e-vehicles should be a private service operator (15/19), (Figure C in the Appendix). Besides, Quito's stakeholders identified the following e-vehicle operators:

- Private industry or private company (to be selected under a call to allocate this service provider);
- Private companies through vehicle leasing, to enable continuous replacement of units due to the transition of electromobility;
- Private companies that could provide the service of transporting goods or transference to areas of difficult access;
- Company with the capability to invest in order to provide the service;- - Manufactures;
- Providers of mobility solutions/logistics/ bike courier services;
- Public-private alliance as a service provider (with the ability to provide standard quality service);
- Mixed provider/ private provider supervised by the municipality;
- And a system where the public subsidizes a part of the costs, or where it is granted to the private operator(s).

2.3 Obstacles, limitations and barriers

For the assessment of online survey questions related to the obstacles, limitations and barriers linked to the e-vehicles implementation, the results are presented based on the counts for each multiple-choice question option (item 19, Subsection 2.3.1) and stakeholders feedback reported in the open questions (items 20 and 21, Subsections 2.3.2 and 2.3.3, respectively).

2.3.1 Most challenging

The top three challenges for the successful implementation of e-vehicles are: lack of money / financial resources (15/19), lack of enabling policies (13/19) and investments needed (11/19), as shown in Figure 8. Other barriers include missing knowledge of the geographical area and socio and economic components.

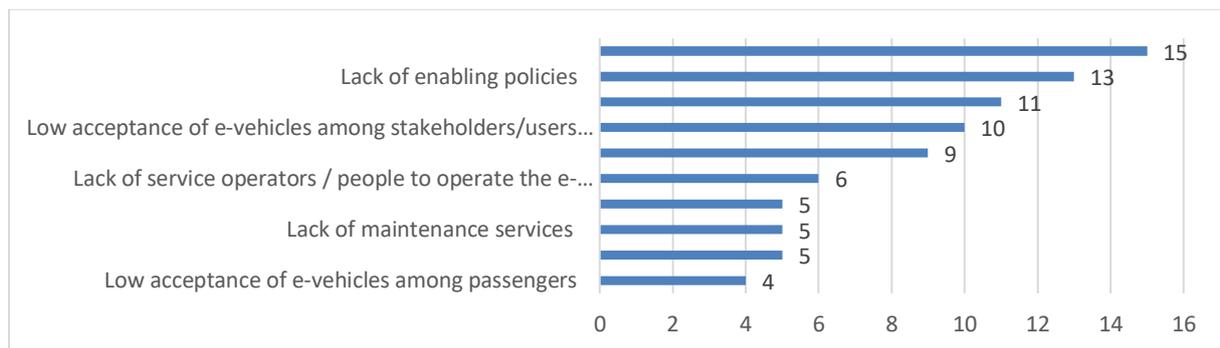


Figure 8: Most challenging for the successful implementation of e-vehicles (N=19).

2.3.2 Regulatory barriers

For the regulatory barriers that currently hinder the implementation, the stakeholders identified several factors and as listed below.

- Absence of specific homologation process for subcategory L electric vehicles (motorcycles, tricycles and quadricycles), which can generate delays in the registration process and circulation permits.
- Urban Planning documents of the Municipality need to be reviewed and harmonized so that all documents are aligned to the Metropolitan Development and Territorial Organization Plan (PMDOT) goals and identify the same intervention areas. More specifically, ordinances revolving heritage issues (i.e. Ordinance No. 260).
- In the same way, the Plan for the Special Tourist Zone of the CHQ should be reviewed or repealed, in conjunction with Quito Tourism so that planning does not encounter different intervention polygons in each of the planning instruments. All planning must be aligned with that proposed in the PMDOT.
- There are no clear regulations or policies on the matter at the local level.
- Availability of information and data to generate regulation.
- Regulations on the classification of light vehicles do not yet exist. It needs to be created as soon as possible for the implementation of the project.
- Lack of clear policies, because currently, CHQ is giving priority to only one type of vehicle (bicycle). The other CHQ users are left out. Ordinances that facilitate the operation of the proposed electric vehicles are lacking.

- No specific policies for the approval of electric vehicles, as well as specific regulations for logistics within the historic center.
- It should be checked whether there are appropriate regulations that motivate incentives for the purchase of electric vehicles such as tax exemptions, traffic preferences, among others.

2.3.3 Other barriers

Other barriers that may exist (e.g. institutionally) that can also hinder the implementation, were identified by the stakeholders as listed below.

- Possible opposition to the pilot from groups of merchants to the Municipality, who previously claimed for the pedestrianization of the Historic Center.
- The Metropolitan Institute of Heritage as executing entity of the interventions in the CHQ and based on its expertise, must know, contribute and suggest, observations in the different design, intervention and planning projects that are carried out in the patrimonial nature polygons with a joint work within the municipality (where all the entities necessary according to the process are summoned) and always aligned with the main planning of the Metropolitan District of Quito, such as the PMDOT.
- The community in this territory is very varied and has a great power of convocation and political power that has been maintained for years but in the same way, it has a fragmentation in representation, which can be felt in the conformation of neighborhood assemblies (there are 3 assemblies formed in the San Marcos neighborhood, for example), so it is suggested to work very hard on the part of citizen participation in parallel with the approval, since if this support does not exist it is very likely that any project will not be achieved;
- It is important to concatenate the processes that have been carried out previously in the case of the CHQ, the information and proposal made by the IMP with the support of the IMPU and the Central District Administration, who in 2018 and 2019 worked in the Partial Plan for the Comprehensive Development of the Historic Center of Quito, from which information of a social nature can be obtained sent through the Multipurpose Survey that was carried out at the end of 2017 to two thousand households that inhabit the heritage polygon of the historic center and its buffer zone.
- Insufficient knowledge of the subject: Likewise about the benefits to health and the environment that this type of mobility alternative could bring in the city.
- Infrastructure challenges in the CHQ;
- Dependence on the will of senior managers when not institutionalized in policies and programs.
- Need to review local regulations of the Municipality to ensure that everything can be carried out.
- Lack of definition of technical specifications on the part of the Passenger Company, and alignment with the Municipality. “Neither does the operating model.”
- Divergence in objectives in the various municipal entities involved.
- Acquisition due to high initial cost.
- Public acceptance by local citizens.
- Political support for the implementation of all elements of the project.
- At the user level, there is the need to communicate in such a way as to control anxiety due to the potential risk of running out of charge.
- Lack of suppliers and infrastructure that allows charging anywhere in the city. Potential hesitation from the unions of the transport operators that might not embrace the shift toward e-vehicles since by tradition buses have always been diesel fueled.

3 Results – Interviews

In the case of Quito, 10 interviews were conducted aiming to grasp the perspective of all stakeholders. From the local authority 4 interviewees were chosen, given the interdisciplinary approach the demo action entails. From an operating perspective, one public transport company and one service provided were considered. From the industry side, one Start-up working already on e-mobility was selected as was a charging infrastructure company, ABB Ecuador. From the demand side, a local association that represents several commercial establishments of the intervention area in the Historic Centre of Quito was included. Finally, a Logistics and Productivity Research Institute provided the perspective from academia. The institutions that were interviewed and representing the different stakeholders groups are identified in Table 1.

3.1. Aims of the city and Expectations of Stakeholders

All interviewees were asked regarding the reasons to get involved in an e-mobility project such as SOLUTIONSplus and most of them pointed out the environmental aspects as a key reason, although specific details varied from climate goals, to the need to address pollution and to improve the quality of life and preservation of heritage. Only the Metropolitan Public Transportation Company (EPMPTQ) and ABB Ecuador mentioned the unavoidable transition to e-mobility. Moreover, the Association called Historic Centred Buró (HCB) raised the importance of studies on the implementation of e-mobility with a citizen-centred approach. And CATENA mentioned the opportunity e-mobility provides for urban logistic solutions.

Complementarily, the main issues they identify that could be addressed through e-mobility revolved around pollution, noise, congestion and quality of life in the zone. Interestingly, CATENA sees a strong linkage between efficient urban logistics and good quality of urban life.

On the other hand, both the Territory, Habitat and Housing Secretariat (STHV) and service provider Bixi Cargo Ecuador expect the project to contribute to balance the participation of alternative modes of mobility and diminish dependence on private-fossil-fuelled vehicles and poor coexistence between modes. Furthermore, Bixi Cargo Ecuador identifies the opportunity to trigger a cultural shift.

Even though all stakeholders mentioned not having previous experience in projects like SOLUTIONSplus, some of them talked about previous experience either on sustainability projects, as mentioned by Territory, Habitat and Housing Secretariat (STHV) or on e-mobility itself, like the Metropolitan Public Transportation Company (EPMPTQ) operating the trolleybus or like SIDERTECH with the design and assembly of their e-scooter ERIDE.

Regarding the potential for scaling-up, all stakeholders agree the potential for replication of similar multimodal e-mobility hubs in other places of the city. The Environment Secretariat specifically mentioned other zones: Iñaquito, El Batán, República del Salvador, Tribuna del Sur, El Recreo. SIDERTECH also pointed out the area around República del Salvador as appropriate for replication, but also suggested other cities such as Ibarra, Cuenca, Manta. Contrastingly, the Metropolitan Public Transportation Company (EPMPTQ) suggested replication could be in areas where currently there is no coverage by public transport.

3.2. Implementation

Regarding implementation of the SOLUTIONSplus demos and how vehicles should be used, all stakeholders emphasize the need to have a design customized for the characteristics of the Historic Centre of Quito and of ensuring quality and good performance given the topography. Additionally, the Central District Administration (CDA) highlights that technical specifications must meet users' need for each use case, which complements the argument presented by SIDERTECH that vehicles should be of ensured quality and performance to make sure the user doesn't get discouraged with the idea of using EVs.

Also, Bixi Cargo Ecuador and the Historic Centre Buró stress the importance of having EVs specifically designed for freight trips and about that ABB Ecuador argues these should comply with international standards of freight vehicles. Complementarily, CATENA states the importance of the design alignment with the operational-logistics plan designed for the intervention area.

Some of the characteristics mentioned by stakeholders overlap with their concerns regarding the EVs such as performance and quality for the topography of the HCQ and the application of international standards. However, the prevention (especially of small parts) is raised as a main concern for various actors as well.

Another concern mentioned by the Central District Administration (CDA) is to find key locations where to distribute the EVs to ensure appropriate use and efficiency of service. Furthermore, the Territory, Habitat and Housing Secretariat expressed its concern on the fact there is no culture of respect to different modes of mobility (pedestrians, bicycles and cars) which might be a serious problem given EVs don't cause noise, as it was also highlighted by SIDERTECH.

User perception is also a concern for SIDERTECH since they think people see EVs as leisure vehicles which discourage the potential as a transport mode. However, the Environment Secretariat, ABB Ecuador and the Central District Administration (CDA) believe there is a generalized lack of knowledge regarding EVs, especially among citizens. In this regard, CATENA argues that even though there might be a lack of awareness of the EVs per se, some actors are open to new solutions for logistics in the pedestrianized zone. This argument is corroborated by SIDERTECH and the Environmental Secretariat who said delivery and courier companies have great expectations regarding the potential of EVs.

3.3. Regulation

According to the stakeholders, the most concerning regulation issue around light EVs revolves around vehicle categorization and labelling. As mentioned by the Metropolitan Public Transportation Company (EPMPTQ), currently some light EVs do not require homologation and for other 2 and 3-wheeled vehicles, varying on size and weight, regulation is not clear. This discourages local design and assembly of EVs due to the potential risk of not complying with homologation norms, and therefore not being able to commercialize the vehicles, as argued by SIDERTECH. Another relevant issue is the lack of safety and speed regulation for different types of vehicles, in order to ensure control, proper use of public space and safe coexistence between transport modes, as pointed out by the Territory, Habitat and Housing Secretariat and Bixi Cargo Ecuador. In a broader sense, several interviewees identified also the lack of incentives both to produce and import parts and CBU CKD; and for the renewal of fleet as barriers.

Finally, the regulation regarding electricity tariff was also identified as an issue. ABB Ecuador recognizes there is a regulation regarding tariffs, but only one and the Metropolitan Public Transportation Company (EPMPTQ) says regulation on tariffs for energy purchase for final users, and detailed regulation of the Energy Efficiency Law are missing. ABB Ecuador complements that regulation for adopting international standards available, especially for charging, is also needed.

3.4. Obstacles, limitations, barriers

For successful implementation, ABB Ecuador, SIDERTECH and the Metropolitan Public Transportation Company (EPMPTQ) emphasized the need for detailed planning of the pilot to make sure it covers all necessary operational aspects and, more importantly, that it includes the perspective and needs of all relevant stakeholders in the area of intervention. On the other hand, the Environmental and the Mobility Secretariats and the Central District Administration pointed out the testing phase as the most critical one. Complementarily, Bixi Cargo Ecuador and the Territory, Habitat and Housing Secretariat specified the safety and security issues that may arise once the EVs start circulating.

In such context, they all suggested early socialization of the solutions planned and the collaborative process for prototyping of the EVs and defining the logistic plan. The Environmental Secretariat mentioned is key to have clear objectives for the intervention and the Mobility Secretariat said it is crucial to start planning operational aspects such as routes as soon as possible, while the Territory Habitat and Housing Secretariat considers it will be necessary to evaluate the accessibility of vehicles to certain zones inside the Historic Centre with EMMOP (Public works Company) and to harmonize pedestrian zones with bicycle zones with right signs before testing.

3.5. Sustainability of the e-Mobility solutions to be implemented

Most stakeholders agreed that e-mobility solutions will improve urban mobility by providing new solutions and improving environmental conditions. Nevertheless, the Metropolitan Public Transportation Company (EPMPTQ) thinks that would only happen if e-solutions come accompanied with control from the authority, matching the Low Emission Ordinance with the EVs adoption, so that it becomes a shift towards e-mobility and not only concurrency with fuel vehicles.

In order to ensure the sustainability of the solutions implemented, interviewees acknowledge mostly the potential positive impacts the pilot can trigger. The Mobility Secretariat, ABB Ecuador and the Metropolitan Public Transportation Company (EPMPTQ) think e-mobility will contribute to job creation, while SIDERTECH and Bixi Cargo Ecuador speak of rather a shift towards more specialized jobs, new business models and the emergence of an industry of alternative mobility.

Another social impact expected is improved quality of life through accessibility and safety, as mentioned by the Central District Administration (CDA); and less air pollution and noise, as mentioned by CATENA. The latter also mentioned public awareness and increased education as another positive effect, which complements the idea of Bixi Cargo Ecuador that new debates around mobility and social differences will come which combined with the creation of local capacities are wide use of e-bikes, might even create a new sense of identity for the Andean cities.

On the other side, interviewees believe the potential negative impacts identified can be mostly mitigated early in the implementation of the demo or maybe addressed with proper integral transport planning by the Municipality. For instance, the potential hired trips reduction for informal transport drivers operating in the HCQ, mentioned by CATENA, or the risk that fossil-fueled vehicle services may be shifted to other zones of the city (usually lower income zones or places where they can operate informally), mentioned by the Metropolitan Public Transportation Company (EPMPTQ), can both be addressed by involving these groups in the project and enabling an opportunity to renew their fleet or innovate in their service to continue operation in the same HCQ.

Likewise, the risks of too many EVs creating congestion, as foreseen by the Central District Administration; or the idea that there might be a limited number of users, limited accessibility and too many restrictions in the HCQ, as considered by the Historic Centred Buró (HCB); and the fact that prices

could increase because of different operational and charging costs for e-vehicles, as mentioned by ABB Ecuador; are issues that can be controlled by proper transport planning.

3.6. Impact on existing business models

Most actors interviewed think there is potential to innovate business models. The Environmental Secretariat thinks this an opportunity to formalize current informal services and provide better transport service for users, and the Mobility Secretariat agrees saying organization and costs can be improved. The Central District Administration approves that Transport and freight of good provision will face a lot of change, especially in markets. Likewise, Bixi Cargo Ecuador believes customers and merchandisers could have better transportation opportunities and that transportation unions could adapt new models and vehicles.

On the other side, The Metropolitan Public Transportation Company (EPMPTQ) thinks good provision for commercial establishments in the HCQ won't change much but freight trip services might change if there is a distribution centre. Opposingly, CATENA thinks commercial establishments will have to adapt to good provision planning needed for the logistics operational model planned for the HCQ, which therefore will in fact change their supply chains.

3.7. Implications for Planning and Urban Development

Most actors were asked about the implications of e-mobility in transport planning. In that regard, the Territory, Habitat and Housing Secretariat (STHV) and the Historic Centred Buró (HCB) think the main implication will be an increase in the quality of transport. The Central District Administration thinks route planning will not face a major change, but that new infrastructure will be needed. In contrast, Bixi Cargo Ecuador thinks transport planning will be more complex and require more specialized professionals. ABB Ecuador agrees, specifying that considering charging time is crucial for route planning.

The Metropolitan Public Transportation Company (EPMPTQ) thinks the Municipality has the duty to increase transport coverage for the population, but formal routes don't reach the outskirts, so those areas are usually provided by informal services. In that sense, they think e-mobility is an opportunity to provide solutions for those areas private operators will not cover.

Regarding implications for overall urban development and urban planning, the Territory, Habitat and Housing Secretariat (STHV) thinks e-mobility needs to be integrated into Quito's urban planning vision, complementing the idea of the Mobility Secretariat that e-mobility will change planning on how to access places, while the Central District Administration (CDA) think e-mobility hubs might act as urban amenities.

Bixi Cargo Ecuador, on the other side, thinks that light EVs will provoke democratization of public space, but that new elements should be included in urban planning like space for non-motorized modes and facilities for parking and charging. Likewise, ABB Ecuador points out that enough space/parking lots for charging (e-buses, e-vehicles) need to be considered.

Finally, SIDERTECH argues that distance is the biggest limitation for e-mobility solutions, so they think a transition towards e-mobility would imply urban planning with focus on enhancing proximity and therefore higher density.

In terms of the electric network, the Mobility Secretariat considers the shift to e-mobility will take a toll on the energy network, which could create challenges for the energy provider (*Empresa Eléctrica Quito*). Bixi Cargo Ecuador also considers new investments will be needed, especially charging

infrastructure for bigger e-vehicles, something ABB Ecuador also details stating that a three-phase network should be available for e-buses and Biphasic network for smaller e-vehicles.

3.8. Contribution of SOLUTIONSplus to Long Term Goals

The last topic discussed with all stakeholders revolves around their own long-term goals in terms of e-mobility and how SOLUTIONSplus could contribute to them. About that, the Environment Secretariat mentions the Climate Goals as the overarching vision of the city and the Territory, Habitat and Housing Secretariat details that alternative mobility is part of the city's long-term vision. In such context, the Metropolitan Public Transportation Company (EPMPTQ) highlights that the newly approved ordinance on the integration of the transport system aims for e-mobility and therefore requires that in order to receive a share of the common cash collection, a company must comply with various e-mobility requirements. SOLUTIONSplus can contribute to the design and operation the company foresees for the LEZ in the HCQ and in the future contribute to access funding for further investments as well.

The Mobility Secretariat, on its side, thinks that the SOLUTIONSplus project will contribute in terms of communication and awareness around e-mobility and represents the first concrete step in the shift towards e-mobility, while the Territory, Habitat and Housing Secretariat thinks the project will also show to citizens how e-mobility operates in practice. In contrast, ABB Ecuador believes Quito might have a long-term vision, but not necessarily well defined. Thus, the SOLUTIONSplus project might help the Municipality realize what is missing.

The private sector stakeholders, on the other hand, think the SOLUTIONSplus project contributes to a shift in culture and in the vehicle market through information regarding user needs and city characteristics, as stated by SIDERTECH, and can therefore contribute to local capacity development and to the creation of multi-actor coalitions, as mentioned by Bixi Cargo Ecuador.

References

DLR and VTT. (2020). *SOLUTIONSplus User Needs Assessment: Guideline*.
https://drive.google.com/file/d/12F3_C5g0doKrdDYdzgLQKFHj1c8VLbqV/view

Appendix

Additional Figures

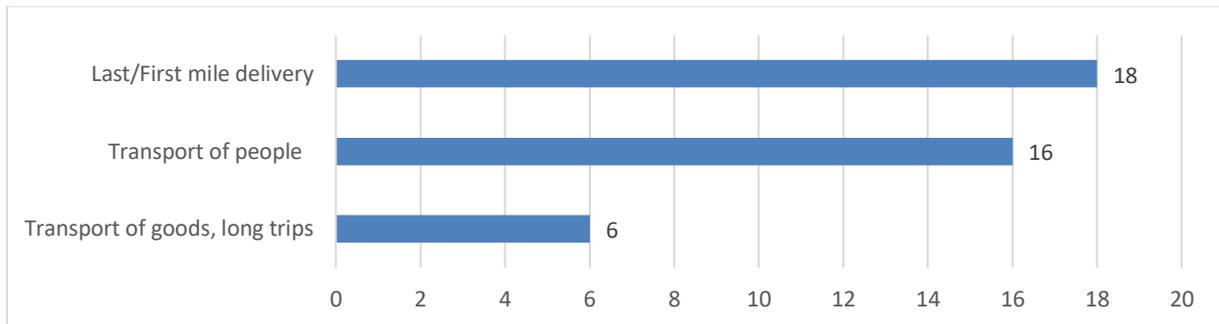


Figure A: Targeted use cases for e-vehicles (N=19).

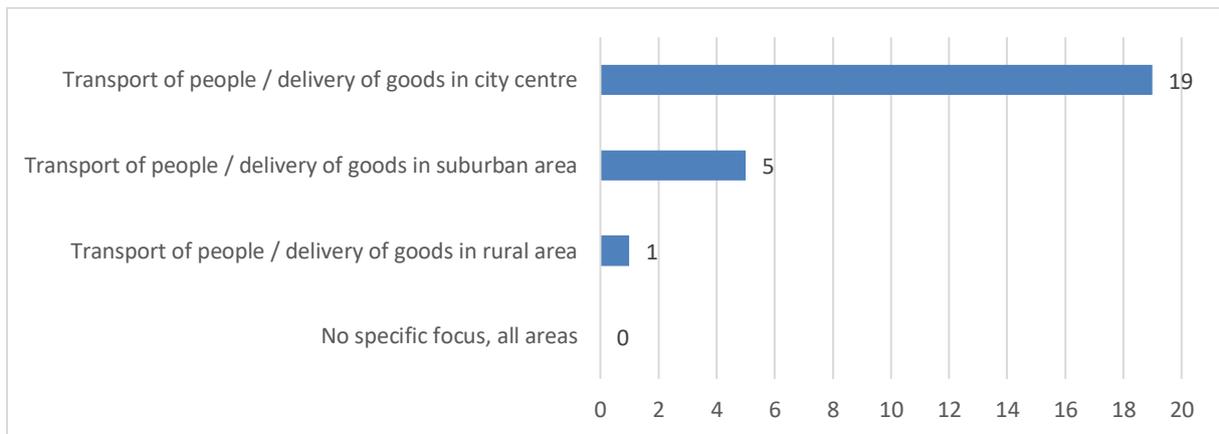
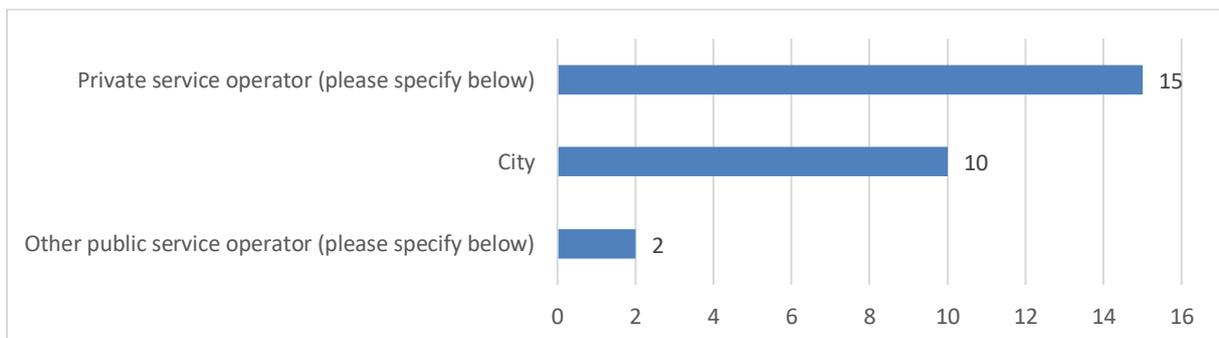


Figure B: Areas of the city/region where the e-vehicles are going to be used (N=19).



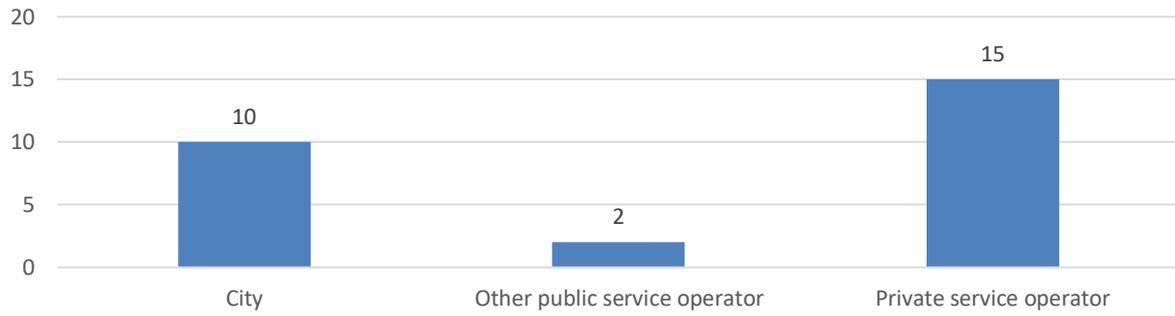


Figure C: Main service operator of the e-vehicles (N=19).

User Needs Assessment – City Report

City: Montevideo

Project SOLUTIONS+

Provided by WP1 team, responsible: DLR / Mirko Goletz, mirko.goletz@dlr.de

Version: 12.10.2020

This document complements the User Needs Assessment Guideline.

https://drive.google.com/file/d/12F3_C5g0doKrdDYdzgLQKFHj1c8VLbqV/view?usp=sharing

1 Approach

The user needs assessment (UNA) for the city of Montevideo, Uruguay, aims to identify user needs and preferences that will contribute to the development of this city demonstration actions targeting the test operations, charging and integration of e-taxis, business models for e-buses and electric utility vehicles for urban logistics during the development of SOLUTIONSplus project. Therefore, information was gathered on the city's background, current mobility situation, and to ascertain the desired solutions as well as available options to support decision making. For this purpose, two qualitative methods were applied: online survey and interviews.

1.1. City report objectives

The main objective of this city report is to present the user needs methodology approach implemented for Montevideo by identifying the steps undertaken and the team involved. In addition, this report presents an overview of the user needs findings and self-reported responses covering the topics pre-defined by the project SOLUTIONSplus consortium team of Work Package 1, (DLR and VTT, 2020).

This report is organized as follows. The first section presents the key stakeholders whose perspectives, experiences, and strategies were the basis to conduct the UNA. Section 2 presents the responses collected through the online survey. Section 3 presents the results of stakeholders' interviews.

1.2. User needs assessment steps and team involvement

The UNA research approach consisted of an online survey and semi-structured interviews involving key stakeholders for the Montevideo Municipality and was conducted accordingly to the instructions on the SOLUTIONSplus project user needs assessment (DLR and VTT, 2020).

Montevideo's city team involved with the UNA activities consisted of the following partners: city representatives, WP1 representatives (VTT), and WP4 representatives (WI and UEMI).

The activities undertaken for the UNA implementation involved three major steps with the contribution of city teams as summarized below.

- First, key stakeholders were identified by the city representatives with the support of the WP4 representatives.
- Second, an online survey and interviews were conducted by the city representatives with the support of the WP4 representatives.

- Third and last, results of the UNA were documented and reported by WP1 (VTT) and WP4 (WI and UEMI) partners.

Table 1 identifies targeted stakeholders and the corresponding group that were selected to carry out the UNA with the application of an online survey and semi-structured qualitative interviews.

Table 1 Selected stakeholders and applied research methods for Montevideo's UNA.

Stakeholder		Method and Sample Size	
Stakeholder group	Organisation Name	Online Survey (N)	Interviews (N)
National / regional / local authorities	Municipality of Montevideo (IM)	1	1
	Public Utility Company (UTE)	1	1
	Mobility Uruguay - NOVELLI Group.	1	
	Ministry of Energy, Industry and Mining (MIEM)	1	1
	MOVES Project	1	1
Public transport Operators (PTOs)	Uruguayan Company of Collective Transport (CUTCSA)	1	1
	Cooperative Union of Transport Workers (UCOT)	1	1
Small and medium-sized enterprises (SMEs) and original equipment manufacturers (OEMs)	SADAR	1	1
	Green Star SRL	1	1
	Weflow / Ecomoving	1	1
Service providers (delivery services)	PedidosYA	1	1
Academy / Research	Institute of Electrical Engineering, Faculty of Engineer of the Public University (UDELAR)	1	1

In total, 12 key stakeholders were selected for the UNA of the city of Montevideo. Those stakeholders represent different groups, such as National and local authorities, Public Transport Operators, OEMs (i.e. vehicle companies, maintenance), Service Providers (delivery services) and Research and Academia. However, one of the participants in the online survey did not report the organisation name. Thus this table identifies 12 stakeholders but there is an additional stakeholder participating in the online survey. The online survey and interviews were conducted during November and December 2020.

2 Results – Survey

The survey data was collected by using a self-completion online questionnaire consisting of twenty-four items measured using five-point Likert scale from -2 “not at all important” to 2 “very important”, multiple-choice questions and open questions. The survey included five major sections: city identification (Question 1), city aims (Questions 4 to 11), implementation (Questions 12 to 18), obstacles, limitations and barriers (Questions 19 to 21), and finally, background questions (Questions 22 to 26).

Montevideo’s online survey comprises 13 responses gathered across different stakeholders’ group, previously identified in Table 1. The participant's ages ranged from 30 to 57 years (M=44,00 yr, SD ±11,75). A copy of Montevideo’s online survey responses can be accessed here [Online Survey Montevideo](#) .

2.1 Montevideo aims

For city aims questions (items 4 to 11), using five-point Likert scale, the importance rating assigned by stakeholders was computed based on the counts of each point Likert scale (e.g. stakeholder response “-2”) and its corresponding weighting factor (e.g. “-2” for point scale “-2”) as presented in the equation below. An overview of the online survey responses and importance assigned by stakeholders with respect to city aims are presented in Figure 1 to Figure 4.

$$\text{Importance Rating} = \frac{[\text{Count}(\text{"-2"}) * (-2) + \text{Count}(\text{"-1"}) * (-1) + \text{Count}(\text{"0"}) * (0) + \text{Count}(\text{"1"}) * (1) + \text{Count}(\text{"2"}) * (2)]}{\text{Number of responses}}$$

The most important aim for the city is *“To analyse costs related to the implementation of e-vehicles”* with importance assigned by stakeholders of 1,77, as shown in Figure 1. *“To increase the share of trips made with e-vehicles”* and *“To identify preferred user groups and usage patterns”* were also very important, (1,62 and 1,54, respectively).

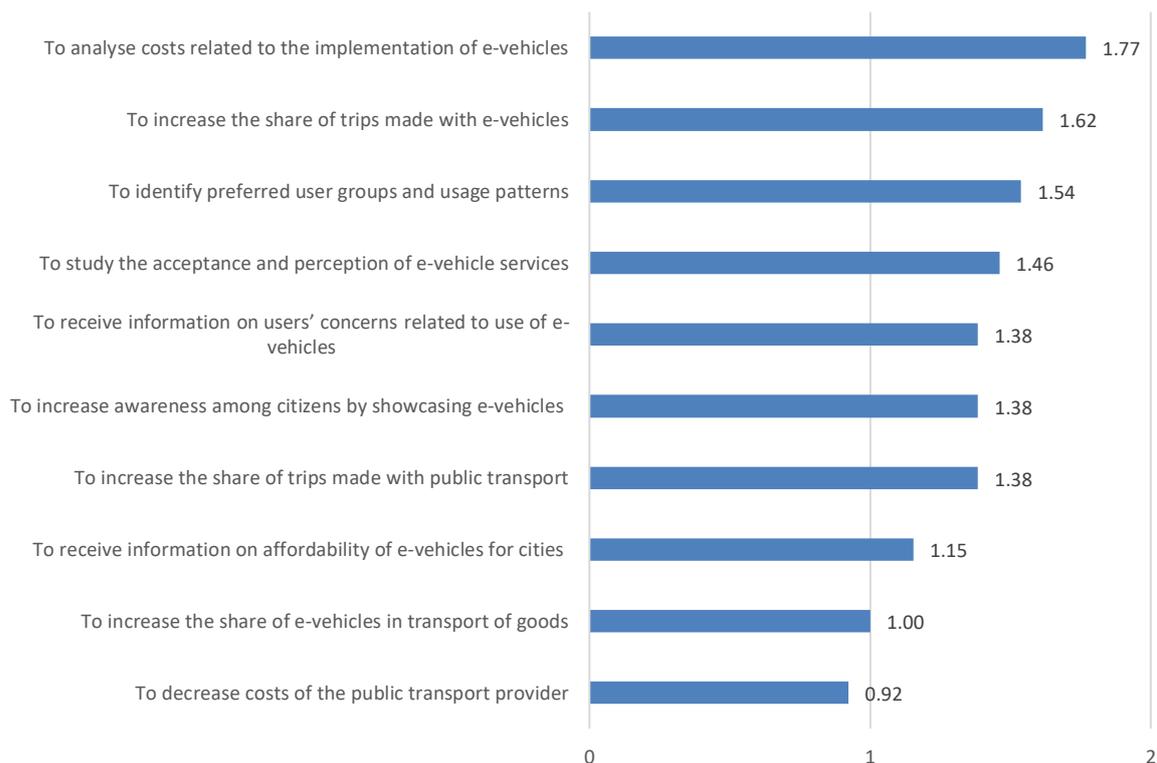


Figure 1: City aims related to usage and user acceptance of e-vehicles and importance assigned by stakeholders (Likert scale -2 “not at all important” to 2 “very important”).

Other important aims regarding usage and user acceptance identified by Montevideo’s stakeholders are (accordingly to the open question 5) are:

- To study different modes and not contradict different electric mobility alternatives.

- To adequately inform users about the benefits of the electric vehicle.
- To generate awareness in the population about public health problems due to transport / multimodal transport and last mile are the key.
- To make information available on charging networks and focus on the user.

For the city mobility patterns, the most important aim is *“To improve quality of travelling”* (1,46), in Figure 2. This aim is followed by *“To study impacts of e-vehicle services on the amount of travelling”* (1,31) and *“To offer a more stable transport service”* and *“To study impacts of e-vehicle services on choice of travel mode”* both with 1,23) based on the importance assigned by the stakeholders.

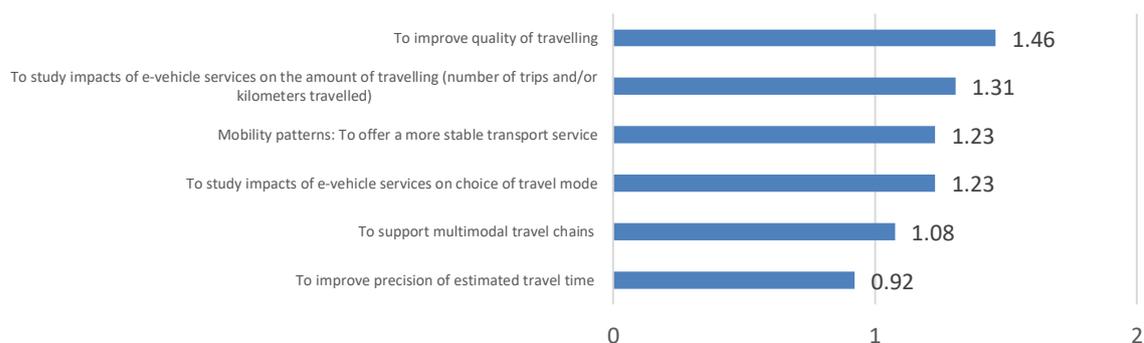


Figure 2: Mobility patterns aims and importance assigned by stakeholders (Likert scale -2 “not at all important” to 2 “very important”).

Other related mobility aims identified by the stakeholders are (accordingly to the open question 7):

- To understand why users choose individual / personal transport.
- To ensure vehicle safety (in competition with two-wheelers) / low operating costs / which should be maintained and profit-enhancing for EV acquisition.
- To improve equity in terms of access to public transport and infrastructure in different areas of the city.
- To gather real-time information on the location and type of public transport vehicle.
- To identify specific patterns related to the characteristics of electric buses (autonomy/load management/incidence of driving).
- To improve comfort.

For the city environment, the two most important aims are *“To reduce CO2 emissions”* (1,56) and *“To reduce pollution (NOX, CO, PM, VOC)”* (1,54), as shown in Figure 3.

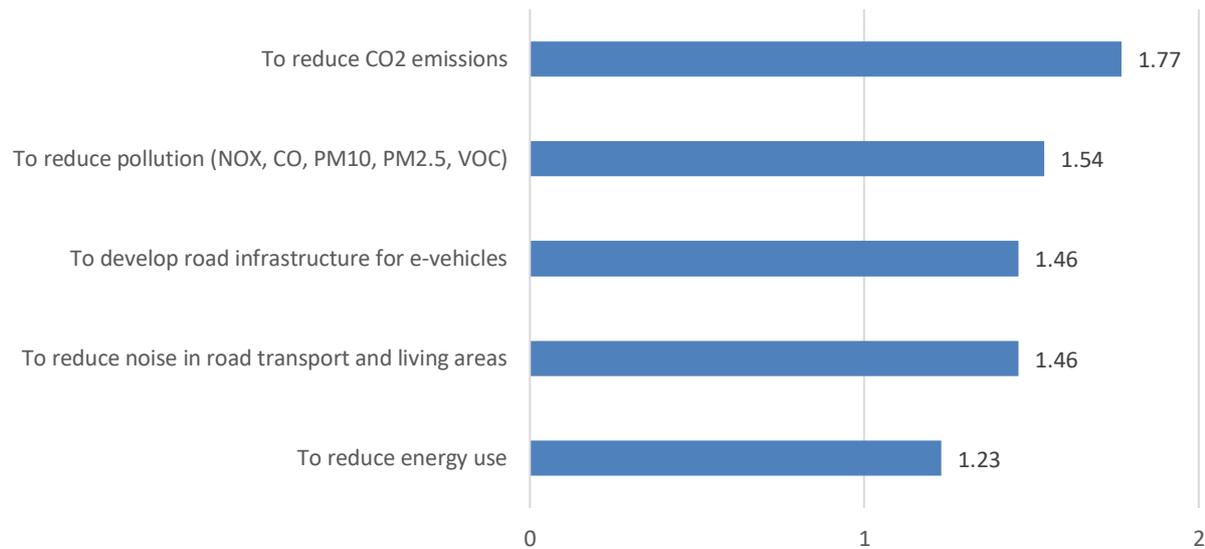


Figure 3: City environment aims and importance assigned by stakeholders (Likert scale -2 “not at all important” to 2 “very important”).

Other city environment aims include:

- To develop compatible charging technologies.
- To promote multimodal nodes and integrate them with public spaces in the city.
- To ensure policies for recycling or reusing EV batteries that when the time comes there will be a large volume.
- To create more spaces for pedestrians and active mobility, which are required to achieve higher levels of equity.
- To segregate space for public and active transport to the detriment of motorized mobility for private/personal mobility.

For the quality of life in the city, the most important aim is *“To improve public health in general, esp. by reducing exposure of citizens to air pollution”* (1,62), in Figure 4. In addition, *“To enhance job creation”* (1,56). *“To improve livability of the city in general”* and *“To improve access to public transport”* are also considered very important (both 1,23).

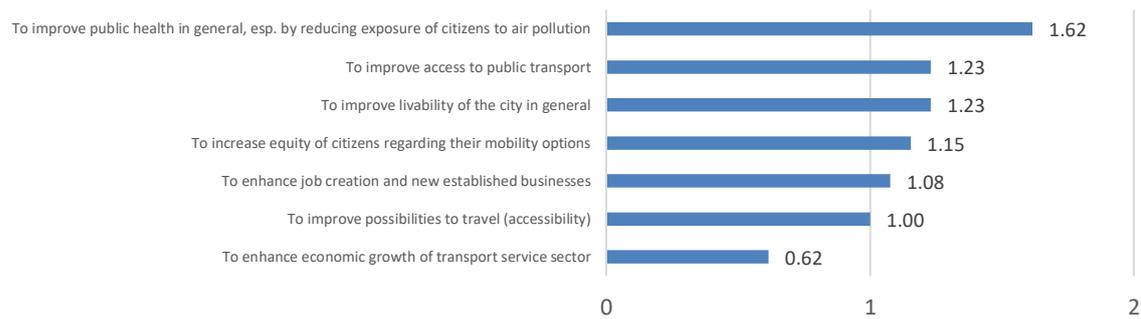


Figure 4: Quality of life in the city aims and importance assigned by stakeholders (Likert scale -2 “not at all important” to 2 “very important”).

Other city environment aims identified by the stakeholders are:

- To achieve minimal impact on urban life (agreement with specific institutions to train drivers).
- To generate qualified labor for maintenance, operation and cargo management that can be replicated in other countries.
- To increase/improve road safety with new technologies.
- To take actions that aim to decongest the city in the number of vehicles (private or public vehicles).
- To complement the multimodality for active mobility that displaces the use of cars and contributes to a dense city being more dynamic.
- To reduce travel times (improvement of commercial speed/use of dedicated bus lanes/improvement of the travel experience).

2.2 Implementation

For implementation questions (items 12 to 18), the results are presented based on the counts for each multiple-choice question options. An overview of stakeholder’s responses to the city e-vehicles implementation is presented next.

For the targeted use cases for e-vehicles in Montevideo city, last/first mile delivery was identified by all stakeholders (13/13), followed by the transport of people (11/13) (Figure A, in Appendix 1). Other targeted use cases include private or industrial use, tourism and recreation.

The e-vehicles will be most used for the *transport of people / delivery of goods in city centre* and in suburban areas (12/13) and (6/13), respectively, (Figure B, in the Appendix 1).

In the transport of people, all citizens were the targeted user group of the e-vehicles with more relevance identified by stakeholders (11/13), followed by people with disabilities and senior citizens, students and commuters though with less relevance (all 3/13), in Figure 5. Other user groups were: pregnant women; families, logistics and tourism.

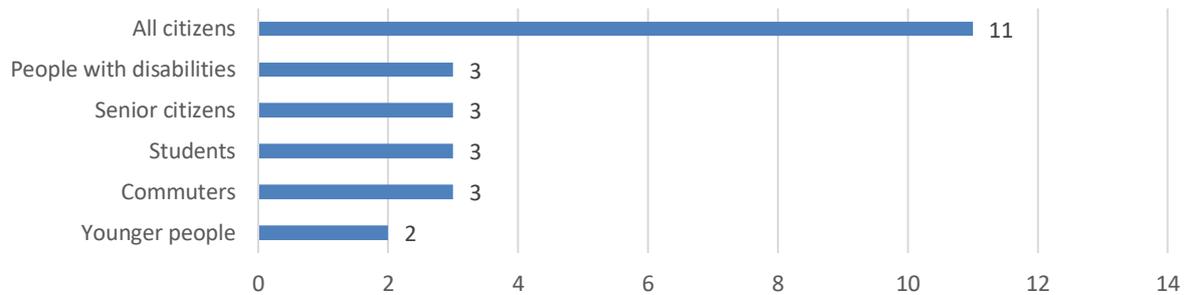


Figure 5: Targeted user groups of the e-vehicles for the transport of people (N=13).

E-vehicles may be used most for commuting (13/13), followed by school trips (12/13) and other job-related trips (8/13), as shown in Figure 6.

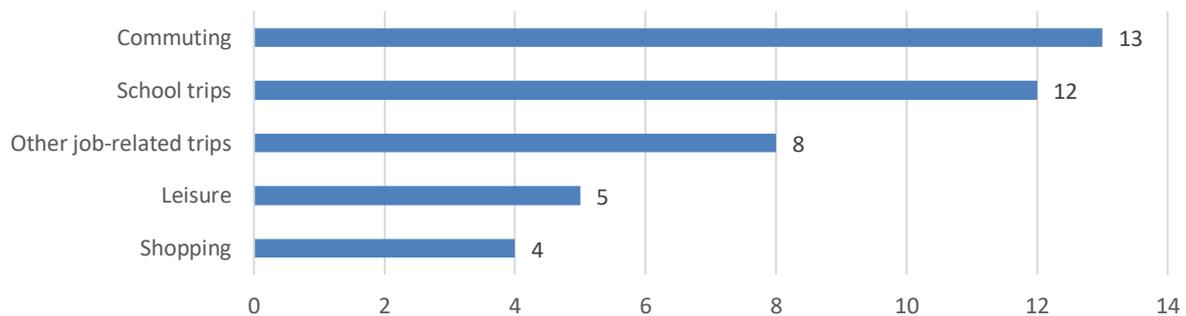


Figure 6: Potential trips that people will make in Montevideo using the e-vehicles (N=13).

In the transport of goods, stakeholders expected that e-vehicles may be mostly used by medium or small private companies (10/13), followed by private large companies and other public actor (both 6/13), in Figure 7.

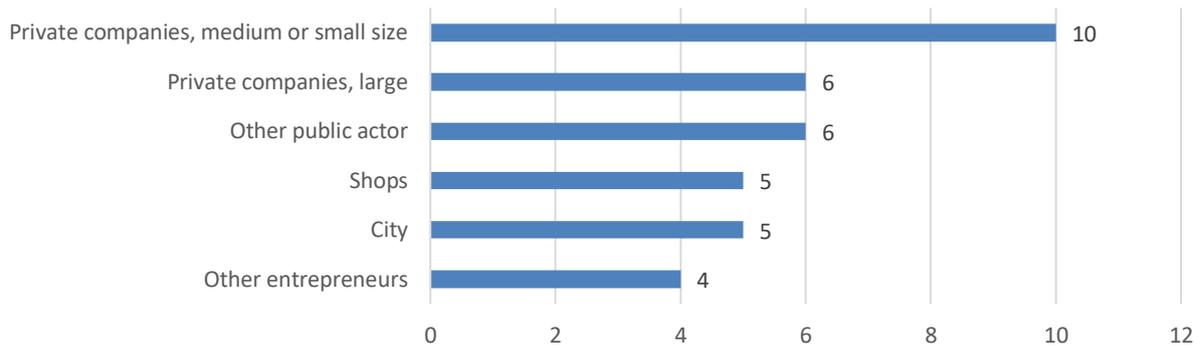


Figure 7: E-vehicles use for the transport of goods (N=13).

Based on the stakeholders' opinion, the main service operator for the e-vehicles should be a private service operator (9/13), (Figure C in Appendix 1). Besides, Montevideo's stakeholders identified the following e-vehicle operators:

- Private companies endorsed by the Municipality of Montevideo.
- Logistics operators/distributors of mass consumption.
- Public / private partnership.

2.3 Obstacles, limitations and barriers

For the assessment of online survey questions related to the obstacles, limitations and barriers linked to the e-vehicles implementation, the results are presented based on the counts for each multiple-choice question option (item 19, Subsection 2.3.1) and stakeholders feedback reported in the open questions (items 20 and 21, Subsections 2.3.2 and 2.3.3, respectively).

2.3.1 Most challenging

The top three challenges for the successful implementation of e-vehicles are lack of money / financial resources (7/13), organizational issues (5/13), and investments needed (4/13), as shown in Figure 8.

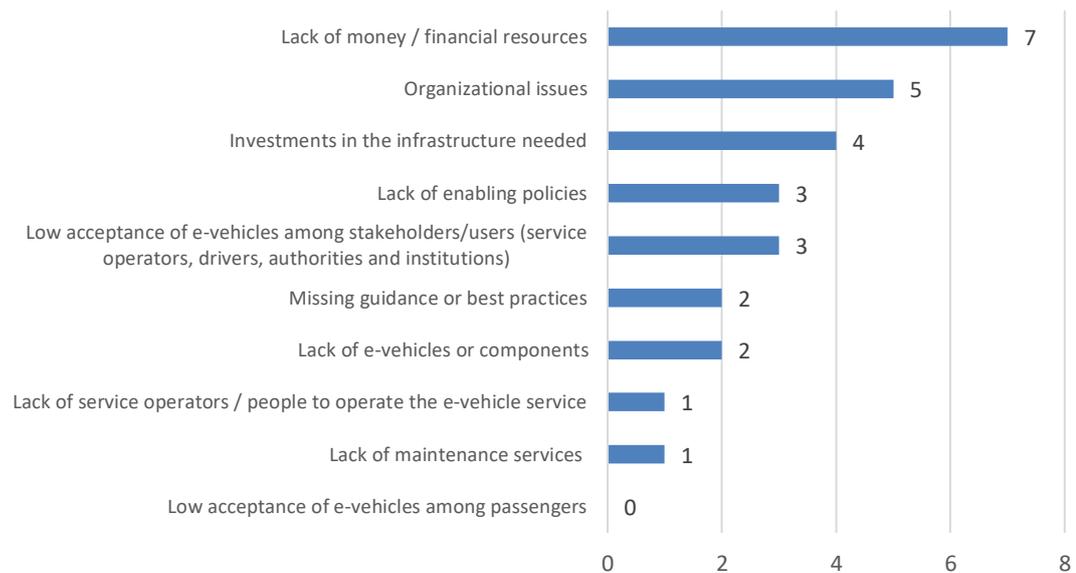


Figure 8: Most challenging for the successful implementation of e-vehicles (N=13).

Another barrier (identified by one stakeholder) is related to the limited battery life and degradation of batteries depending on the speed of recharging.

2.3.2 Regulatory barriers

For the regulatory barriers that currently hinder the implementation, the stakeholders identified several factors and as listed below.

- Incentives period and the useful life of the investment (10 years).
- Regulations referring to batteries should be issued (currently in process, in legal proceedings of the Ministry of the Environment).
- Regulatory framework that helps to reverse the sector and standards or regulations for safe circulation in public spaces.
- Limitations of the battery life and degradation of batteries depending on the speed of recharging.

Supplement information on regulatory barriers identified by the Montevideo stakeholders is presented in Section 3, the viewpoints from the interviews.

2.3.3 Other barriers

Other barriers that may exist (e.g. institutionally) that can also hinder the implementation, were identified by the stakeholders as listed below.

- Deviation between different state entities, thus there is the need to strengthen the regulation of collective public transport for all cities in the country / there must be a collective transport system at the country level.

- Delay in publishing regulations, as sometimes technological advancement appears first.
- Complex homologation processes and difficulties for patenting. Besides differences, according to Municipality (Department), / Institutions may impair safe conditions for transit.
- Need to create economic incentives for the transition to electric mobility (the current stimulus is limited in the number of units).
- Need to strengthen the regulation of collective public transport for all cities in Uruguay; there must be a collective transport system at the country level.
- Uncertainty regarding the change in the political "color" of the central government and the fluid relationship at different levels of government.

Supplement information on other barriers identified by the Montevideo stakeholders is presented next, in Section 3.

3 Results –Interviews

In the case of Montevideo, 11 interviews were conducted aiming to grasp the perspective of all stakeholders. At the Government and Public sector level, 4 interviewees were chosen: the Municipality of Montevideo (IM), the Ministry of Energy (MIEM), the MOVÉS project and the Public Utility Company (UTE). From an operating perspective, 2 public transport operators (PTO) were interviewed: they were CUTCSA and UCOT. Then, one actor from the academy was also interviewed, who was the president of UTE for a period of 10 years. Several stakeholders from the industry and services were also asked: Sadar (importer and manufacturer of conventional cars), GreenStar (3-wheelers manufacturer), WeFlow (e-cargo bikes manufacturer) and PedidosYa (Delivery services). All these institutions representing the stakeholders that were interviewed are identified in Table 1, except for ABB Uruguay, in which the interview is pending as expected to be conducted in a few weeks.

3.1 Aims of the city and Expectations of Stakeholders

All interviewees were asked regarding the reasons to get involved in an e-mobility project such as SOLUTIONSplus and most of them pointed out the environmental aspects as a key reason, although specific details varied from climate goals, to the need to address pollution and to improve the quality of life and preservation of heritage.

The Public Utility Company (UTE) highlighted the economic benefit for the Company with the growth of e-mobility. Other important issues and/or challenges for them is how to optimize the use of the grid with the introduction of e-mobility and how to manage the new energy demand without increasing the power of the grid nor the power generation (important solar and eolic surplus already exist in Uruguay).

The conditions for electricity generation are an important topic for the MIEM considering that important solar and eolic surpluses already exist in Uruguay which positions the country in a good place to promote electric mobility. In addition, the alignment of Uruguay with international commitments to reduce emissions were also mentioned as well as the fact that Uruguay can be a good

pilot country due to its size.

From the side of the Municipality, the reasons to get involved in an e-mobility project such as SOLUTIONSplus are the reduction of emissions in the city center, the energy efficiency, the autochthonous and renewable electric energy consumption and the associated improvement of comfort in the travel. Another important point is the promotion of a new technology from the side of the public sector as well as the dissemination of some knowledge about this new technology.

For the Academy, regarding the Ciudadela terminal, the SOL + project is seen as an interesting project to solve the problem of recharging electric buses. In addition, the Ciudadela initiative is seen as an interesting charging hub where to test technologies and/or test modes of use both in relation to charging and in relation to the use of electric buses. Regarding the project to promote local manufacturers with MOVES, it is very good to do a pilot that shows that this technology works and it is a good opportunity to promote work and add value to the processes.

For the delivery services company, PedidosYa, the motivations are the reduction of emissions and contamination and the alignment with objectives of Delivery Hero. Finally, for the SMEs the motivations are the passion for development of this type of vehicle as well as the thinking that mobility and efficiency in transport are a great opportunity to improve the quality of life. Economic reasons are also among the most important motivations.

3.2 Implementation

Regarding implementation of the SOLUTIONSplus demos and how vehicles should be used, the comments of the interviewees depend on the component of the project. For the last mile logistic component (local manufacturing of light electric vehicles) some stakeholders commented on the need to have a design customized for the characteristics of the city, taking into account, for example, the slopes and the availability of bikeways, and ensuring the quality and good performance given the topography (the power of the motor was discussed in some cases). Another relevant point that emerged during the interviews, in particular with MOVÉS, was the requirements for the homologation of the 3-wheelers - for the moment there are no particular requirements for this type of vehicle but the homologation depends on the National Direction of Industry that belongs to the MIEM. At the time, the local manufacturers must comply with the requirements.

All the stakeholders related to the local manufacturing agreed that the technical specifications must meet users' needs for each use case and the vehicles must also comply with the security and regulation of local standards. Additionally, support from EU experts will be desired and required in order to get those objectives.

Regarding the powertrain for 3-wheelers, it does exist some worries about the dimensions of that part of the vehicle since Valeo has not given that information related to that part of the vehicles. Among the required information that determines the design of the vehicles is the width of the powertrain. That worry was mentioned by GreenStar during the interview and also by Novas. The programming and control of the powertrain is another important topic for local manufacturers.

Batteries for the vehicles was another important topic that emerged during the interviews for both one another components of the project (local manufacturing and charging infrastructure). First of all, it was asked if the project will supply the batteries for the vehicles and then it was commented on the issue regarding the final disposal or second life of the batteries. That topic was remarked by CUTCSA, UCOT, GreenStar and some of the public authorities.

As regards the charging infrastructure component, there are several concerns regarding the operation of the public charging point for the Ciudadela terminal. One of the PTOs, CUTCSA, said that it would be not possible to organize the plug-in and energy dispatch if the charging point is public and shared among the PTOs. On the other hand, UCOT said that they don't see major troubles with that, pointing that if it is free one charging point inside the terminal it should be used by the first applicant and the power dispatch should be organized in a reasonable way. Following that reasoning the management of the charging point should be in the hands of the IM or UTE, they said.

The second component is also seen as a pilot for further scaling of charging hubs for e-buses. Some of the interviewees commented that other public charging hubs would be required in a short time in different locations of the city, mainly because of the autonomy of the buses and the battery degradation.

3.3 Regulation

Regarding the local manufacturing of e-cargo bikes and 3-wheelers, there is no for the moment of local regulation. However, the DNI is currently working on an homologation regulation for motorbikes and 3-wheelers that will take as reference the UN regulations for that type of vehicle. It is expected that this regulation will be issued at the end of 2021 / beginning of 2022. Regarding e-cargo bikes, there are no local regulations but the MOVÉS project points to the compliment of the UN regulations of that kind of vehicle, which means that the power of the motor must be no bigger than 250 W.

Regarding charging infrastructure and fast charging for e-buses, there have been recently issued the standard UNIT-1234/2020 which set down the requirements for connectors for fast charging infrastructure, taking as reference the IEC61851 and the IEC62196 standards (CCS2). No additional regulations were mentioned by the different stakeholders.

3.4 Obstacles, limitations, barriers

Regarding the first component of the project, one of the most important obstacles was the one related to the charging infrastructure standard. This obstacle was solved through the writing and publication of the UNIT-1234-2020 standard, which set down the conditions for fast charging connectors. Another important obstacle or limitation that emerged from the interviews was the one related to the energy dispatch and the limits of responsibility for charging infrastructure. For instance, it was discussed who will be the responsible during the manipulation of every charging point as well as who will be responsible for the control and energy dispatch. For example, from the point of view of CUTCSA, each PTO should be designated with one dedicated charging point. On the other hand, from the point of view of UCOT, as well as the Municipality, the charging points should be shared by all the PTOs.

Regarding the second component of the project, there were some concerns regarding technical issues such as the power and the control of the motor for the different types of vehicles that will be manufactured. Another topic that arose in the interviews was the size and the type of the batteries as well as the final disposal once the lifetime is ended. Another important topic that was mentioned during the interviews was the homologation for 3-wheelers since there are no current specific requirements for that type of vehicle but there is a draft in the Ministry of Industry, Energy and Mining (MIEM) that will be issued in 2021/2022.

3.5 Sustainability of the e-Mobility solutions to be implemented

Regarding the sustainability of the project, all actors said that the planned E-mobility solutions are useful to improve the urban mobility in the city on both components: charging infrastructure and local manufacturing.

Regarding the first component, it is understood that the planned implementations can help to increase the participation of people in public transport and improve intermodality since users' perception of electric buses is very good and, additionally the e-buses are more modern and better valued. On the other hand, in electric taxis the user experience is not as good compared to electric buses.

On the other hand, in relation to the second component of the project, which consists of the manufacture of light electric vehicles, the authorities observe that despite being electric, the problem of the number of vehicles remains. Either way, it is understood that electric vehicles will make a great contribution to improving air quality in Montevideo and the fact that manufacturing is local is also seen as very positive.

Regarding social positive or negative impacts derived from the demonstration project it was observed that, for example, the ticket price would not be affected. Additionally, it is assumed that the TCO of electric buses would be the same in comparison with a conventional bus. Regarding other social aspects such as gender issues and accessibility, it is observed that there is an absolute improvement with electric buses since they incorporate certain amenities that were not previously required of PTOs (the accessibility of women with children, adults older, etc.)

At the employment level, it is necessary to train the PTOs employees in EV topics in order to avoid job losses. In this sense, there is a definition already assumed which determines that there will be no layoffs and the people will be re-trained. In order to mitigate the negative impacts and potentiate the positive ones, the training on charging issues and electric mobility is quite important and they are being carried out by entities such as UTE, UTU and UTEC in coordination with MOVES.

3.6 Impact on existing business models

Regarding the main impacts of the adoption of e-vehicles (e.g. SOL + vehicles) on the existing business models, there are some critical points such as the TCO and the battery life for the first component of the project. On the one hand, the conventional bus is evaluated from a financial point of view in 16 years. On the other hand, the electric bus has a battery life of 8 years which makes the economic and financial evaluation more complex and would force companies to perform a battery replacement within the financial evaluation period. On the other hand, there is a very high level of risk given that these are new technologies and there is a lot of ignorance about various elements of the electric bus, among which are particular issues related to the behavior of batteries and issues related to recharging systems.

Regarding the second component of the project, electric delivery vehicles could imply certain economic benefits for the owner of the vehicle, due to a greater extent to the savings in fuel. However, there are certain difficulties in making this known to dealers who use conventional vehicles that are purchased at a very low price and whose fuel consumption is affordable.

3.7 Implications for Planning and Urban Development

Regarding the urban development and planning, there is a very important expectation at the level of the Municipality of Montevideo and other actors of the Montevidean society in relation to the specific improvements that will be seen in the Ciudadela bus terminal. Within the Municipality of Montevideo, it is understood that in order to massify electric mobility it is essential to coordinate actions with the "Department of Urban Development and Planning" (for example in the green space that is adjacent to the citadel terminal) with "Department of Mobility" which is SOLUTIONSplus' counterpart in the city.

Another comment that emerged during the interviews was the necessity of additional public charging stations for e-buses along with the city. In that regard, the charging station at the Ciudadela terminal could represent a good model for further replications in the city. Several points were mentioned as an example where new charging stations could be implemented.

Regarding the urban development and planning for the second component, some of the interviewees such as WeFlow and Moves commented that it is necessary to improve and expand the bikeways in particular for bikes and e-cargo bikes. Additionally, in some areas such as the Old City the 3-wheelers would be a good option for last mile logistics since there is not much space for big and medium vehicles.

3.8 Contribution of SOLUTIONSplus to Long Term Goals

The contribution of SOL + in the long term is seen with very good eyes in both components of the project since in both cases they are prototypes that, if they are successful, can be replicated in other areas of the city or the Country.

Regarding the first component, the charging center at the Ciudadela terminal is seen as a shared center for experimental use, which can be used as a model for future replications, in addition to being seen as an experience for learning and training capabilities.

Regarding the second component, the local manufacture of electric vehicles is seen as an experience that can also be replicated in other cities of the country as the number of bikeways grows and the trust of users and distributors in electric vehicle technology grows. The project is also seen as an excellent opportunity to acquire skills and local knowledge in the manufacture of small electric vehicles.

References

DLR and VTT. (2020). *SOLUTIONSplus User Needs Assessment: Guideline*.
https://drive.google.com/file/d/12F3_C5g0doKrdDYdzgLQKFHj1c8VLbqV/view

Appendix

Appendix 1 – Additional Figures

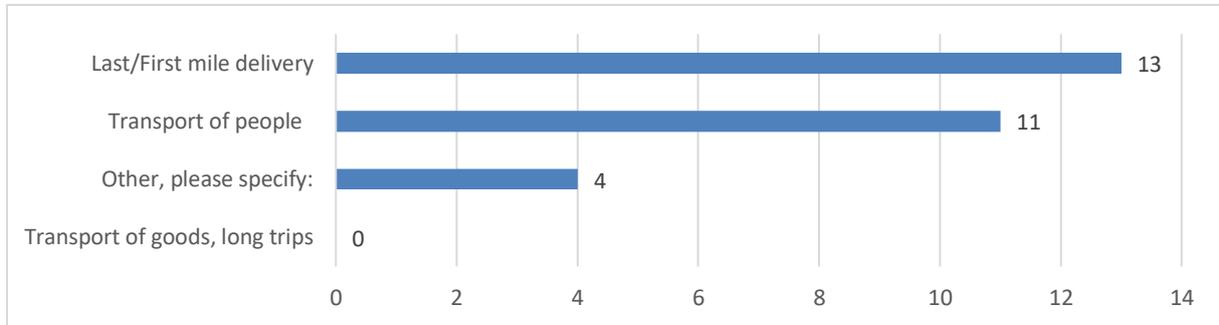


Figure A: Targeted use cases for e-vehicles (N=13).



Figure B: Areas of the city/region where the e-vehicles are going to be used (N=13).

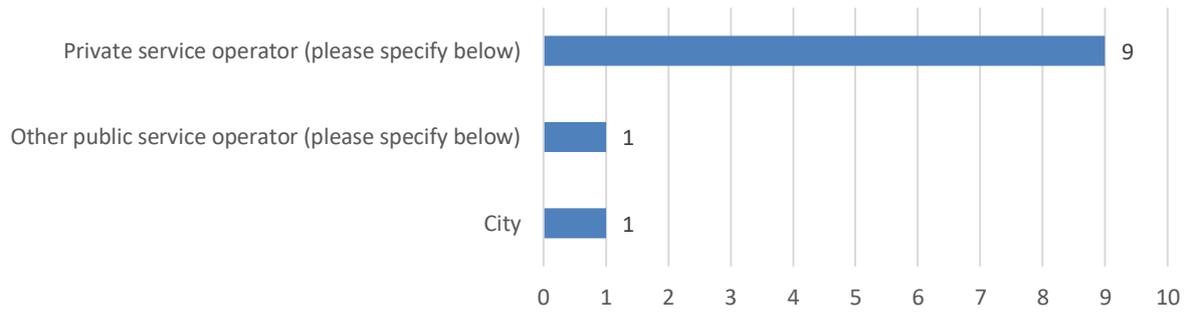


Figure C: Main service operator of the e-vehicles (N=13).

Appendix 2 – Systematization of Questions and Answer, by stakeholder group and organization

Aims and expectations

What are the main reasons why your organization is embarking on projects involving E-mobility?		
E-vehicle OEMs	UTE	<ul style="list-style-type: none"> - Generation of new demand for electric energy can improve electric infrastructure - Increased demand for electric energy without increasing the power of the grid - Use existing surplus energy generated by renewable sources - Decarbonize the transport system - Economic benefits
Private transport companies (delivery)	PedidosYa	<ul style="list-style-type: none"> - To be in line with objectives of Delivery Hero - Reduce emissions and contamination
E-Vehicle OEMs	SADAR	<ul style="list-style-type: none"> - The total cost of ownerships (TCO) of EVs will be better in short-term - MCI vehicles will be replaced by EVs for first and last mile logistics and for private transport
Local Authority	MIEM (Ministry of Industry, Energy and Mining)	<ul style="list-style-type: none"> - The conditions for electricity generation are in place to promote electric mobility - Alignment with international commitments to reduce emissions - Uruguay is a pilot country due to its size
Local Authority	Intendencia de Montevideo	<ul style="list-style-type: none"> - Reduce emissions in central areas of Montevideo - Energy efficiency, production of autochthonous and renewable electric energy - Setting a good example - Distribution of knowledge about this new technology - Economic aspects: lower energy consumption - Improve travelling comfort
E-Vehicle EOM	Green Star SRL	<ul style="list-style-type: none"> - Advantages for the company's business idea of exporting vehicles: E-vehicles require a smaller amount of different components, they are simpler, and more reliable than conventional vehicles
Research	Engineering Faculty	<ul style="list-style-type: none"> - Contribute to a solutions for charging e-vehicles in Ciudadela - A recharging hub where to test technologies and modes of use

		<ul style="list-style-type: none"> - In regards to MOVES: It is good to show that such a project can work; it is a good opportunity to encourage work and add value to the process
E-Vehicle EOM	WeFlow	<ul style="list-style-type: none"> - passion for development - mobility and efficiency in transport is a great opportunity to improve the quality of life
PTO	CUTCSA	<ul style="list-style-type: none"> - environmental pollution is a point of concern for them. - They recognize that PTOs are polluting and therefore seek to reduce the degree of pollution. For example: they have a driving school, they prioritize vehicles that consume less and emit less (in total they have 1150 buses), they add diesel with a product that reduces approximately 3% of consumption - they are evaluating buses of different technologies - in 2016 they incorporated the first electric bus to make a learning curve - They are committed to national and departmental government initiatives
PTO	UCOT	<ul style="list-style-type: none"> - The boost given by the government is the first reason - Reducing emissions is a priority but it would be impossible without state support
What have been your experiences in the current project so far (until now)?		
E-vehicle OEMs	UTE	<p>Positive aspects</p> <ul style="list-style-type: none"> - A lot of public interest/ support for new technologies - Massification of energetic concepts - Companies are ready to implement electric vehicles (EVs) - Investments in this sector - Understanding of challenges and opportunities (especially among public transport suppliers) <p>Hurdles</p> <ul style="list-style-type: none"> - Lack of supply of EVs - Few local initiatives - Resistance in the taxi union (owners) - Few capacities and lack of technical staff for reparation and failure diagnosis - Importers train their own staff - Low quality of after-sales service - Delays in obtaining spare parts - Insufficient infrastructure in private areas
Private transport companies	PedidosYa	<ul style="list-style-type: none"> - Broken streets cause problems for tricycles of MOVÉS - Would prefer e-cargo bikes to tricycles - Average load <5 kg

(delivery)		<ul style="list-style-type: none"> - Tricycles amount of 2% of entire fleet → their main purpose is publicity - Tricyclists are dependent workers - Are now monitoring the battery life (what they did not do before)
E-Vehicle OEMs	SADAR	<ul style="list-style-type: none"> - High user acceptance of EVs due to the ease of use of EVs - The demand exceeds the predictions because of governmental initiatives (until 31.03.2021, uncertainty amount development after march)
Local Authority	MIEM	<ul style="list-style-type: none"> - Learning curve: currently measuring system variables - Lack of supply of EVs - tax exemption mechanisms do not fully reach the end user - Some externalities have not been taken into account: maintenance, lack of training, user difficulties, services, etc.
Local Authority	Intendencia de Montevideo	<ul style="list-style-type: none"> - A lot of learning, for example about hurdles and opportunities - Good experience for taxis and buses
E-Vehicle EOM	Green Star SRL	<ul style="list-style-type: none"> - Production geared to user needs → users can use e-vehicles for various purposes
Research	Engineering Faculty	<ul style="list-style-type: none"> - Incorporation of 90 e-trucks with a fleet management system - Supporting MOVÉS with e-mobility - Successful implementation of taxis
E-Vehicle EOM	WeFlow	<ul style="list-style-type: none"> - They have a previous experience of 300 bikes sold and more than 2000 bicycle users, that is to say, economically and profitably the project has been a great success.
PTO	CUTCSA	<ul style="list-style-type: none"> - the experience with electric buses so far is very positive and promising for the future - there are opportunities for improvement that will be resolved by the industry (for example, the autonomy of buses) - the technology of electric buses with its limitations in terms of autonomy would imply not reaching the required distances in 80% of its current trips - They understand that the State's policy is to recharge at night to take advantage of night-time wind surpluses, which may not be enough to recharge quickly during the day.
PTO	UCOT	<ul style="list-style-type: none"> - the experience has been positive due to public acceptance, low noise emission, good performance and very satisfied drivers

		<ul style="list-style-type: none"> - satisfactory rate in terms of electricity rate - concern about autonomy and battery life - it would be interesting to have opportunity cargo in intermediate terminals such as the citadel example
What are the main challenges in the selected area / city / your operations, which you think e-mobility can help address?		
E-vehicle OEMs	UTE	<ul style="list-style-type: none"> - Centralized challenges in PT possible due to well regulated field - More efficient public transport & higher customer satisfaction - Cooperation between PTOs in adaption to EVs is a challenge - Interoperability between different PTOs - Taxis: few regulations, atomized, irrational decisions, non-professional behaviour of taxi-union, perception of new technologies as threat
Private transport companies (delivery)	PedidosYa	<ul style="list-style-type: none"> - Reduce physical exhaustion & improve the comfort of cyclists → happy deliverers could increase customer's satisfaction - Increase the speed of bicycles - Improve productivity
E-Vehicle OEMs	SADAR	<ul style="list-style-type: none"> - Fears about short ranges and loss of autonomy - Public quick charging is key
Local Authority	MIEM	<ul style="list-style-type: none"> - Noise - Emissions
Local Authority	Intendencia de Montevideo	<ul style="list-style-type: none"> - Better quality of service would improve modal split - User perception improved over the last years - Generate actions so that issues related to the environment and number of vehicles does not worsen - Hurdles: lack of supply, price, financing
E-Vehicle EOM	Green Star SRL	<ul style="list-style-type: none"> - All components are bought from the same supplier - The construction of the vehicle in its electric version is quite easy - Integration of Valeo's engine is feasible, no major adjustments necessary
Research	Engineering Faculty	<ul style="list-style-type: none"> - E-mobility as possibility to align actors - Implement improvements that go beyond electric vehicles - Intermodal transportation required - E-mobility can attract investors
E-Vehicle EOM	WeFlow	<ul style="list-style-type: none"> - the biggest challenge is culture and communication - it is necessary to generate knowledge (awareness), understanding of the situation and empowerment - Electric mobility can help in part but it is not all, but

		there are a lot of other factors that must be intervened
PTO	CUTCSA	<ul style="list-style-type: none"> - In the event that electric buses are added more and more, night recharging becomes a problem and the future need to carry out opportunity charging for rapid recharging in the middle of the bus work shift appears. - SOL + pilot see it as a necessity considering rates should be equalized at night - reducing emissions is the priority
PTO	UCOT	<ul style="list-style-type: none"> - the electric bus is very well accepted by the user and therefore can attract a greater number of users, which could help to solve congestion issues in the city and emissions issues
What's your vision for a scale-up of the project? Where could it be implemented next?		
E-vehicle OEMs	UTE	<ul style="list-style-type: none"> - Shared recharge infrastructure, for example in public terminals or next to them - Implementation in different areas of the city
Private transport companies (delivery)	PedidosYa	<ul style="list-style-type: none"> - Evaluate (un-) loading spaces & autonomous e-cargo bikes in the context of scaling up: cadets of 60-70 km in 8-10 hours - Financial support to include e-vehicles into cadet
E-Vehicle OEMs	SADAR	<ul style="list-style-type: none"> - Incentives for final users to equalize the TCO - Install public fast-charging infrastructure - Car-sharing
Local Authority	MIEM	<ul style="list-style-type: none"> - Replication of experiment in Ciudadela in Eastern parts of the city where the public transport operators (PTOs) have their charging infrastructure - Replication also possible in other nearby cities like La Paz, Las Piedras, Maldonado, Salto, Colonia, Rivera - The urban logistics project could also be implemented in other cities
Local Authority	Intendencia de Montevideo	<ul style="list-style-type: none"> - Support stations for recharging - Opportunity charging - Scale up in Montevideo as the fleet grows
E-Vehicle EOM	Green Star SRL	<ul style="list-style-type: none"> - Scale up production of GS above 100 units per month, producing also in other countries (Argentina, Europe) - Scaling up in Uruguay is very difficult due to political and technical barriers
Research	Engineering Faculty	<ul style="list-style-type: none"> - Possibility for scaling-up at 8 different places in the metropolitan region - Nodal center, electric energy and security are required

E-Vehicle OEM	WeFlow	<ul style="list-style-type: none"> - The cargo bike will be sold in a scaled way with an exponential upward curve since the cargo bike will be sold in a “customized” way (made to measure) - the e-cargo bike has 5 different variables to achieve higher sales levels - Weflow currently has no mass production capacity but could expand their activities in 6 months
PTO	CUTCSA	<ul style="list-style-type: none"> - the scalability of the electric bus project for Montevideo (MIEM subsidy) is limited / progress has to be made as the industry solves technological problems / number of people transported by each bus is lost by 10% -12% - European industry is very focused on serving the European market and they are also behind China the management is as important as the technological problem so it must be clear who will manage the community charging point - They manage their own charging center in a very good way and are very jealous about the charging point - 3 or 4 charging points should be dedicated one for each PTO (the example of taxis already denotes some problems in terms of sharing the charging point)
PTO	UCOT	<ul style="list-style-type: none"> - Portones terminal could be a point with good centrality and with an influx of many lines - It could also be the Punta Carretas bus terminal

Implementation

What are your expectations with regards to how the SOLUTIONSPUS vehicles / charging equipment are to be used in the demonstration project? What characteristics should the vehicles have?		
E-vehicle OEMs	UTE	<ul style="list-style-type: none"> - Meet the requests of the buses - Provide energy for each vehicle - Vehicles should be safe, reliable, robust
Private transport companies (delivery)	PedidosYa	<ul style="list-style-type: none"> - access to financing plans - Charging infrastructure - Durable vehicles
E-Vehicle OEMs	SADAR	<ul style="list-style-type: none"> - Prevent major changes in the use cases of vehicles to avoid adaptations of internal processes

Local Authority	MIEM	<ul style="list-style-type: none"> - Serve to later replicate - Enable scale-up - Strengthen regulations - Generating an sustainable ecosystem beyond SOLUTIONSPLUS
Local Authority	Intendencia de Montevideo	<ul style="list-style-type: none"> - Equipment for opportunity charging and charging at night - Functional load to the vehicles - Make the terminal more friendly for operators, chofers and users - More harmonious environment
E-Vehicle EOM	Green Star SRL	<ul style="list-style-type: none"> - The diffusion of the product via el plan “Flota Verde” would be very important - Good braking system - Relatively quick recharging of batteries -
Research	Engineering Faculty	<ul style="list-style-type: none"> - Contribution to understanding how the system functions - Evaluating of security and charging issues - Providing solutions and that lessons can be learned from experience
E-Vehicle OEM	WeFlow	<ul style="list-style-type: none"> - The versatility (techniques and efficiency) of the vehicle is very important to be in demand. Weflow has 5 different types of cargo bike - For bike-loads the motor should be from 350W to 1000W of power, not 250W, and the maximum speed 33 km / h => it has to have displacement force to carry the load - The design of the bicycle will have to be accessible to all, that is, older adults can climb - Bicycles have to be affordable, repairable and durable in the Latin American context.
PTO	CUTCSA	<ul style="list-style-type: none"> - compatible with the CUTCSA fleet standard - have a management system that communicates with the CUTCSA system and be able to reserve a charging point - there are no commitments with any brand of electric buses - The standardization of the fleet has given them a lot of results since having many brands was problematic in terms of maintenance and operating costs, so a brand unification process has begun (MBenz / Marcopolo) - have their own authorized workshop with preferential shopping line - The key is to choose the correct bus brand, but the next selection of brands will depend on market conditions.

PTO	UCOT	<ul style="list-style-type: none"> - it is necessary to generate many charging points in the city available to encourage the use of the electric bus since autonomy is a problem - today there should be between 5 and 6 electric bus charging stations - Regarding the loading standard, UCOT understands that it has to be unified. The connector and associated software must be unique. Yutong provided them with electric buses with the GB / T standard, which was a mistake and promised to solve (with CCS2) in the next call.
<p>Do you have any concerns/worries regarding the vehicles? Are there any risks regarding the vehicles that need to be taken into account?</p>		
E-vehicle OEMs	UTE	<ul style="list-style-type: none"> - Integration of the EVSE to the UTE charging infrastructure - Incompatibility of chargers and buses - Consider technical aspects in the next call for applications
Private transport companies (delivery)	PedidosYa	<ul style="list-style-type: none"> - Where to charge the e-cargo bikes, especially at night - Battery swapping could work, depending on the user acceptability
E-Vehicle OEMs	SADAR	<ul style="list-style-type: none"> - Security issues in traffic - Bicycles should use bike lanes
Local Authority	MIEM	<ul style="list-style-type: none"> - Different objectives of PTOs - E-bikes: risk of financial and technical viability, vandalism
Local Authority	Intendencia de Montevideo	<ul style="list-style-type: none"> - Consensus with PTOs necessary about changes in the terminal - No technical problems - The facilities must be exploited
E-Vehicle EOM	Green Star SRL	<ul style="list-style-type: none"> - Security aspects, especially because of three-wheelers - Changing of batteries could be technically complex
Research	Engineering Faculty	<ul style="list-style-type: none"> - Vandalism - Uruguay as a small country has few possibilities to influence the supply of components, vehicles, etc. - Maintaining of the vehicles has to be contemplated from the business model
E-Vehicle OEM	WeFlow	<ul style="list-style-type: none"> - there is a lot of concern about the power limitation of electric motors (250W) - For the user to be satisfied and convinced, the motor must be greater than 350W and the batteries allow autonomy of at least 60km

		<ul style="list-style-type: none"> - Users of the previous renting plan of the MOVES plan equipped with 250W motors were not satisfied - logistics companies (fedex, dhl, mercadolibre) would be a target audience for e-cargo bikes through mercadoenvío (they could have a fleet of 1,500 cargo bikes). - The 300 bikes sold by Weflow / Ecomoving are assisted bikes for passengers, not for freight. - Weflow / Ecomoving will insist on MOVES so that the motor power is greater than or equal to 350W - locally manufactured product has to be repairable locally
PTO	CUTCSA	<ul style="list-style-type: none"> - the power supply must be permanent and there can be no dips (7x24x365) which exceeds the load point (for example, in fuels they have their own backup of 4-5 working days autonomously) - To minimize recharging risks, they have a recharging center at the Añón plant for 100 electric buses with power guaranteed by UTE with a ring-shaped connection to minimize supply risks. - the user's point of view is key and there should be no drop in trips due to recharge problems
PTO	UCOT	<ul style="list-style-type: none"> - an operator for the charging point would have a high cost (the driver should recharge) - Ideally, each company has its own recharging point and that each PTO uses its own charger and the driver himself performs the opportunity recharging - They welcome the use of a pantograph, consequently reducing the size of the battery - Personnel costs. The charging time is much longer than that of conventional vehicles. - there is concern about power failure - They see the Ciudadela charging terminal as a backup and do not see too badly sharing charging points with other companies
How would you rate the current perception of EVs in the target population?		
Private transport companies (delivery)	PedidosYa	<ul style="list-style-type: none"> - A narrative about expensive e-bikes is a big hurdle for their implementation - Cadets know how to fix their bikes with MCI but not about LEVs
Local Authority	MIEM	<p>Business owners & delivery companies::</p> <ul style="list-style-type: none"> - Do not know about their savings due to a lack of quantification of energy costs - Doubts about autonomy and problems with battery

Local Authority	Intendencia de Montevideo	- PTOs: Some companies are interested in EVs, they are training people and they achieve good results
E-Vehicle EOM	Green Star SRL	- Users, business owners & delivery companies: Good adaptation of the product
Research	Engineering Faculty	- Drivers: highly appreciated the EVs, challenged public charging stations - Business owners: Investors are having doubts concerning batteries, reselling value and spare parts
E-Vehicle OEM	WeFlow	- there is a good perception on the part of potential users although the strength has to be adequate for the user experience.
PTO	CUTCSA	- very positive. they value that they are non-polluting and silent. Accessible. 30% of the fleet with low floor (all electric with low floor)
PTO	UCOT	- very satisfied. Doubts regarding autonomy. Routes that cannot be done
What would be your expectations with regards to the SOLUTIONSPPLUS start-up incubator?		
E-Vehicle OEM	Green Star SRL	- The European market could generate more demand - Partnering with European companies would be important added value - Gave positive feedback regarding the training the European companies will acquire in the process of the SOLUTIONSPPLUS project
E-Vehicle OEM	WeFlow	- There is a high level of expectations, specifically regarding sharing knowledge, measurements for the search for solutions, brand knowledge for product development - more solidity is sought in the product they are developing - frames made in Uruguay will be validated by Legend in Europe once they are finished

Regulation

Based on your experience with e-mobility projects, specifically with the one being implemented under SOLUTIONSPPLUS, are there existing regulations that you think need re-thinking, or are missing, in order to accelerate the adoption of e-mobility?		
E-vehicle OEMs	UTE	- Regulatory challenges regarding charging standards: control imports to make sure certain norms are met - A wider spread of charging infrastructure

		<ul style="list-style-type: none"> - Regulation of recharging services
Private transport companies (delivery)	PedidosYa	<ul style="list-style-type: none"> - No clear regulations regarding delivery services on the part of the <i>Intendencia de Montevideo</i> (IM) - IM should improve quality and concept of bike lanes
E-Vehicle OEMs	SADAR	<ul style="list-style-type: none"> - Lack of fiscal incentives and long waiting periods to access them - Lack of standards for fast-charging - Obligation of having a EV for 10 years: time period is too short, the total costs of ownerships is not paid off in this time
Local Authority	MIEM	<ul style="list-style-type: none"> - There should be more direct restrictions on petrol vehicles - The new regulation of the Municipality of Montevideo is sufficient for public transport (Euro 5, hybride, electric) - Need for clear regulations on technicals standards and safety for e-bikes
Local Authority	Intendencia de Montevideo	<ul style="list-style-type: none"> - It was necessary to modify the subsidy for the purchase of electric buses and incentives for taxis (regulatory change)
E-Vehicle EOM	Green Star SRL	<ul style="list-style-type: none"> - Incentives for e-vehicles exist - Uruguayan policies for producing and exporting are good - Support from the National Agency of Investigation and Innovation for the design of the vehicle - Homologation (Uruguay and United States) should be feasible
Research	Engineering Faculty	<ul style="list-style-type: none"> - Regulations and norms already exist, except for the final disposition of the batteries - Over the past years, different institutional actors started a coordination process
E-Vehicle OEM	WeFlow	<ul style="list-style-type: none"> - minimum and safety qualities in promoted vehicles - lack of inspection bodies for this type of vehicle (brake, tires, road safety) - Lack of coherence in policies (public health, transport, etc.). Lack of inter-institutional coordination. - 1,200,000 conventional motorcycles sold in 8 years without homologation requirements or controls
PTO	CUTCSA	<ul style="list-style-type: none"> - in Montevideo the service is highly regulated and the Municipality has the capacity to carry out the necessary regulations in a timely manner. - in relation to the recharging center in Ciudadela, the Municipality will have the capacity to manage the charging point

		<ul style="list-style-type: none"> - the promulgation of the UNIT standard is a key point but it is not mandatory and there should be additional regulation that mandates the use of this standard
PTO	UCOT	<ul style="list-style-type: none"> - Tariff issues are critical for opportunity charging. The reduced rate is only the night - Battery replacement issue at the half-life of the BUS is a concern - the auxiliary fleet incentives (IRPF exemptions) do not see it because the Cooperatives do not pay personal income tax, so they cannot access that benefit

Obstacles, limitations, barriers

In which phase of the project do you see the biggest hurdles/obstacles? What's your strategy to overcome these?		
E-vehicle OEMs	UTE	<ul style="list-style-type: none"> - The first months after the implementation are key - Adequate communication - Importance of close monitoring
Private transport companies (delivery)	PedidosYa	<ul style="list-style-type: none"> - Financing: need of credits
E-Vehicle OEMs	SADAR	<ul style="list-style-type: none"> - without an opinion
Local Authority	MIEM	<ul style="list-style-type: none"> - Buses: Technical support of the importer or representative has to improve - Urban logistics: Need of management of productive projects
Local Authority	Intendencia de Montevideo	<ul style="list-style-type: none"> - Main hurdles: Connectors → already half-way solved - Bureaucracy and a lack of time
E-Vehicle EOM	Green Star SRL	<ul style="list-style-type: none"> - In the beginning, user acceptance could be problematic - Mass production in Uruguay is a big challenge - Financial difficulties in the beginning
Research	Engineering Faculty	<ul style="list-style-type: none"> - There are no unbridgeable hurdles - Incorporation of private actors could be challenging
E-Vehicle OEM	WeFlow	<ul style="list-style-type: none"> - There is currently a lot of misinformation - bad sales on VEs. Very poor quality vehicles have been imported - Users have not been well informed about the

		proper use of vehicles. For example, the batteries in some of these vehicles stop working in 1 year.
PTO	CUTCSA	<ul style="list-style-type: none"> - availability of the charging point and agree on access to recharging in an orderly manner - the use of the intermediate charge will be finely evaluated to determine if it would generate degradation in the battery
PTO	UCOT	<ul style="list-style-type: none"> - in the initial phase would be the biggest obstacles, that is, to think well the initial design of the project
What are the capacity building needs related to demo and in general e-mobility in the city?		
Private transport companies (delivery)	PedidosYa	<ul style="list-style-type: none"> - Basic knowledge of how an e-bicycle works - Knowledge about repairs - Accessible repair points for drivers
E-Vehicle OEMs	SADAR	<ul style="list-style-type: none"> - without an opinion
Local Authority	MIEM	<ul style="list-style-type: none"> - without an opinion
Local Authority	Intendencia de Montevideo	<ul style="list-style-type: none"> - Recharging issues must be enhanced and expanded - Necessity of a person in the terminal responsible for carrying out the manual charging process - Develop capacities in the PTOs to carry out the management of the recharge
E-Vehicle EOM	Green Star SRL	<ul style="list-style-type: none"> - Manufacturing the bodywork as a great difficulty due to lack of knowledge among electrical technicians
E-Vehicle OEM	WeFlow	<ul style="list-style-type: none"> - Technical University of Uruguay (UTU) => Education model focused on practice => could be a very interesting partner for the development of capacities => strong focus on the automotive issue, although mainly on internal combustion vehicles (especially tuning) . - UDELAR and UTU Eco Challenge project in which each group manufactured an electric vehicle.
PTO	CUTCSA	<ul style="list-style-type: none"> - Not answered
PTO	UCOT	<ul style="list-style-type: none"> - For now the electric buses are under warranty. At the moment it is a very new technology but not even the factory itself knows the main problems of this technology. - Maintenance and software

		<ul style="list-style-type: none"> - They also see that all the components are expensive and there is also a very high electrical risk so training is required for this - With the current electrical and physical infrastructure, there would be a limit on the number of buses that could be incorporated and there is concern that the necessary investments in electrical infrastructure (substation) should be made by UCOT (terminal located in Castrisi and Cabrera, in the Union). With the current infrastructure they have capacity for 4 vehicles.
--	--	---

Sustainability of the e-Mobility solutions to be implemented

Are the planned E-mobility solutions useful to improve urban mobility?		
E-vehicle OEMs	UTE	- Yes
Private transport companies (delivery)	PedidosYa	without an opinion
E-Vehicle OEMs	SADAR	- without an opinion
Local Authority	MIEM	- without an opinion
Local Authority	Intendencia de Montevideo	<ul style="list-style-type: none"> - Increase the number of persons using public transport - Improve intermodality - E-buses are more modern and are better evaluated by users - Still too many light vehicles - Electric mobility improves the quality and travel times in the city
E-Vehicle EOM	Green Star SRL	- without an opinion
E-Vehicle OEM	WeFlow	- without an answer
PTO	CUTCSA	- without an answer
PTO	UCOT	- without an answer

Do you foresee any social positive or negative impacts derived from the demonstration project?		
E-vehicle OEMs	UTE	- No negative impacts for society are foreseen
Private transport companies (delivery)	PedidosYa	- By seeing many EVs, more people can become motivated to use LEVs - Economy of scale - Improve quality of life
E-Vehicle OEMs	SADAR	- The impact will be positive
Local Authority	MIEM	- The comfort and accessibility for the people has to be improved - People who work in the vehicle maintenance have been retrained - Similar trainings would be necessary for e-bikes - Logistic vehicles should be comfortable
Local Authority	Intendencia de Montevideo	- The TCO of the buses is not clear at the moment, so it is assumed that the costs would be the same (lack of evidence at the moment) - Prices would not be affected - Improvement in social, gender and accessibility issues - Improve the aspect of the terminal (less emissions) - Employees must be retrained in PTOs to avoid job losses
E-Vehicle EOM	Green Star SRL	- Generation of jobs - Technological transition without job losses - Positive impact on security, accessibility etc.
Research	Engineering Faculty	- Job losses due to maintenance activities
E-Vehicle OEM	WeFlow	- without an answer
PTO	CUTCSA	- there may be additional job opportunities as new skilled jobs are created
PTO	UCOT	- the impact on employment would be positive - the issue of personal safety of the employees who carry out the load
What do you think needs to be done to mitigate the negative impacts and potentiate the positive ones?		
E-vehicle OEMs	UTE	- Improve public transport

Private transport companies (delivery)	PedidosYa	without an opinion
E-Vehicle OEMs	SADAR	- without an opinion
Local Authority	MIEM	- without an opinion
Local Authority	Intendencia de Montevideo	- Training on recharge issues is being carried out by other entities such as UTE (also MOVES)
E-Vehicle EOM	Green Star SRL	- without an opinion
Research	Engineering Faculty	- Locally assembled employment units
E-Vehicle OEM	WeFlow	- without an opinion
PTO	CUTCSA	- without an opinion
PTO	UCOT	- without an opinion

Impact on existing business models

What do you think would be the main impacts of the adoption of e-vehicles (e.g. SOLUTIONSPPLUS vehicles) on the existing business models/jobs/services?		
E-vehicle OEMs	UTE	<ul style="list-style-type: none"> - UTE: improve energy management (in vehicle fleets) and efficiency - New schedule for energy generation & consumption - Business idea: respond to a price signal given by a joint venture incorporating technology
Private transport companies (delivery)	PedidosYa	- without an opinion
E-Vehicle OEMs	SADAR	<ul style="list-style-type: none"> - Transition to renting and leasing (pay what you use); the initial investment will be assumed by larger companies - In the long term: negative impact for current employees because higher qualified persons will be required
Local	MIEM	- Leasing services

Authority		<ul style="list-style-type: none"> - Freight management - Small importeurs of conventional vehicles could disappear
Local Authority	Intendencia de Montevideo	<ul style="list-style-type: none"> - Reconvert the subsidy from diesel to electric as the initial investment is much higher - There is a challenge in the life of the batteries that will have to be replaced at an unknown price (in 7,8,9 or 10 years) - EVs increase the cost of tires by weight but the cost of maintenance is lower - Challenge when using air condition
E-Vehicle EOM	Green Star SRL	<ul style="list-style-type: none"> - Production without batteries would facilitate the production process a lot and make it more economical - In the previous export scheme, each distributor had its own guarantee system - here in Uruguay it would be Green Star who would face the after-sales service
Research	Engineering Faculty	<ul style="list-style-type: none"> - Uncertainty - Varying prices
E-Vehicle OEM	WeFlow	<ul style="list-style-type: none"> - not answered
PTO	CUTCSA	<ul style="list-style-type: none"> - the conventional bus is rated at 16 years and the electric one has a battery life of 8 years - from an environmental point of view the impacts are positive - the negative impacts mentioned above will be evaluated over time
PTO	UCOT	<ul style="list-style-type: none"> - not answered
What can be done to dampen/reduce possible impacts on existing business models? How can currently active workers be included?		
E-vehicle OEMs	UTE	<ul style="list-style-type: none"> - Sharing services to make EVs more profitable - Optimize logistic services: decouple logistics and core business
Private transport companies (delivery)	PedidosYa	<ul style="list-style-type: none"> - without an opinion
E-Vehicle OEMs	SADAR	<ul style="list-style-type: none"> - without an opinion
Local Authority	Intendencia de Montevideo	<ul style="list-style-type: none"> - Currently there are no major technical issues - There are 100% electric lines (they are short lines in general)

		- There is a longer line that would need opportunity load
E-Vehicle EOM	Green Star SRL	- without an opinion
E-Vehicle OEM	WeFlow	- not answered
PTO	CUTCSA	- not answered
PTO	UCOT	- not answered

Implications for Planning and Urban Development

How can e-mobility affect the planning of the transport system in the city?		
E-Vehicle OEMs	SADAR	- No circumstantial changes that are exclusively caused by e-mobility
Local Authority	MIEM	- Reduction of emissions and noise
Local Authority	Intendencia de Montevideo	- without an opinion
E-Vehicle EOM	Green Star SRL	- without an opinion
E-Vehicle OEM	WeFlow	- not answered
PTO	CUTCSA	- not answered
PTO	UCOT	- Some autonomy of the buses is lost, so there could be a problem in that sense, but the convenience and comfort is much greater, which would favor the use of electric buses.
How can e-mobility affect urban development/planning?		
E-Vehicle OEMs	SADAR	- Positive impact on health, emissions, etc. - Future investments in infrastructure have to consider e-mobility - New technologies bring about changes in individual mobility
Local Authority	MIEM	- Electric mobility will not have effects on the territorial order in short-term

Local Authority	Intendencia de Montevideo	<ul style="list-style-type: none"> - Generation of charging points in public streets - it would be defined in coordination with the "Planification and Urban Development Department of the Municipality and also the Mobility Department
E-Vehicle EOM	Green Star SRL	<ul style="list-style-type: none"> - No big impact on urban logistics by GS - Electrification of public transport would be good, as well as making it more efficient and faster
E-Vehicle OEM	WeFlow	<ul style="list-style-type: none"> - not answered
PTO	CUTCSA	<ul style="list-style-type: none"> - cutcsa understands that the industry does not have a sufficient degree of maturity and Montevideo does not have major air pollution problems - the 8-year useful life of the buses is a key point and obsolescence can be a serious problem about which you have to be very careful
PTO	UCOT	<ul style="list-style-type: none"> - not answered
How can e-mobility affect the energy network?		
E-vehicle OEMs	UTE	<ul style="list-style-type: none"> - Power is enough for several years - Integrate surpluses from wind energy into the system - Some buildings / large surfaces could require some adaptation (transformers, cables) because of increased power demand, but demand management could avoid this
Private transport companies (delivery)	PedidosYa	<ul style="list-style-type: none"> - without an opinion
E-Vehicle OEMs	SADAR	<ul style="list-style-type: none"> - without an opinion
Local Authority	MIEM	<ul style="list-style-type: none"> - If private/personal transport is promoted there could be problems with power peaks
Local Authority	Intendencia de Montevideo	<ul style="list-style-type: none"> - without an opinion
E-Vehicle EOM	Green Star SRL	<ul style="list-style-type: none"> - without an opinion
Research	Engineering Faculty	<ul style="list-style-type: none"> - Generation of opportunities for expansion - Modernization of the network
E-Vehicle	WeFlow	<ul style="list-style-type: none"> - without an opinion

OEM		
PTO	CUTCSA	- without an opinion
PTO	UCOT	- UTE must carry out infrastructure works to enable the growth of the electric bus fleet
<p>Is there currently a long-term goal/vision for e-mobility in the city/ within the company? If yes, how might projects such as SOLUTIONSPUS demonstration be able to contribute towards the achievement of this long-term goal?</p>		
E-vehicle OEMs	UTE	<ul style="list-style-type: none"> - No concrete goal about number of EVs or amount of electric energy used for e-mobility - There will be specific requirements for buses - Faster decisions based on demand
Private transport companies (delivery)	PedidosYa	<ul style="list-style-type: none"> - they do not have specific goals in this regard other than the adoption of EVs in order to give a good image - In this type of delivery people, the economic is what prevails - If there were, in the future, providers of this type of EV and if there was a good adoption of EV by the distributors, it would be positive to migrate from motorcycles to electric bicycles or electric tricycles
E-Vehicle OEMs	SADAR	- Pilot projects are crucial for further sale-up projects
Local Authority	MIEM	- The pilots could contribute to attraction of supply of EVs
Local Authority	Intendencia de Montevideo	- without an opinion
E-Vehicle EOM	Green Star SRL	<ul style="list-style-type: none"> - Training on experiences in other countries - Exchange with other countries and markets - Linkage with other companies
E-Vehicle OEM	WeFlow	- without an opinion
PTO	CUTCSA	<ul style="list-style-type: none"> - The age of the cutcsa fleet is an average of 7 years / each conventional bus has a useful life of 16 years / the oldest buses are currently from 2008 so there is no urgency to renew buses but they do have the commitment to accompany the transition process towards electric mobility by completing the 150 buses (nationwide), of which 100 would be for CUTCSA, which would reach 100 in the next 3 years depending a little on state policies - the shared charging center can represent an experience that can provide data for or against this type of community charging solutions

PTO	UCOT	<ul style="list-style-type: none">- Being able to count on an intermediate load would allow the buses to increase their autonomy during the day, even more so as the fleet grows- intermediate load would give flexibility to UCOT operations and increase autonomy
-----	------	--

User Needs Assessment – City Report

City: Pasig

Project SOLUTIONS+

Provided by WP1 team, responsible: DLR / Mirko Goletz, mirko.goletz@dlr.de

Version: 06.01.2021

This document complements the User Needs Assessment Guideline.

https://drive.google.com/file/d/12F3_C5g0doKrdDYdzgLQKFHj1c8VLbqV/view?usp=sharing

1 Approach

The user needs assessment (UNA) was carried out in the City of Pasig through the collaborative efforts of the SOL+ partners that are directly working on the Pasig City demonstration activities - City Transportation Development and Management Office (CTDMO) of the City Government of Pasig City, Clean Air Asia, and the Wuppertal Institute. Information was collected through key informant interviews and an online user needs assessment survey. The interviews were conducted in a semi-structured manner, while the online user survey utilized the same form that was disseminated to all the SOLUTIONS+ cities.

Identification of Respondents

The relevant stakeholders that were targeted for the UNA were jointly identified by the SOL+ partners. The stakeholders were primarily separated into two levels: national and local. The CTDMO was assigned to conduct the interviews for the local (city-level) stakeholders, while Clean Air Asia was assigned to conduct the interviews with the national (and other relevant stakeholders that are not specifically based in the city).

In the case of Pasig, the target respondent groups include representatives from relevant government offices at the local and national levels, as well as potential end users of the multi-purpose electric quadricycles that are to be developed under SOLUTIONSPlus. It must be noted that only selected institutions were requested to respond to the UNA online survey questions (end-users were not asked to respond to the survey but were interviewed using a different set of questions).

Table 1. List of stakeholders approached for Either Surveys or Interviews or Combined

Institution	Short Name	Category
Philippine Postal Corporation ¹	PHLPost	Project partner/ Government-owned and controlled postal services provider; end-users
Department of Energy	DOE	National government
Department of Environment and Natural Resources	DENR	National government
Department of Transport - UNDP Low Carbon Transport Project ²	DOTR-UNDP LCT	Development agency
City Transportation Development and Management Office	CTDMO	Project partner/ City government
City Environment and Natural Resources Office	CENRO	City government
General Services Office	GSO	City government
Medical Depot		City government

Tricycle Operation and Regulation Office	TORO	City government
Medical depot	-	City government
Clean Air Asia	CAA	Civil society organisation
Senior Citizens' Association – Barangay Sta. Lucia		Other; end users
Tricycle Operators and Drivers' Association – Driver	TODA	Other; end users
Commuters		Other; end users

¹For the Philippine Postal Corporation, interviews were conducted with 3 mail carriers and 4 management representatives.

²The Promotion of Low Carbon Urban Transport Systems in the Philippines (LCT) Project is implemented by the Department of Transportation (DOTr) and the United Nations Development Programme (UNDP) and supported by the Global Environment Facility. The DOTr endorses the coordination including interviews for SOL+ to the UNDP LCT team.

Conversations were conducted with potential end-users of the EVs to get an idea of the practical user considerations which need not to be undermined (i.e. PHLPost letter carriers/ drivers, tricycle driver/operator, senior citizen's association representative). The questions asked to these stakeholders differed from the questions used for the institutional representatives.

Contextualization and Tailoring of the Assessment Questions

The common user assessment guidelines were detailed and tailored to the specific needs and context of the City of Pasig. The drafting of the bespoke interview questions based on the general guidelines was led by the Wuppertal Institute. These questions were then commented on/edited by the other partners.

Conduct of Interviews and Surveys

The interviews were conducted from November to December 2020 (listed in Table 1), while the surveys were kept open up to the second week of January 2021. Pasig CDTMO conducted the interviews for relevant stakeholders situated within the City of Pasig, while Clean Air Asia conducted the interviews for other stakeholders.

2 Results – Survey

In this section, we will be presenting results from the online survey. The results are prepared through the online portal by the WP1 team and made available to the respective city teams.

The survey data was collected by using a self-completion online questionnaire consisting of twenty-four items measured using five-point Likert scale from -2 “not at all important” to “very important”, multiple-choice questions and open questions. The survey included five major sections: city identification (Question 1), city aims (Questions 4 to 11), implementation (Questions 12 to 18), obstacles, limitations and barriers (Questions 19 to 21), and finally, background questions (Questions 22 to 26).

A total of 13 respondents answered the UNA survey:

Table 2. Survey Respondents by Type of Organisation

Row Labels	Count of Type
Local Government	6
NGO/Academe	3
National Government	2
Government-Owned and Controlled Corporation	1
Development Agency	1

2.1 Aims

For city aims questions (items 4 to 11), using five-point Likert scale, the importance rating assigned by stakeholders was computed based on the counts of each point Likert scale (e.g. stakeholder response “-2”) and its corresponding weighting factor (e.g. “-2” for point scale “-2”) as presented in the equation below. An overview of the online survey responses and importance assigned by stakeholders with respect to city aims are presented through Figure 1 to Figure 4.

$$\text{Importance Rating} = \frac{[\text{Count}(" - 2") * (-2) + \text{Count}(" - 1") * (-1) + \text{Count}("0") * (0) + \text{Count}("1") * (1) + \text{Count}("2") * (2)]}{\text{Number of responses}}$$

User and User Acceptance of E-vehicles

The top scoring goal related to “usage and user acceptance” of e-vehicles are: to study the acceptance and perceptions of e-vehicle services”; and to increase the share made with public transport. These are also quite related to the second highest goals relating to the analysis of costs of implementation, and increasing the trips made by e-vehicles.

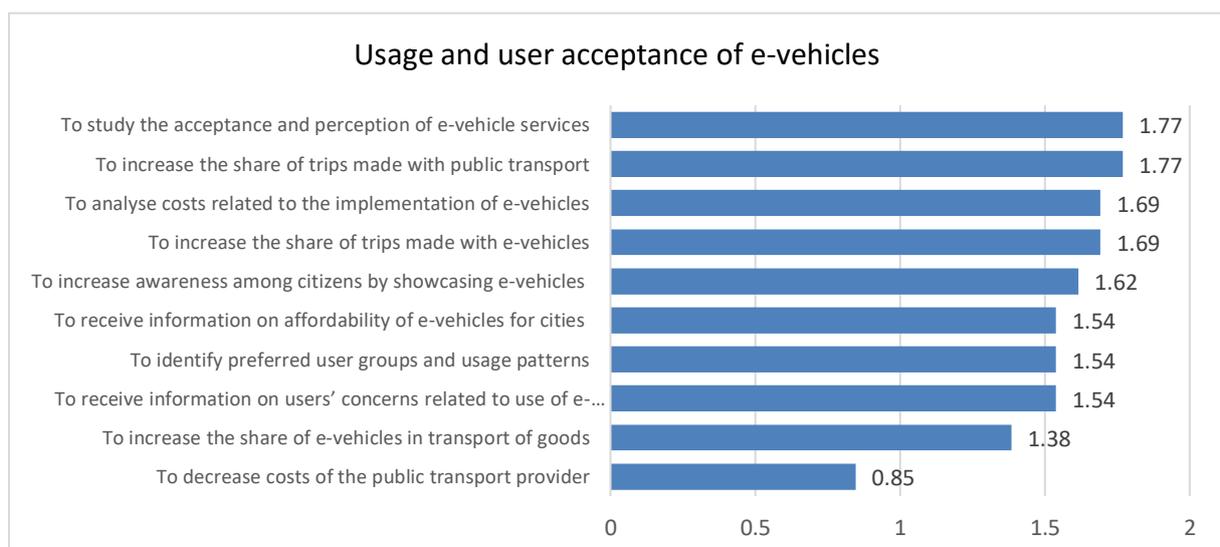


Figure 1. Aims: Usage and User Acceptance of E-Vehicles

Mobility Patterns

In terms of influencing mobility patterns, the respondents, rated the provision of stable transport services as the highest aim, on average.

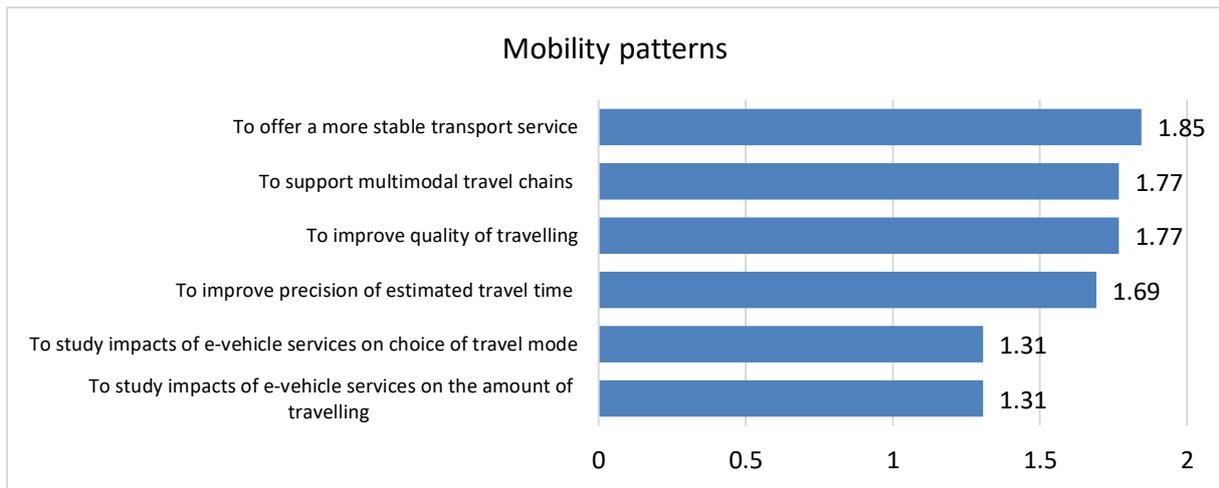


Figure 2. Aims: Mobility Patterns

City Environment

The reduction in CO2 emissions is rated as the top aim in relation to the city environment. This closely followed by the aim towards developing road infrastructure for e-vehicles.

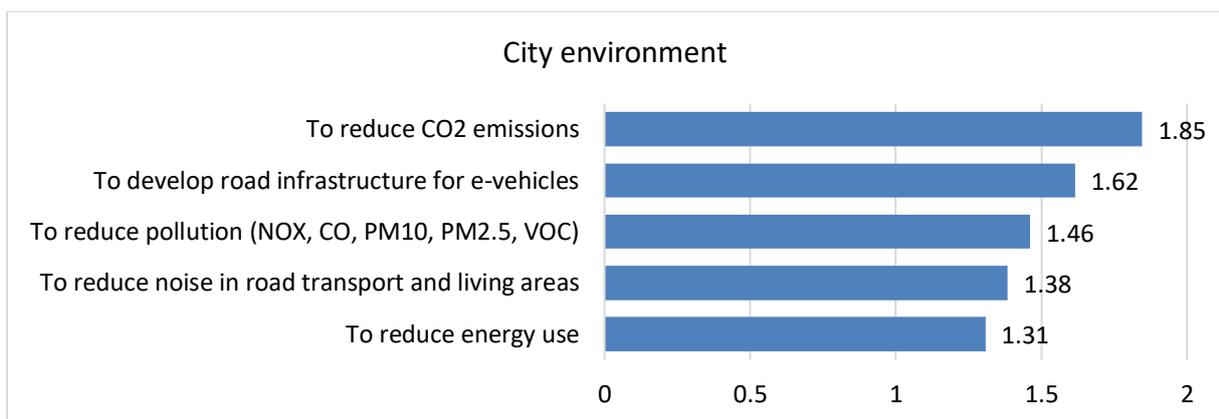


Figure 3. Aims: City Environment

Quality of Life in the City

Improving public health was rated as the highest in terms of aims relating to the quality of life in the City, followed by improving the livability of the city in general.

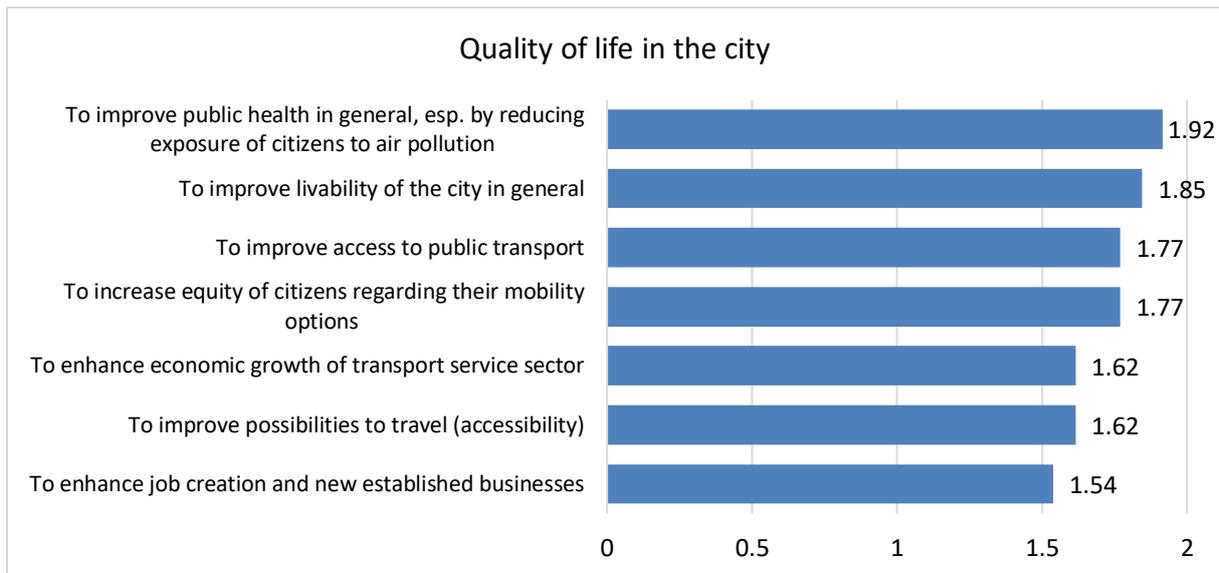


Figure 4. Aims: Quality of Life

2.2 Implementation

Target Use Cases for E-Vehicles

The results of the survey shows that the respondents expect or are envisioning the penetration of e-vehicles in different use cases: passenger (yes = 13) ; goods (yes = 10, with 9 respondents stating yes to last mile deliveries). Two respondents mentioned that e-vehicles would be used for the conduct of local government services/operations.

Areas where E-Vehicles are to be Used

Twelve (12) out of the 13 respondents expect that e-vehicles would be operating within the city centre. Five of them envision that e-vehicles will be used in suburban areas. Two (2) respondents expect that they would also be used in rural areas, and 1 respondent say that e-vehicles would be used in all the three area types.

E-Passenger Transport: Target User Groups

The graph below shows that majority of the respondents think that e-mobility should target all citizens in the city.

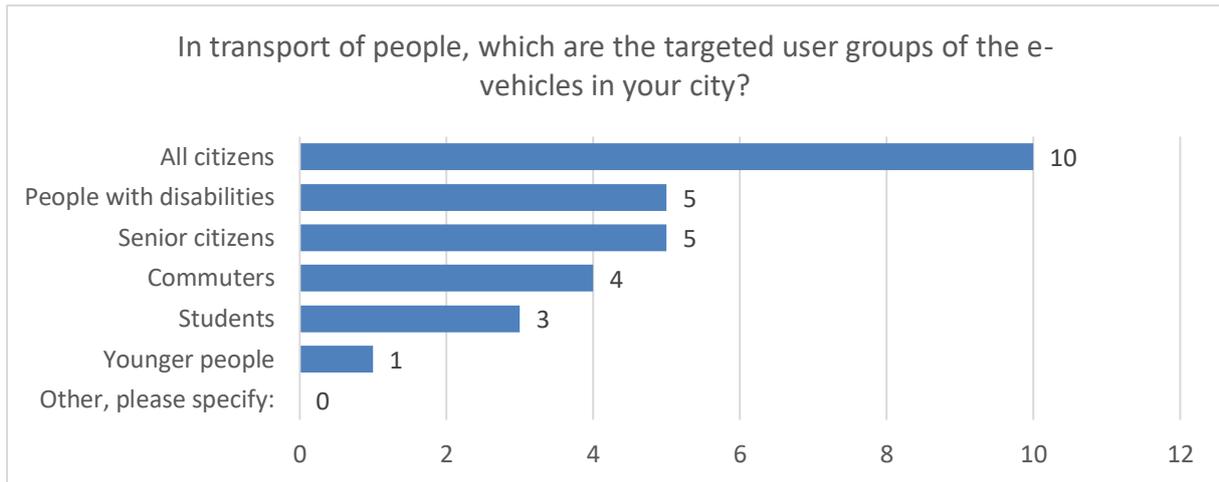


Figure 5. E-Passenger Transport Target User Groups

Passenger Transport: Types of Trips

All the respondents agree that e-vehicles will be adopted in the conduct of commuting trips. Twelve (12) respondents agree that e-vehicles will also impact job-related trips, and 10 respondents believe that e-vehicles will also impact school trips. One respondent mentions that tourism trips would also be influenced.

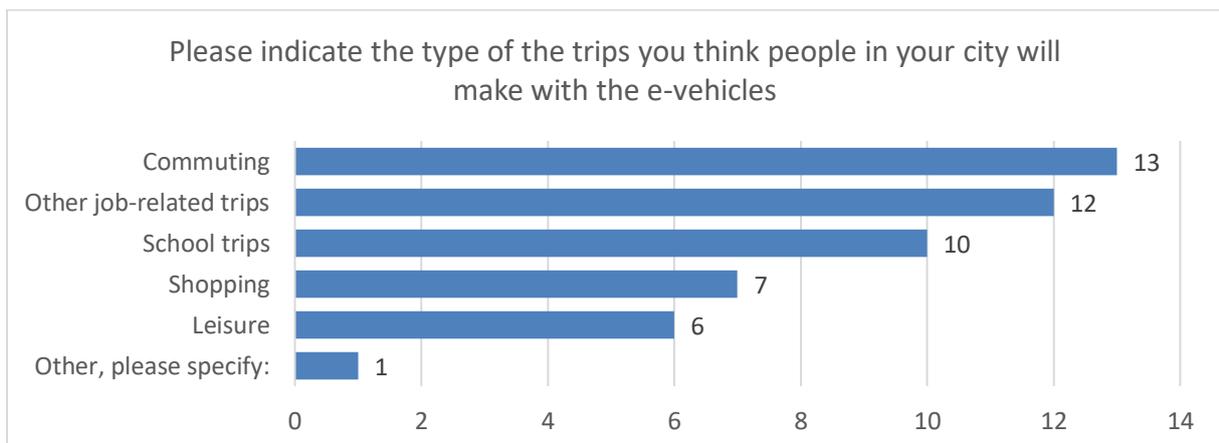


Figure 6. E-Passenger Transport : Type of Trips

E-Goods Transport: User Groups

Eleven (11) of the respondents expects that the city government would be using e-vehicles in its own goods distribution-related tasks.

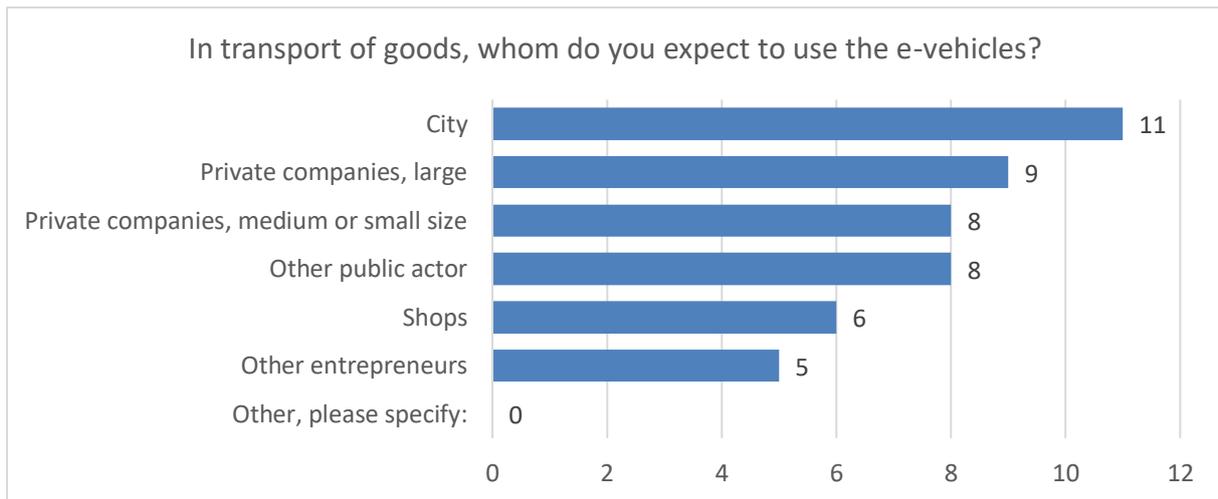


Figure 7. E-Goods Transport User Groups

Service Operator

The respondents were asked about their sentiments as to which type of organisation should be the main service operator of e-vehicles. Eight (8) respondents chose the “city government”, and “other private service operators” respectively. The following were mentioned under as potential private sector operators:

- Local post office
- Local logistics/ mobility companies (including e-commerce companies)
- Meralco (electricity distributor)
- Electric Vehicle Association of the Philippines (and/or its members)
- Other corporations which would provide e-shuttle services

One of the respondents mentions that the operations should be left to the private sector, but with strict oversight by the government.

2.3 Obstacles, Limitations and Barriers

The graph below summarizes the responses highlighting the most important barriers in implementing e-mobility programs/projects. The top response relates to the infrastructure investments needed (12), followed by (11) the low acceptance of e-vehicles by actors (e.g. transport service operators, drivers, authorities).

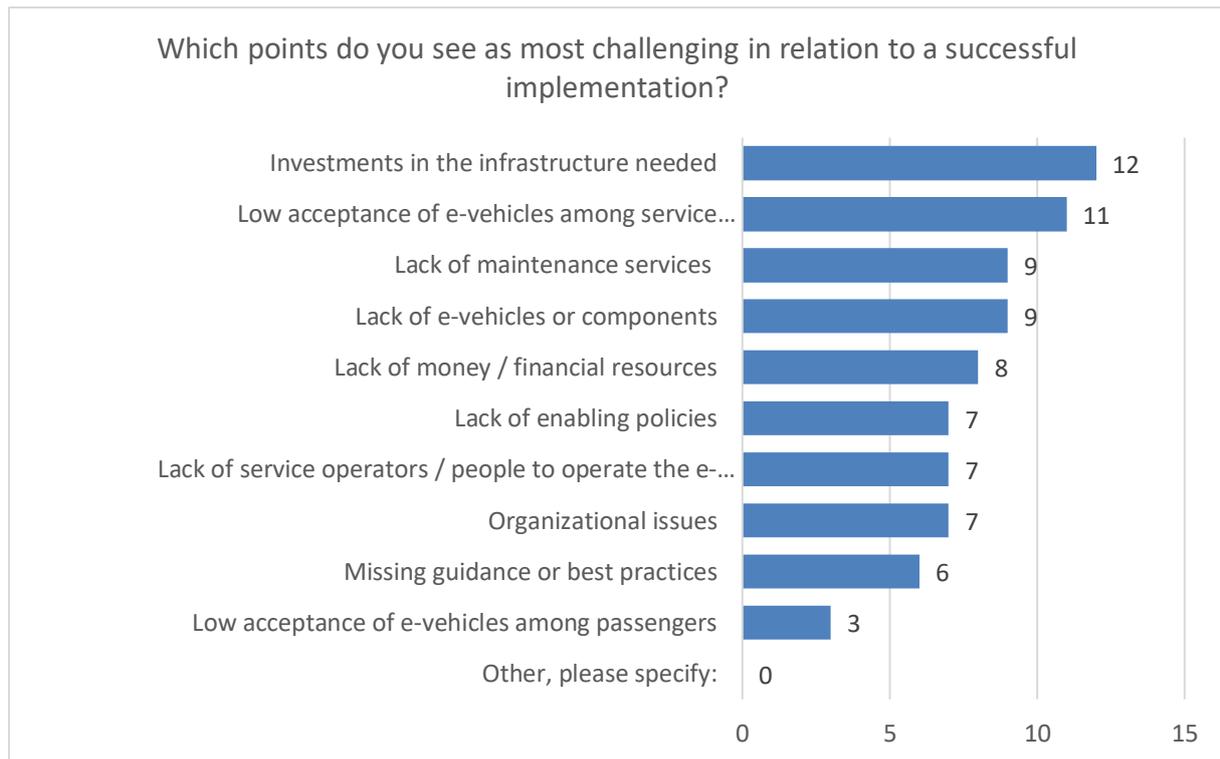


Figure 8. Challenges / Barriers to E-mobility Implementation

The following points were provided by selected respondents in relation to barriers towards the adoption of e-mobility:

Regulatory

- The draft guidelines of the national government's Land Transportation Office severely limit the places where e-vehicles can be operated legally. Essentially, light e-vehicles are proposed to be limited to recreational use, and we hope this project can provide a good counter test case
- The existing procurement law will always be on the lowest cost of acquisition for the vehicles or services. This regulation puts EVs acquisition at a lesser priority compared with petroleum-fuelled vehicles that are cheaper
- Franchising and green route identification within the route plans headed by local governments; standards that truly capture comfort and safety and quality of service; a marrying of range, capacity, route planning and infrastructure planning
- Necessary permits for operating e-vehicles (e.g. in the tricycle sector)
- Lack of national policies (regulation, incentives, etc)
- There is also a need for the clear roadmap on EV for both the government agencies and the private sector
- Need for a harmonize roadmap amongst champion agencies, the DOTr, DOE and DTI, in particular
- Lack of common charging standards

Infrastructure and Funding

- Limited public land ownership limits places where city can unilaterally place charging infrastructure
- Lack or limited counterpart funding
- Lack of charging facilities
- Lack of incentives for users to shift from ICE to EVs

Institutional and Behavioural

- Lack of support from the local leadership and *sanggunian* (local council) officials to accelerate EV adoption
- Shift to the more energy efficient and environment- friendly EVs is not the LGU's priority
- Political will of the LGU to implement new activities like e-mobility
- Capacity to assess performance and validate Strategic Tactical and Operational indicators
- Concern of the operators and drivers of conventional jeepneys and tricycles who may be displaced and will not benefit individually on EV deployment.

Others

- Lack of full pilot implementation from EV deployment/units and charging stations applicable for urban areas.
- Lack of after-sales supply chain limits the willingness of business users to take up e-vehicles

3 Results – Expert Interviews

This section presents the findings from the interviews. The findings are reported per topic; commonalities and differing views are highlighted whenever possible.

In total, there are 28 interview respondents (Table 3) for the 12 institutions for which interviews were completed as several agencies provided representation from relevant divisions internally. The list of questions were mostly shared beforehand and the interviews were conducted through a mix of in-person meeting, online call (e.g. Zoom, Google Meet, Skype), as well as typewritten responses given the time constraints and scheduling conflicts.

Table 3. Interview Respondents by Type of Organisation

		Number of Interviewees	Date of Interview
Government-owned and Controlled Corporation			
1	Philippine Postal Corporation ¹ (management)	4	Nov 27 & 28, 2020
	Philippine Postal Corporation (mail carriers)	3	3 rd week of November
National Government			
2	Department of Energy	6	Dec 3, 2020
3	Department of Transport - UNDP Low Carbon Transport Project	4	Nov 19, 2020
4	Department of Environment and Natural Resources ²	2	Dec 28, 2020
City government			
5	City Transportation Development and Management Office	3	Dec 4, 2020

6	City Environment and Natural Resources Office	1	Nov 17, 2020
7	General Services Office	1	Nov 16, 2020
8	Tricycle Operation and Regulation Office	1	Nov 15, 2020
9	Medical depot	1	Dec 15, 2020
NGO/CSO			
10	Senior Citizens' Association – Barangay Sta. Lucia	1	Nov 18, 2020
11	Commuter representative	1	Nov 16, 2020
12	Tricycle Operators and Drivers' Association – Driver	1	Nov 15, 2020
Total		28	

Notes:

¹PHLpost is a government-owned and -controlled corporation and is target beneficiary of the electric vehicles.

²There were a total of 10 attendees from the Department of Environment and Natural Resources coming from different divisions during the project introduction and interview; however, only the Hazardous Waste Management Section provided immediate answers to the interview and the rest of the respondents from Climate Change Section and Air Quality Management Section intend to provide their responses typewritten in late January. Only the Hazardous Waste Management Section's response is reflected in this report.

3.1 Aims of the city and Expectations of Stakeholders

The interviews were asked about the aims that their institutions have in relation to e-mobility, as well as the expectations that they have in relation to the SOL+ project (e.g. demonstration components such as the e-vehicles and charging solutions), and e-mobility in general.

Aims

The City of Pasig is a trailblazing city in the Philippines in terms of promoting the use of environmentally friendly vehicles, and both the CTDMO and CENRO deem that the activities done through the SOL+ project would support the city's push towards the acceleration of e-mobility to support their initiatives towards **mitigating the negative externalities of urban transport** in the City. The City is also looking forward to gauging the **feasibility of transformations** that can be brought about by e-mobility – e.g. transforming the *tricycle* sector; filling in transportation services gaps (temporal and spatial); exploring cooperation models with the private sector.

The Philippine Postal Corporation (PHLPost) representatives expressed that the SOL+ project is consistent with the entity's goal of **moving towards sustainable fleets**. It is aligning itself with the global sustainability standards and goals by the Universal Postal Union (UPU).¹ PHLPost is also envisioning that e-vehicles would ultimately help them financially (through **cost-efficient operations** and **reductions in fuel spending**). They view e-mobility as a key approach towards supporting the national government's programs towards **reducing emissions from road transportation**. They seek evidence on how might e-mobility support their aims towards improving their social impacts (i.e. number of volume of transactions of pieces of mail items injected into PHLPost chain and availability of services to every settlement in the country); improving the satisfaction of their customers and their partnerships with other government agencies and business partners; supporting the financial growth

¹ The Universal Postal Union is an intergovernmental organization of 191 member countries. It is also the United Nations specialized agency for international postal services. The UPU is the main forum for cooperation among governments, Posts and other postal sector stakeholders. The organization's mission is to develop social, cultural and business communication between people through effective postal services. It also plays a role in constantly modernizing such services.

of the institution; improving the efficiency and reliability of their services through continuous improvement of processes and application of operational Information and Communications Technology (ICT) and efficient transport means; and in supporting the learning and growth of their staff.

The Department of Energy (DOE) views e-mobility as a key strategy towards **alleviating the heavy reliance of the country on imported petroleum fuels** by reducing the demand for such. Moreover, e-mobility is a promising approach to **mitigate the continuous increase of greenhouse gases (GHG), noise, and criteria air pollutant emissions** from the transportation sector due to the existing dominance of old and dilapidated vehicles.

The representatives of the Low Carbon Transport project co-implemented by the Department of Transport and UNDP (DOTR-UNDP LCT) also recognizes the importance of e-mobility in **addressing environmental externalities** brought about by road transportation. The transformation of the fleets towards electrification should also ideally realize the **wider transport system transformation** -e.g. integration of technologies into newer fleets that improve service reliability and predictability, rethinking of networks to improve connectivity. They also mention that e-mobility is critical in future directions that concern **land use planning** (e.g. green routes identification for public transport). They also see that engaging higher **participation and investments from different sectors** is critical in the acceleration of e-mobility in the country.

Expectations

General Expectations about SOL+

The CTDMO of the Pasig City Government expects that the SOL+ demo becomes **a testbed for viable e-mobility solutions**, including infrastructure-related elements, which can then be scaled-up not only in the City of Pasig, but to other cities in the country as well (supported by a feasibility plan to achieve this at scale).

The DOTR-UNDP LCT project expects that the SOL+ activities will open possibilities for generating **private sector support** for EV and charging facility development **through visibility and awareness raising**. They expect that SOL+ and the LCT project **find synergistic opportunities to cooperate** as they are also working with the City of Pasig. Potentially, cooperation can be sought in the following types of activities: conduct of studies; business planning; policy recommendations formulation, and capacity building activities for local stakeholders. Currently they are in a preliminary stage of exploring solar charging in Pasig.

Vehicles

The CTDMO expects that the vehicles be **compatible with current commercial electric vehicle technology standards** including those that are related to charging (e.g. standards at the regional/ ASEAN level). They expect that the SOL+ vehicles use of lithium-ion batteries instead of (still predominant) lead-acid batteries. The interviewed current users of e-vehicles (pax tricycle and PHLpost letter carriers) all identified poor battery range as the key challenge in using (current) e-vehicles. One PHLPost staff mentioned that the current e-three-wheeler that they have runs up to around 24 kilometres per charge. Their primary concern as users is battery depletion while conducting their tasks.

The CENRO hopes that the vehicles are **cheap to maintain**. Similarly, PHLPost hopes that the vehicle units are cost-efficient. CENRO also expects that the vehicle units are **energy efficient**, even though they are locally assembled.

PHLPost mentions that **after sales service** should be taken into consideration in the formulation of recommendations, particularly for scaled up projects later, as their Bids and Awards Committee is quite strict with this.

The DOTR-UNDP LCT agrees that the integration of **advanced telematics and automated data collection and analysis systems** into the vehicle would be beneficial. With the telematics technology that will be part of the SOL+ Project, DOE expects that the cost of operation and maintenance of the EVs will be less and more services can be provided by the e-quads.

The General Services Office of Pasig City (GSO) expect that the vehicles would be useful in the mobilization of our staff, as well as in the delivery of supplies. Suitability towards the conduct of the primary tasks such as delivery of supplies would be the priority. The GSO expresses its concern about the **use of the vehicle in cases of floods** and suggests that this be considered in the vehicle design (e.g. use of protective casings or place batteries higher). They also highly suggest that **support towards troubleshooting and maintenance, and training for relevant staff and users (e.g. drivers)** be included in the project design. The GSO also suggests the exploration of innovative ideas such as the integration of solar power into the system.

The Medical Depot, which is under the Pasig City government, also sees the potential of the vehicles for the delivery of medical supplies of Pasig Health Aide, Pasig City General Hospital, and Child's Hope (Pasig City Children's Hospital) and would like to see any EVs for their use as being able to carry the supplies of these institutions.²

Charging

In terms of charging, CENRO suggests that **centralized common charging stations be explored** to maximize the utility of such stations by opening them up to multiple users. This identification process for strategic locations for charging facilities is also something that DOE suggests.

PHLPost suggests that **fast charging solutions be explored**, with cost considerations in mind. They also suggest that **accessibility to charging stations** be given priority in the program design (e.g. temporal and geographical access to common stations).

For the Medical Depot, they would like the charging stations to also be close to the Pasig City Hall (e.g. parking area) to make the transportation of medical supplies easier.

This sentiment is shared by the DOTR-UNDP LCT project representatives who think that exploration of **charging facilities that can be co-used** by passenger (private and public transport) and cargo e-vehicles might be beneficial. They suggest that a comprehensive study be done for charging infrastructure (including elements such as siting, policy development, financing, business models).

² To serve as a reference, the presently used Mitsubishi L300 transports 10 boxes with 144 bottles of syrup.

The DOTR-UNDP LCT also suggests the integration of proper **user interfaces for public charging stations** so that usage becomes easier and informative. They also agree on the importance of setting up a central hub for monitoring the state of the charging stations and their operations.

The GSO suggests that the project explore **battery swapping** mechanisms to address that excessive vehicle downtimes due to charging. DOE expects that the demonstration will be able to establish a systematic method in charging the vehicle fleet viz a-viz the operational demand for the e-quad units.

The concern on usage and charging during wet situations (e.g. rains) was shared by an existing driver of e-vehicle from PHLPost, and stresses the importance of **proper space allocation, and practical design considerations** for charging facilities.

3.2 Regulation

The interviewees were asked regarding their sentiments on the relevant regulations that they think are critical in shaping e-mobility in the City of Pasig (and the Philippines, in general). They were also asked to provide information on the most relevant policies and regulations that they have instituted in relation to e-mobility.

At the city-level, CTDMO states that Pasig City is **updating guidance on bicycle-related ordinances and active transport** to consider e-bikes, electric kick/standing scooters, and other similar light electric vehicles. The COVID pandemic has also opened some opportunities for prioritizing active transport for essential mobility. An executive order was issued by the Mayor in early 2020 that enables the development of a safe bicycle network in the city which is also inclusive of light electric vehicles (e.g. electric bicycles, scooters). The provision of such is granted to local governments under the Philippine Local Government Code (RA 7849). However, the regulation of larger vehicles and charging standards is within the jurisdiction of national agencies higher than the local government.

CENRO shared that the City of Pasig has implemented a **Tricycle Upgrading Ordinance** (2016). This ordinance is pursuant with the responsibilities of city governments under RA 7849. The said ordinance phased out two-stroke tricycles and provided an incentive program for realizing the transformation. CTDMO shared that the city is now looking into policy options to ensure continued improvement of the tricycle fleet (e.g. perhaps electrification).

The City is also looking into potential options for incorporating e-mobility considerations (e.g. provision of charging facilities) into its **Green Building Ordinance** (2016). The said ordinance provides for tax credits for constructing a green building, or rehabilitating/ retrofitting a building into a green one (based on the standards set by the Philippine Green Building Council). The ordinance also became the basis for the creation of a Green Building Division within the CENRO.

The DOTR-UNDP LCT suggests that **revisiting the Land Transportation and Traffic Code** (RA 4136) and EO 628-2007 (Harmonization of Vehicle Standards and Regulations). The draft “**Administrative Order on the Registration and Recording of Electric Vehicles**” of the Land Transportation Office (LTO) which is still officially under review is a critical regulation to monitor. Standards are still needed for covering the following: vehicle fuel efficiencies; whole-vehicle standards for electric vehicles; standardization of technologies and infrastructure; guidelines for selecting green routes for public transport. Incentive mechanisms (c/o the Department of Finance and the Department of Trade and Industry) should also

be strengthened. Better alignment with the national regulations and local ordinances needs to be aimed for.

Regarding taxation, the DENR has mentioned that the Department of Finance's Bureau of Internal Revenue (BIR) has begun using DENR certification in 2018 to determine whether the EVs qualify for tax exemptions following the issuance of **BIR Revenue Regulations (RR) No. 24-2018** in November 2018. This amends the guidelines for the processing of the request for tax exemption of hybrid or purely electric vehicles (HEV/EV). This responsibility was previously with the DOE. For EVs, instead of a certificate of conformity (COC), a Certificate of Non-coverage (CONC) shall be presented by the manufacturer/ assembler/importer, which contains a statement that the vehicle applied for COC is an EV and has no tailpipe emission, and therefore, not covered by RA No. 8749 or the Philippine Clean Air Act. The said CONC shall also be issued by the DENR-EMB.

The DOE has issued **Department Circular Number DC2020-10-0023** and is scheduled for publication soonest. The DC prescribes the policy framework for the fuel economy rating, fuel economy performance, and related energy efficiency and conservation policies for the transport sector and other support infrastructures. There will be consultations to be conducted and that include the relevant metrics on e-mobility. The DOE expresses a need for **reviewing the authority granted to local governments** towards franchise provision for three-wheeled vehicles for public transport. Local officials are elected by their constituents and most likely their decisions are influenced by what their constituents desire. A significant percentage of the voters are tricycle drivers and operators and can make or break a local official political career. Also, a **comprehensive plan for the routes** of the e-trikes, e-quads, e-bikes must be developed or enhanced to accommodate this new transport technology.

The mandate of DENR is regulatory in nature, such as the proper management of hazardous substances. Used **lead acid batteries** are just among the hazardous wastes being regulated by the **Department Administrative Order 2013-22**. The DENR requires all agencies, in this case Pasig city local government unit and the PHLPost, to register online as a hazardous waste generator³ should they own an EV, and thus suggests ensuring that the ownership of a shared-use EV be clear. Each of these agencies will have their own pollution control officer. Philippines has a recycling facility for lead acid batteries, and the DENR suggests having Pasig City government and PHLPost collaborate with initiatives such as *Balik Baterya* done in partnership with Philippine Business for Social Progress. (PBSP) and/or *Bantay Baterya* with *Bantay Kalikasan* of the ABS-CBN. The DENR-Hazardous Waste Management Section is still formulating the guidelines for lithium ion and nickel metal hydride batteries. At the time of interview, li-ion are exported for final recovery and disposal. There is minimal generation, so the country does not have the sizeable volume to attract investors to set up recycling facilities.

3.3 Obstacles, limitations, barriers

This section presents the discussions regarding the views of the interviewees regarding the main obstacles, limitations, and barriers to e-mobility.

³ <https://emb.gov.ph/hazardouswastemanagementsection/>

The PHLPost management mentions that the **perceptions of the letter carriers/vehicle operators** towards the use of e-vehicles is one of the main obstacles for transitioning towards e-mobility within the institution. This is perhaps due to two primary reasons: **concerns with the current models of EVs** (e.g. limited range, long charging cycles), and the fact that the current scheme provides “**gasoline allowance**” to the users (i.e. letter carriers) of conventional motorcycles (roughly 2,000 pesos per month or 35 Euros). Proving the **financial viability** of integrating e-mobility solutions into the current business model of PHLPost is also key challenge. This concern is intertwined with concerns regarding the **reliability and sustainability** of the e-mobility solutions packages when infused into the operations of the institution. In terms of regulations, one key consideration is the **registration process** with the Land Transportation Office of such vehicles. As per the current rules, if the vehicle is not registered with LTO, the vehicle cannot be covered under the government insurance scheme (Government Service Insurance System – GSIS).

The CTDMO deems that the adoption of e-mobility is constrained by the **lack of charging infrastructure**. Furthermore, unclear guidelines at the national level seem to unreasonably restrict lighter vehicles to small village roads instead of enabling their usage throughout the road network. CENRO sees budget constraints and the availability of locally available technologies, charging infrastructure, and suitable parking areas for EVs are key challenges to be addressed.

The DOE identifies the following as key barriers: **high acquisition costs of EVs, limited knowledge on the sustainability of EV operations, limited support from local leadership** (perhaps due to lack of funding, limited counter funding, and lack of priority and political will towards pushing for energy efficiency and environmental sustainability at the local level); **lack of charging infrastructure**. Early engagement and consultation among LGUs, transport groups, electric utility, developers, funding institutions, technology providers and other concerned groups for EV adoption in the area. The existing government procurement regulation which favours the “**least-cost principle**” favours lowest cost of acquisition for the vehicles or services. This regulation puts EVs acquisition at a lesser priority compared with petroleum-fuelled vehicles. Also, the franchising regulation that will support e-mobility.

The DOTR-UNDP LCT project mentions **costs recovery** and **sustainability in operations** as key local concerns, while other factors such as **lack of policy and budget, bureaucratic red tape, and lack of institutional buy-in** are some of the key obstacles for wider adoption of e-mobility. Operational concerns such as **range anxiety, battery safety** (e.g. explosions) and **the useful life of the vehicles** are also important. It agrees that **lack of infrastructure, awareness and successful precedents, and supportive policies** (e.g. charging standards, facility siting) are also important challenges to address. It suggests that initiatives towards **strengthening private sector participation** through lobbying be supported. **Integrating e-mobility into existing local plans** (e.g. GHG management plans, sustainability plans, traffic, and transport plans) is also important.

3.4 Sustainability of the e-Mobility solutions to be implemented

The respondents were asked about their views regarding the sustainability of the e-mobility solutions to be implemented. The questions revolved around the identification of enabling factors that would support sustain and expand e-mobility solutions.

The CTDMO believes that e-mobility is an important approach towards reducing motor vehicle kilometres travelled, fuel use, air pollution, and ambient noise levels. The SOL+ project can maximize

benefits and achieve scale by presenting use cases that can feasibly be scaled into larger-scale, commercial applications. CENRO mentions that the demonstration can contribute towards impulses that can be useful for **upgrading the city-owned vehicles**, as well as insights towards the **development of a bicycle and e-scooter loan assistance program** (for city employees) that they are currently exploring. Moreover, it can provide further insights towards supporting the promotion of the use of modernized jeepneys for public transportation.

In terms of the sustainability of the e-Mobility solutions to be implemented, PHLPPost suggests that special consideration towards ensuring the **longevity and quality of components** (particularly the battery), as these would weigh in heavily towards the determination of the overall feasibility of integrating these into their operations. Similarly, **“after-sales”** (or after-project) service would be highly essential. This is a sentiment shared by the DOE.

Apart from the components, PHLPPost would also like to understand other related costs they might need to invest in after the project closes.⁴ PHLPPost also said that the pilot should be able to demonstrate there are savings so that they can better justify the scaleup of their EV fleets. Savings could come from reduced motorcycle allowance and reduced fuel consumption (for PHLPPost’s own vehicle fleets).

The DOE mentions the following as critical elements towards ensuring the sustainability of the e-mobility initiatives: **engagement of key stakeholders** that include LGU and concerned offices, fleet operators, electric utility, technology providers, funding institutions, etc.; **further provision of supportive policies from the LGUs** such as incentives, parking spaces, green routes; information, education and communication activities that will demonstrate the benefits of EV adoption.

The DOTR-UNDP LCT project believes that the provision of adequate **local budgets, policy support, capacity building, and infrastructure support** are key towards supporting the long-term sustainability of the initiatives.

3.5 Impact on existing business models

The respondents were asked about their sentiments as to how might e-mobility might impact business models (taking PHLPPost as the primary example). The intended demo was explained to the national stakeholder respondents beforehand. The discussions also included envisioned impacts of e-mobility in general.

The integration of the quadricycles into the PHLPPost operations can potentially lead towards **transformative effects towards enabling the expansion of their parcel business**. The PHLPPost management shares that currently, their parcel deliveries are limited as their system is designed as a “pick up by customers” model wherein parcels are held in post offices and customers are given notices to pick them up.

In terms of operations, the **vehicle range** would play a key role in determining how the e-quads can be integrated into the operations. Similarly, the **charging modality** is key (e.g. minimizing vehicle down time during operations due to charging), and PHLPPost prefers a fast-charging vehicle. Moreover, **charging facility networks** is also key as to how e-mobility can be integrated into the operations. As

⁴ The current electric 2- and 3-wheelers in PHLPPost uses GPS tracking system by <https://manilagpstrackers.ph>. The cost is PHP 549 per unit (about EUR 9.40 per unit).

mentioned earlier, a key consideration to address is the **uncertainty towards what would happen to the “fuel allowance”** that is given to the PHLPost letter carriers/drivers who currently use gasoline motorcycles.

The DOE envisions that the e-quads can potentially lead to the following impacts to the business operations of PHLPost: **optimized and improved delivery of services; modernisation of the delivery services; operational and maintenance savings**. PHLPost needs to be **creative in designing possible revenue streams** in the operations of the e-quads through mobile ads and collaboration with other establishments in the area as part of their Corporate Social Responsibility (CSR).

At a wider level, DOE deems that e-mobility will **generate new jobs** in the design, manufacturing, assembly, repair, and maintenance of electric vehicles, and charging stations. Such a transition would require **skills upgrading** of workers to be able to meet the demands of the industry.

The DOTR-LCT sees that e-mobility can deliver business benefits through the **enhancement of the safety and quality of services, and the company’s image**, in general. **Competency frameworks for enhancing jobs/skillsets** those in the e-mobility sector need to be created.

3.6 Implications for Planning and Urban Development

The respondents were also asked how e-mobility might impact or interact with higher level planning (e.g. in terms of urban planning, wider transport planning, etc...).

The CTDMO highlights that Pasig City (and many of the Philippine cities, in general) have strong potential for e-mobility adoption, especially light electric vehicles, and the utilization of EVs in public transportation, and business operations. The **relative compactness of Metro Manila's** urban design leads to most travel being well within the range of e-mobility. Urban noise is a negative feature of the Metro Manila landscape, which can be directly alleviated by higher adoption of e-mobility. Right now, what the Philippines needs more a way to **introduce e-mobility into popular imagination**. The SOL+ demonstration can build momentum for e-mobility by showing people that everyday e-mobility applications extending beyond simple private ownership can be built in the Philippines. Introducing charging, e-vehicle sharing and business use of e-vehicles into the landscape of possibility, it would help make large steps towards higher e-vehicle adoption.

DOTR-UNDP LCT stresses the need to integrate e-mobility into relevant local plans such as the **comprehensive land use plan, GHG management plans, and green route plans**. Similarly, the DOE sees that the strengthening of the integration of EVs (particularly in public transport) may require **amending the LGUs' existing local public transport route plans** and the **zoning requirements** for charging infrastructures. Also, the **annual investment plans and the identification of priority programs and projects** need to better incorporate e-mobility considerations (including infrastructure).

User Needs Assessment – City Report

City: Hanoi

Project SOLUTIONS+

Provided by WP1 team, responsible: DLR / Mirko Goletz, mirko.goletz@dlr.de

Version: 12.10.2020

This document complements the User Needs Assessment Guideline.

https://drive.google.com/file/d/12F3_C5g0doKrdDYdzgLQKFHj1c8VLbqV/view?usp=sharing

1 Approach

This section describes the approach for the user needs assessment that was carried out with the stakeholders in Hanoi.

1.1. User Needs Assessment Team

The User Needs Assessment (UNA) in Hanoi was performed by a team responsible within Solutions+ for the demonstration in Hanoi Vietnam. This team is led by TNO and received support from UTT, in which the local university UTT arranges the majority of the contacts with local stakeholders and TNO gathers and analyses the results.

1.2. Stakeholders

Six different stakeholders from the different stakeholder groups have participated in the interviews and surveys. The interviews were carried out in face-to-face meetings, online meetings making use of video calling and in written form. The different stakeholders from the different stakeholder groups, the people involved in the interviews and surveys and the date of execution of the interviews and surveys are listed in the table below.

Stakeholder group	Organization/ Department	Name and position	UNA activities	Date and medium
National Authorities	National Traffic Safety Committee (NTSC) [N1]	Tran Huu Minh, Deputy Chief Office	Interview, survey and KPI weighting	5 Jan 2021, Online MS Teams
	Hanoi Department of natural resource and environment	Le Thi Thuy, Staff	Interview, survey	14 Jan 2021, face to face interview
	Hanoi Department of Transport	Nguyen Tuyen, Deputy Head of Department of Vehicles Do Huong Giang, Deputy Head of Department of Transport Management	2 Survey inputs	17 November 2020
	Department of Environment,	Mai Van Hien Official	survey	30 December 2020

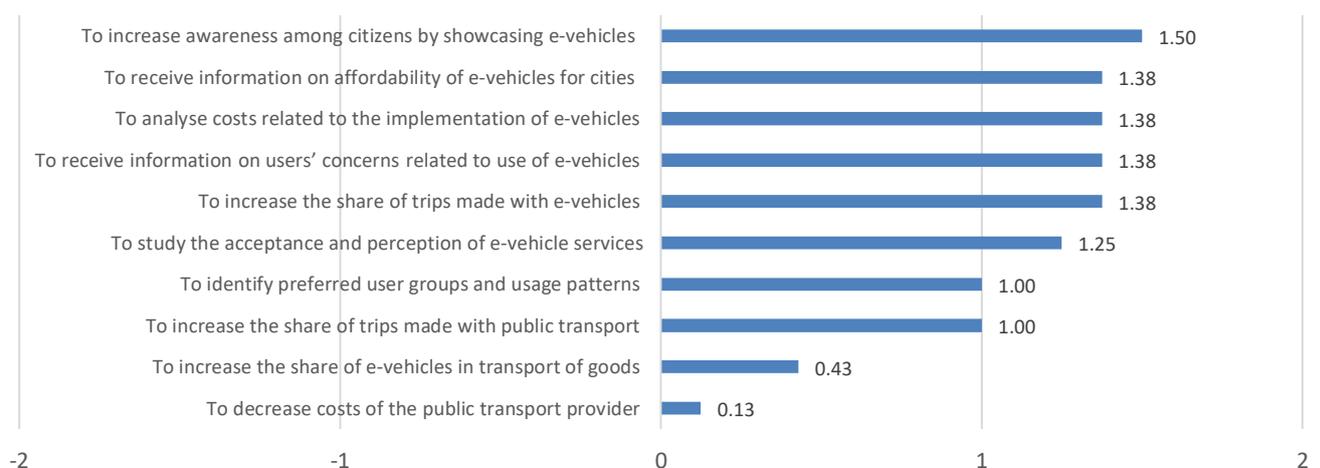
	Ministry of Transport			
Public Transport company	Hanoi Transport Service Company (Transerco)	- Nguyen Thi Hai Yen, Deputy Head of Bus Operation Center - Nguyen Manh Dat, Head of Department of Customer Service	2 Survey inputs	8 December 2020 11 December 2020
Local Manufacturing Companies	Honda Vietnam [L1]	Bui Van Dinh, GR Section manager	Interview, survey	5 Jan 2021, written interview document

2 Results – Survey

This section describes the results of the surveys that were conducted with the stakeholders in Hanoi. In total 8 stakeholders from the different stakeholder groups participated in the surveys, as indicated in the stakeholder table in section 1.2. The surveys were filled in by the stakeholders directly online or by means of a survey document that was sent to the stakeholders via e-mail. In the latter case, the survey results from the document were entered to the online survey by UTT. Even though the number of responses is low with 8 completed surveys, especially for statistical analysis, the results that are presented in this section provide a view on the stakeholders opinions regarding e-mobility in Hanoi.

The survey questionnaire consisted of twenty-four items measured, using five-point Likert scale from -2 “not at all important” to 2 “very important”, multiple-choice questions and open questions. The survey included five major sections: city identification (Question 1), city aims (Questions 4 to 11), implementation (Questions 12 to 18), obstacles, limitations and barriers (Questions 19 to 21), and finally, background questions (Questions 22 to 26).

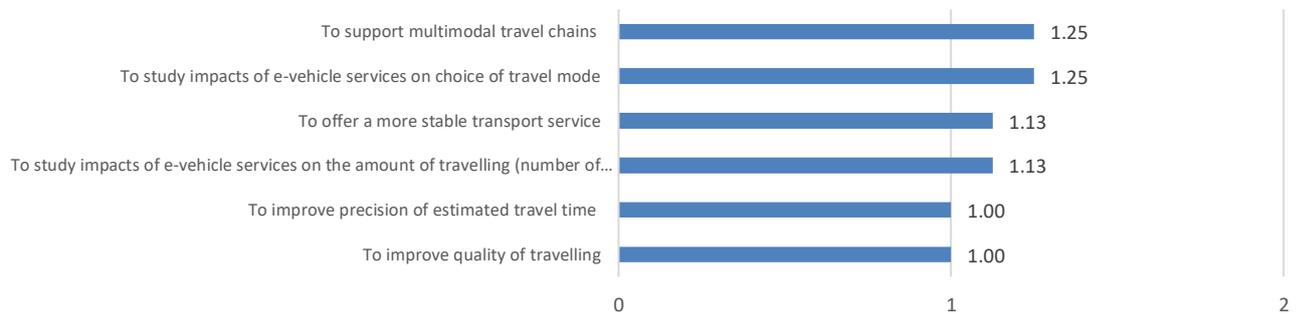
City aims- Usage and user acceptance of e-vehicles



Regarding the usage and acceptance of e-vehicles, the increase of awareness among citizens is considered the most important by the stakeholders, with a score of 1.5 out of 2. Receiving information about affordability, analysis related to the costs of implementation, receiving information about users concerns and increasing the share of trips made with e-vehicles were indicated to be almost equally

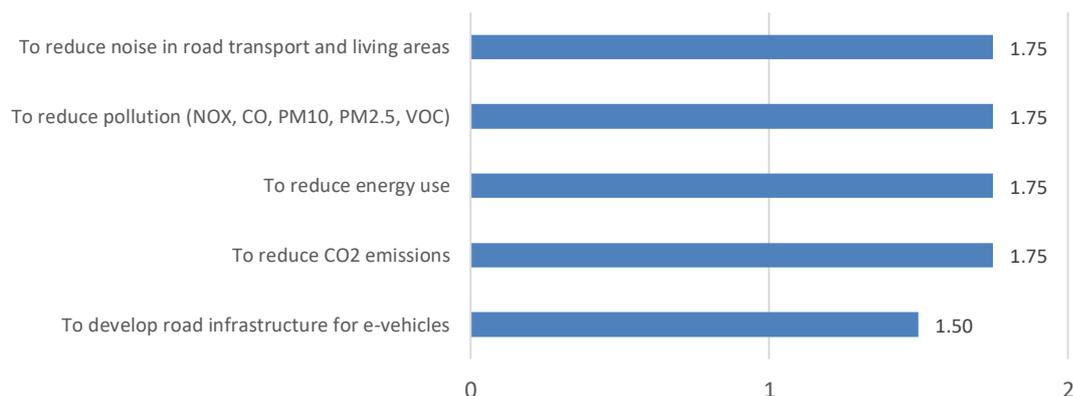
important, with a score of 1.38 out of 2. Decreasing cost of the public transport provider is found to be the least important for the surveyed stakeholders.

City *aims:* *mobility* *patterns*



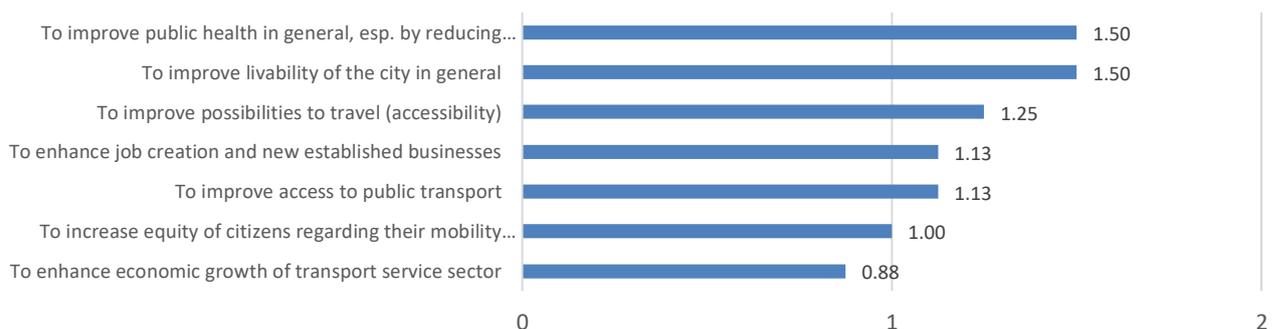
Regarding the mobility patterns, all surveyed items with found almost equally important on average. support of multimodal travel chains and studying the impact of e-vehicles services on the choice of travel mode were rated as most important, offering more stable transport service and studying the impact on the amount of traveling almost equally important.

City aims: city environment



Concerning the city environment, there is no clear difference in importance visible for the different activities based on the stakeholder survey responses. Reducing noise, pollution, energy use and CO2 emission were found to be equally necessary for Hanoi. Development of the road infrastructure for e-vehicles was considered to be slightly less important, but still important with a score of 1.5 out of 2.

City *aims:* *quality* *of* *life* *in* *the* *city*



For the aspects related to the quality of life in the city, improving the public health and improving the livability were considered the most important, with a score of 1.5 out of 2. Improving the possibility to travel was also found to be important (1.25 out of 2). Enhancing the economic growth of the transport service sector was considered by the stakeholders to be the least important with regards to quality of life.

Implementation and obstacles, limitations and barriers

Regarding the implementation (questions 12-17), the most important findings are:

- Transport of people is considered to be the most important use case for e-mobility in Hanoi. All citizens should be targeted as users according to the stakeholders. First/last mile delivery is considered the second most important use case
- The city center should be the main focus area for e-mobility according to most stakeholders, although some of the stakeholders indicate that attention should be given to all areas
- The majority of the stakeholders expect that commuting will be the main type of trip for e-vehicles
- Transporting of goods by means of e-vehicles is expected to be mainly used by shops and small to medium sized companies
- Both public and private service operators as well as the city are expected to be the main operators for e-vehicles in Hanoi
- The required investments, lack of money and financial resources and the lack of enabling policies are considered to be the biggest challenges regarding the successful implementation of e-mobility in Hanoi.

3 Results – Expert Interviews

In this section, please report about the findings from the interviews. Interviews should be carried out based on the interview guideline. Please report per topic about the findings, if so please also indicate possible differing opinions, strong common views.

3.1 Aims of the city and Expectations of Stakeholders

Expectations and needs of local stakeholders regarding e-Mobility in Hanoi in relation to the demo in Solutions+ and the upscaling afterwards

Improvement of traffic flow in Hanoi, leading to less congestion

N1 expects the demonstration in Solutions+ to demonstrate a solutions for the current traffic congestions by improving the accessibility of public transport with the implantation of e-scooters in area's lacking public transport. They expect this pilot to be a successful example, this expectation is also expressed by N2. The city will be investing in a subway network, which should be accessible by such e-mobility solutions as well. The most important KPI is the reduction of travel time to be demonstrated in the pilot. N1 expects that in future the city of Hanoi will invest in e-mobility if the Solutions+ pilot is successful. This should lead to an overall transportation system that minimizes congestion in the city.

L1 expects the pilot to provide a basis for Hanoi authorities to access customer demands and needs for e-mobility, presenting all the pro's and con's of electric vehicles. Hanoi will be able to offer safe and healthy mobility solutions, combining between private vehicles and public transportation in order to reduce emissions and congestion in Hanoi.

Additionally, N2 mentions other running demonstrations on e-mobility in Hanoi, suggesting other sectors like waste collection and transportation could also be electrified.

Long term vision for sustainable transport in Hanoi (e-mobility)

Short/Planned trip transportation can most likely be replaced by e-mobility

N1 sees the need for an social acceptance survey under the population of Hanoi, accessing the need for future mobility solutions. The most likely usage of e-scooters will on the one side be for regular trips to school and work, while on the other side a trivial usage group will also be the tourists. N2 mentions that all people should use the e-mobility solutions in future.

L1 mentions the most likely group of users will be people in need of short trip transportation during the day and people with fixed travel routes.

Usage of sustainable transport in Hanoi

Locations with a high number of visitors in big cities

The major locations with a high number for visitors, like main transport hubs (train stations, bus stops, etc.), hospitals, shopping centers and universities, have a high demand for relatively cheap transport according to N1. After that they see e-mobility being used for internal transport in big residential areas for short, on-site trips. As a last items they also see e-mobility as a viable solution for travel along the main corridors of the city, where currently approx. 20.000 – 30.000 vehicles/hour pass by. L1 sees bigger cities in general as the main usage locations of future e-mobility. While N2 suggests the whole city of Hanoi to be a area of interested for such e-mobility and especially the district of Hoan Kien, which has good government support on the running demonstration already.

Besides the transportation of people, L1 also thinks e-mobility solutions could be used for transportations of goods, although the demand at the moment is still low.

3.2 Regulation

Applicability of existing regulatory framework on e-mobility

No policy for e-mobility, meaning not blocking implementation, but potentially not beneficial for investors

There currently seems to be no relevant policy/regulations on the use of e-mobility, according to N1 such regulations need to be implemented in order to pursue people from using e.g. e-scooters instead of the commonly used and very cheap (in fuel, maintenance, purchase, etc.) gasoline motorcycles. They envisioned subsidies to be needed to support this transition to e-mobility. Without regulations and subsidies, previous research already showed investments not to be beneficial. L1 doesn't specifically see the lack of regulations as a bottleneck, since this allows them to implement their leasing construction of e-scooters without problems.

N2 confirms the lack of regulations, suggesting that this indeed means that there are no blocking conditions for implementing e-mobility.

Need for regulatory amendments to incorporate e-mobility

Lack of regulation on e-mobility and special attention needed for enforcement of regulations

According to N1 there is a need for specific regulation on e-mobility, Vietnam typically has regulations on everything, but those are insufficient for e-mobility at the moment. There are regulations for e-bikes in place already (like a maximum speed), but the enforcement of such regulations also requires attention. They specifically mentioned the need to regulations on driving locations, e.g. which lanes to drive, keeping it safe for the scooters as well as other road users (like pedestrians).

L1 mentions that there is need for regulation on vehicle management and the rental process of these scooters. N2 doesn't think there are specific regulations needed, but they do stress that the implementations need to align with the development plans of the city and private sectors should be informed properly and in time.

N1 also mentioned the lack of driving license requirements for such types of vehicles, leading to unskilled drivers driving e-scooters (and gasoline versions as well), the only requirement is age (can drive as of 16-18 years old). Hanoi already encounters this issue with the current fleet of mopeds (<50cc engine), which are often driven by young and inexperienced drivers, leading to the fact that that group is involved in 90% of the serious traffic accidents in Hanoi.

As far as N1 is aware of, there are currently only recommendations on emissions, no compulsory regulation. They also stated that they see the traffic congestion as a bigger issue than the emission issue. Although the national government does consider e-mobility as a solution for both congestion and pollution issues.

3.3 Obstacles, limitations, barriers

Obstacles, limitations and barriers in the implementation of the Solutions+ demonstration and the scale-up afterwards

Safety, security and parking space are the main challenges when it comes to e-scooter implementation in Hanoi

A major obstacle identified by N1 is the of lack of space for these e-mobility solutions, especially shared versions like those planned in Solutions+ require public parking spaces and space for their chargers as well. At the moment only 8% of Hanoi's available space is dedicated to parking, which is already a very low value compared to the recommendation of approx. 20-25%. This bottleneck on infrastructure is shared with N2, who also see a barrier in involvement of authorities which needs to happen in time for a pilot and the scale-up.

Another major concern identified by both N1 and L1 is the security of those e-scooters being parked on the street, especially overnight. Where during the day a normal lock would be sufficient to prevent theft, during the night N1 expects more advanced solutions are needed to keep the e-scooters from being stolen.

Both N1 and L1 also identified the barrier of safety, where they consider people to be reluctant of using e-scooters if they turn out to be relatively unsafe, especially if it considers usage by their kids.

N1 also indicates that a poor public transport system could also block the acceptance of the e-mobility solution, since it is likely that a large amount of trips will be realized by a combination of e-mobility and public transport.

Other aspects like way of charging, maintenance issues and investment benefits are also identified as potential dealbreakers.

How can these obstacles be addresses as early as possible in Solutions+?

Pursued users and decision makers with proper reporting and a media campaign

According to L1 it is to be advised to start building prototype charging stations as early as possible, e.g. within the Solutions+ pilot already. Linked to this both N1 and L1 suggest to arrange location for parking/storage of the vehicles as early as possible and consider the future in e-mobility for this as well.

N1 also sees a role for Solutions+ in persuading users and decision makers in an early stage, especially by providing proper reporting and making sure that these are available at with the right people. They also think a media campaign during the project could help in spreading a positive message to the people of Hanoi, which is supported by N2.

To make such pilots successful N1 envisions that regulatory changes should also be initiated early, not only on city level, but also on national level. N2 suggests to assign a local authority as project manager and ensure the pilot/project objectives align with the city targets.

3.4 Sustainability of the e-Mobility solutions to be implemented

Usefulness of e-mobility for improving urban mobility

Dependent on proper implementation

The electricity grid of Vietnam is quite far from being sustainable, which causes zero-emission vehicles to indirectly still emit polluting gasses. This could be a barrier for this improvement according to L1, as well as the lack of regulation on battery recycling and disposal. They however also think that the exchange of motorcycles for e-scooters doesn't change anything regarding traffic and congestion of the city. While N2 thinks it should help the issues with traffic congestion.

N1 claims this improvement is dependent on the actual implementation of the project, hinting to previous lessons learned with introducing bus lanes. These were placed next to the normal lanes, without any barriers, leading to drivers of other vehicles not respecting them busses ending up in the congestion after all.

Usefulness of e-mobility for improving sustainable mobility, especially in ecological and social sense

There is a high potential to improve with sustainable mobility, when all aspects are covered

Hanoi has an air-quality monitoring system, which clarifies the poor air quality throughout the year, they typically have pollution above the WHO limits for more than 300 days per year. From this N1

concludes that e-mobility for sure could improve the sustainable mobility in Hanoi from ecological point of view. Especially keeping in mind that at current the car and motorcycle fleet grows respectively with 10% and 6-7% per year. L1 also adds to this that the electricity grid in Vietnam is far from sustainable and therefore the emissions and pollution of e-mobility won't be fully zero. N2 also mentions the potential improvement of air quality that e-mobility could realize.

The lack of skilled drivers on e-scooters is still a potential risk according to both N1 and L1, this puts the safety of both the scooters and the other traffic at risk and might therefore lower the user acceptance. N1 also add the lack of space and proper driving lane guidance as key items to make e-mobility a success. While L1 stresses that the production of batteries also requires rare and toxic materials, which can end up in the environment if not handled properly.

Contribution of the e-mobility solution towards the fulfillment of public and official sustainability plans

Very likely, if properly applied on the large scale

Both N1 and L1 claim that this pilot could help fulfilling these plans, when all aspects are covered and a proper plan for the entire city is made. This should be supported by decent reporting from the pilot in Solutions+, preferably accompanied by a media campaign. N2 agrees that these solutions have the potential to improve air quality and reduce traffic congestions.

3.5 Impact on existing business models

Impact on existing business model, jobs and services

Mostly positive for public transport and e-mobility services, potential negative impact on other existing modes of transport

A positive impact in several areas is envisioned by N1, specifically mentioning increased usage of public transport by better accessibility and more business for graph services (apps for planning and routing e-scooters). L1 appends to this in the area of production, trading, warranty and repair services for e-scooters.

Due to a potential shift in travel plans (e.g. e-scooters instead of mopeds) other type transport might reduce as well according to N1. But specifically mentioning that they envision most impact to be positive.

Impact limitation on existing business model, jobs and services

Good information towards the people of Hanoi is key in this

A proper transition roadmap is necessary to minimize the impact on other business models according to L1, they also mention the need for ensured product quality to make e-mobility a success. N1 states that the negative impact aren't too big and that proper communication to the people of Hanoi would be sufficient to make them support government and ensure successful implementation of e-mobility. Media communication should be careful to position e-mobility properly in parallel to public transport, rather than placing them as competition.

3.6 Implications for Planning and Urban Development

Planning implications for urban development

Early integration into the urban planning is needed

The size of the pilot is rather small according to N1, therefore the impact on planning will be small as well. When it comes to the scale-up it should be very well integrated with the urban planning, since the impact on the whole city will be significant. N2 also expects limited impact due to the experience with currently running e-mobility solutions in Hanoi.

Planning implication for the transport system

Auxiliaries like charging and other infrastructure should be tackled early on

L1 sees the main challenge in synchronizing the planning between the implementation of e-mobility in combination with infrastructure and charging locations. Charging systems need to be setup on a large scale as well, and regulations on battery disposal should also be implemented. N1 sees the pilot mainly as a small start-up phase that allows the city to learn what is needed for the implementation of e-mobility on a larger scale.

Planning implications for the energy network

National strategy on clean energy is needed

With the increase of e-mobility the government needs to develop an overall strategy and solution for clean energy to meet the industrialization and modernization needs according to L1. N1 sees the pilot as a point to learn about the needs for the energy network.

User Needs Assessment – City Report: Kathmandu

Date: 15.01.2021

Authors: Shritu Shrestha (Wuppertal Institute) and George Panagakos (Technical University of Denmark)

1 Approach

1.1 User Needs Assessment team

In Kathmandu, the user needs assessment (UNA) was carried out through the collaborative efforts of the SOLUTIONSplus team for the Kathmandu demo activities: Technical University of Denmark (DTU), Wuppertal Institute (WI), Sajha Yatayat and Urban Electric Mobility Initiative (UEMI) local staff. The local partners - Bhushan Tuladhar of Sajha Yatayat and Abhisek Karki of UEMI provided the connection to the stakeholders in Kathmandu, while George Panagakos of DTU and Shritu Shrestha of WI conducted the expert interviews combined with the survey and KPI weighting as mentioned below.

1.2 Stakeholders and UNA activities

The UNA team in Kathmandu identified more than 20 experts that could be contacted for soliciting feedback. Until 4 Dec. 2020, interviews were arranged with 13 of these experts. In order to minimize the burden to stakeholders and ensure proper responding to the survey, the Kathmandu team decided to combine the interview questions of the abovementioned Guideline with those of the online survey in a single session (per interviewee) where the stakeholder feedback was fed directly into the online survey by one of the interviewers, while notes were taken on the stakeholder views. In order to ensure transparency, all interviews were recorded with the interviewees' consent.

Furthermore, the interview session described above was extended to include KPI weighting, which is not part of UNA. Instead, it is needed for assessing the scaled-up project, which will be proposed at a later stage of SOLUTIONSplus based on the demo results. However, as this function is conceptually very much related to the stakeholder needs expressed through the UNA, it was decided to include this part of project work in the interviews conducted under UNA.

The online survey was further circulated among additional stakeholders from groups that had already provided sufficient feedback. Three responses were also received through this path until 7 Dec. 2020. The Kathmandu team will continue communicating with the stakeholders throughout project duration. In this sense, the findings of this report cover the period up to Dec. 2020 and should be viewed as preliminary. Important additions will be reported with subsequent project deliverables if necessary.

Table 1 presents in groups the stakeholders who provided input for this report. For anonymity purposes the name, title and affiliation of the respondent are not published here.

Table 1. Respondents by stakeholder group and UNA activity

Stakeholder Group	Organisation	Code	Date	UNA activities		
				Online survey	Interview	KPI weights
Public Transport Operators	Sajha Yatayat	P1	2 Nov. 2020	√	√	√
National Authorities	Ministry of Physical Infrastructure and Transport, Department of Transport Management	N1	2 Dec. 2020	√	√	√
Local Authorities	Lalitpur Metropolitan City	C1	13 Nov. 2020	√	√	√
	Kathmandu Metropolitan City	C2	25 Nov. 2020	√	√	√
Local manufacturing companies	Shree Eco-Visionary/Electric Vehicle Association of Nepal (EVAN)	M1	9 Nov. 2020	√	√	√
	Abhyantri Karmashala	M2	2 Nov. 2020	√	√	√
	Nepal Electric Vehicle Pvt Ltd	M3	24 Nov. 2020	√		
	AGNI ENERGY PVT.LTD.	M4	27 Nov. 2020	√		
Service Providers	Wind Power Nepal Private Limited	S1	2 Dec. 2020	√	√	√
Donors	Global Green Growth Institute, Nepal	D1	12 Nov. 2020	√	√	√
	Asian Development Bank, Nepal	D2	23 Nov. 2020	√	√	√
Academia	Kathmandu University	A1	6 Nov. 2020	√	√	√
	Tribhuvan University	A2	10 Nov. 2020	√	√	√
Environmentalists /NGOs	Clean Energy Nepal	E1	4 Dec. 2020	√	√	√
	Weekly Nepal/Renewable Energy Confederation of Nepal	E2	2 Dec. 2020	√	√	√
	Aeloi Technologies	E3	7 Dec. 2020	√		

Section 2 below presents the survey results on the basis of input received from 16 individuals (13 interviewed plus 3 directly). The feedback received through interview questions is presented in Section 3. The obtained KPI weights are reported in project deliverable D1.6 (Part A).

2 Results – Survey

2.1 City aims

Figures 1 to 4 exhibit the importance that stakeholders assign on a set of potential city aims organized in four groups: usage and user acceptance of e-vehicles; mobility patterns; city environment; and quality of life. Importance is indicated in a scale from -2 (not important at all) to +2 (very important). All possible aims in the first group are scored in the zone of highest importance (between +1 and +2). The need to increase awareness among citizens by showcasing e-vehicles ranks first with the impressive average weighted score of 1,94. An extensive awareness campaign is, thus, required to accompany the demo activities of the project in Kathmandu. The role of the demos in analyzing the cost structure of EVs features as the second most important aim together with the possibility of e-mobility to increase the use of transport means in the city. The issue of affordability is also high in the concerns of the stakeholders.

Among the mobility-related aims, only the one concerning the improved precision of estimating travel time falls below +1 (important) with a score of 0,81. Given that the precision in forecasting the expected time of arrival is influenced by external factors (e.g. congestion) much more than the type of powertrain, the relatively high score of 0,81 can be indicative of a potential bias introduced due to having negative values in the scale of importance. The potential of e-mobility in improving the quality of traveling is the most important aim in this group, providing useful marketing insights for the new services.

In relation to city environment, it is no surprise that the reduction of air pollution and CO₂ emissions feature as the two most important aims (with an equal score of 1,88). Also expected was the appearance of noise reduction in the third place (1,63). These results are consistent with the domineering position of public health improvements in the quality of life category (1,94). It is rather surprising, however, that the second rank in this category is taken by the possibility to enhance economic growth in the transport sector (1,63), a finding that requires further investigation.

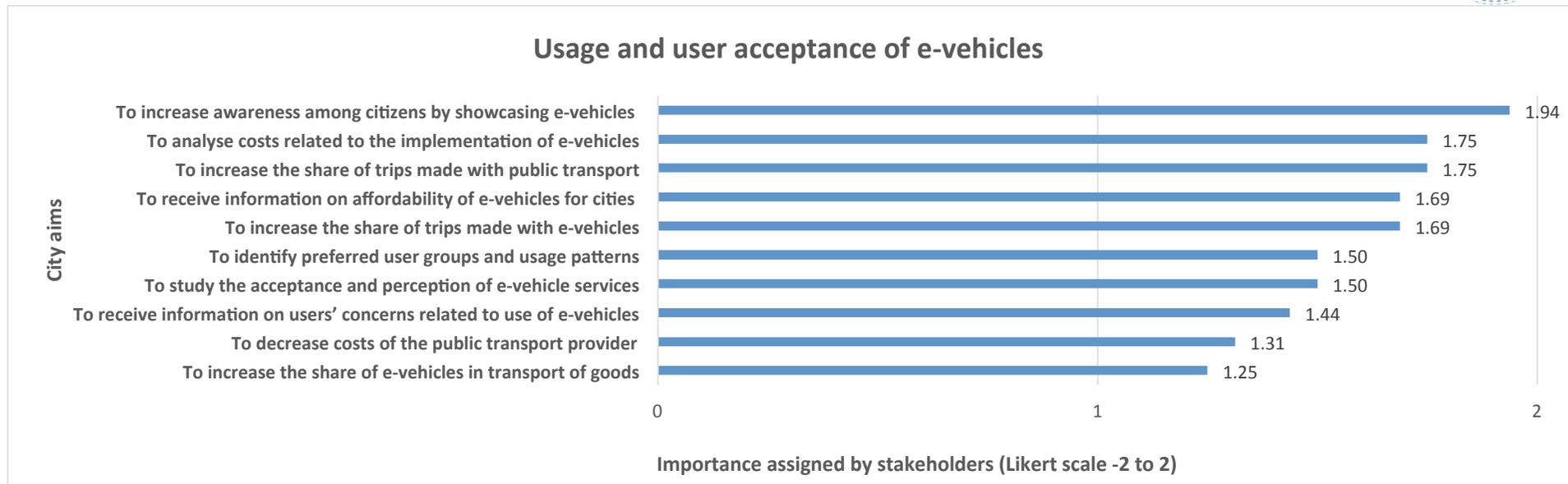


Figure 1. Importance of aims related to the usage and acceptance of e-vehicles

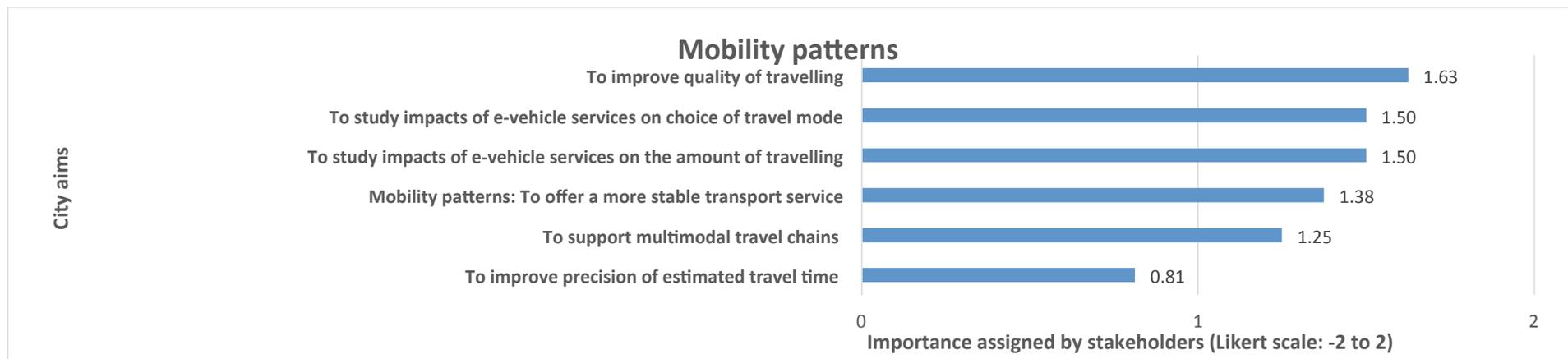


Figure 2. Importance of aims related to mobility patterns

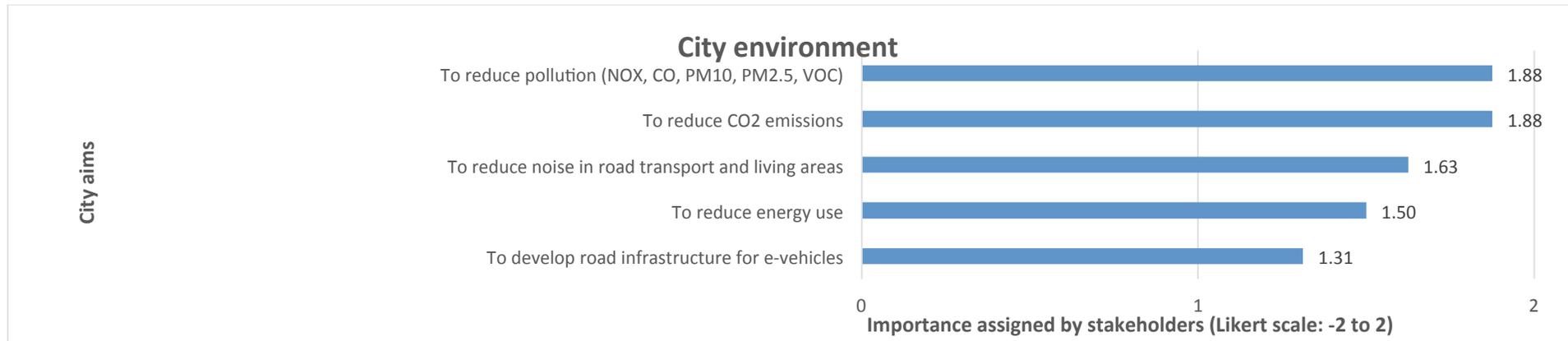


Figure 3. Importance of aims related to the city environment

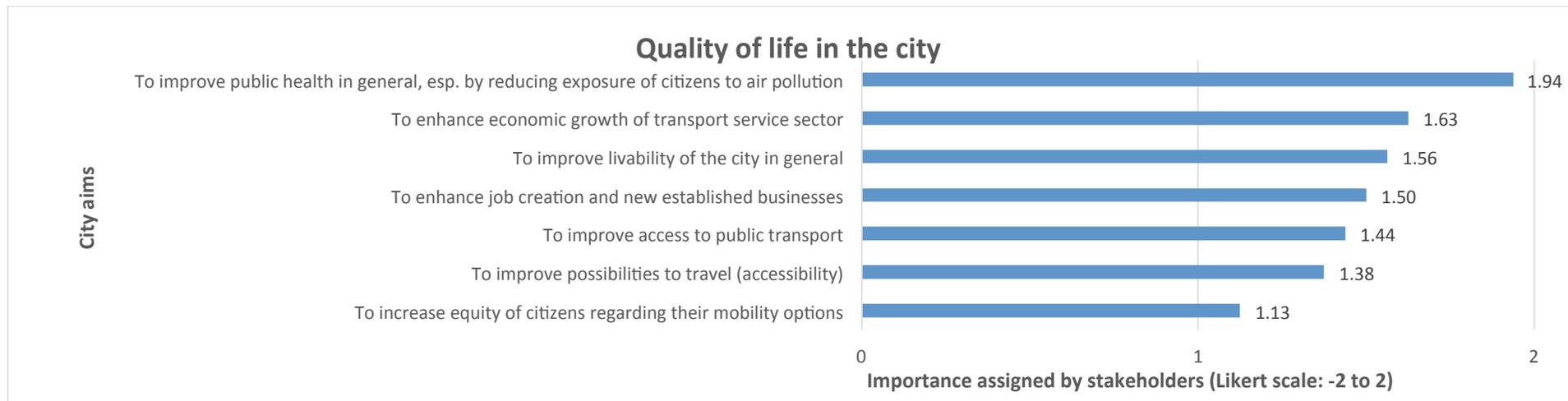


Figure 4. Importance of aims related to the quality of life in the city

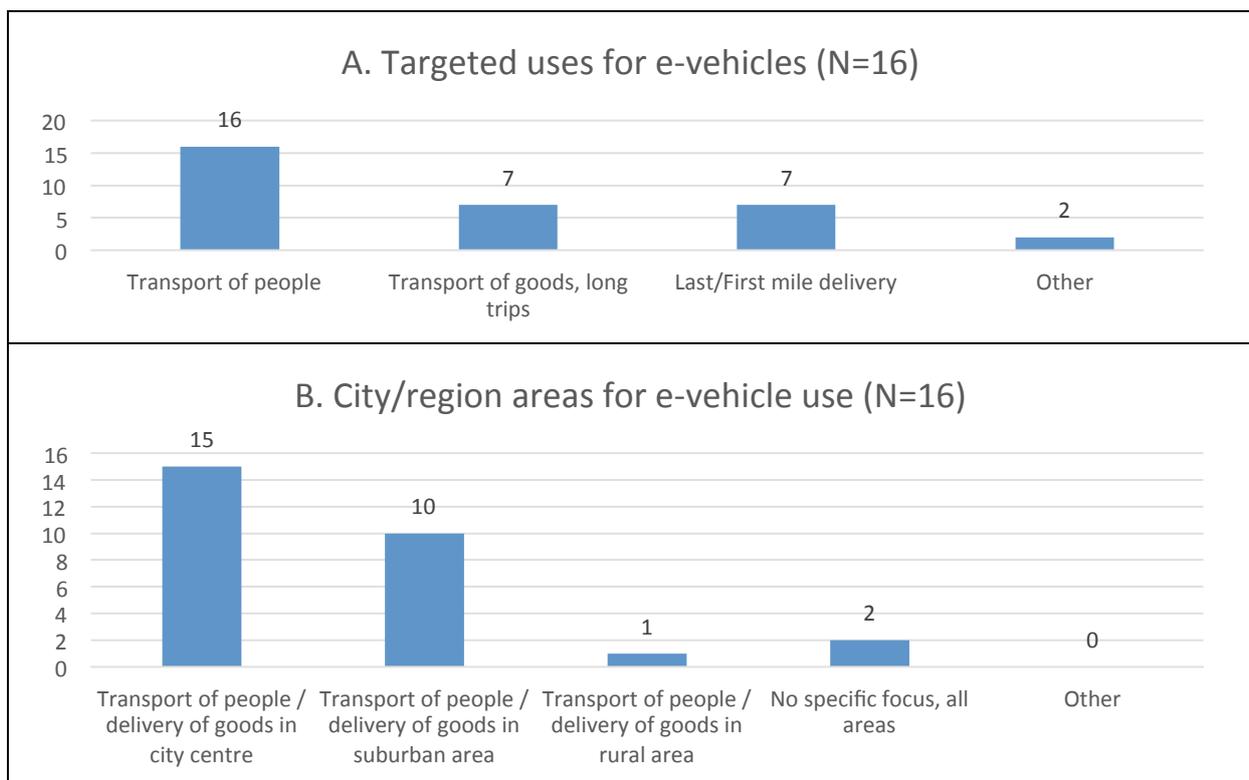
2.2 Implementation

The results concerning intended uses are depicted in the 6 graphs of Figure 5. In terms of targeted uses (Graph A), all 16 respondents selected the option of transporting people, against 7 who also selected one of the two freight transporting options. The two responses appearing as ‘other’ concern vehicle sharing uses for people and cargoes. In terms of geographic coverage (Graph B), it is no surprise that 15 out of 16 respondents selected the city center, followed by 10 answers for the suburban areas.

The clear predominance of ‘all citizens’ among the suggested user groups (Graph C) was also expected. It is worth noting that the two ‘other’ responses concern tourists and women respectively. Commuting is the most frequent type of trip (Graph D), while there is a more or less balanced reaction to all other options.

As for freight (Graph E), private SMEs attract the highest number of responses (15 out of 16) followed by shops and the city itself with 7 selections each. Garbage collection must be the most common use of cargo vehicles by the city authorities.

When it comes to preferences with regard to who should be the main operator of public transport EVs (Graph F), 14 out of 16 respondents select the private sector against only 5 who favor the city. The two ‘other’ responses concern private-public participation schemes.



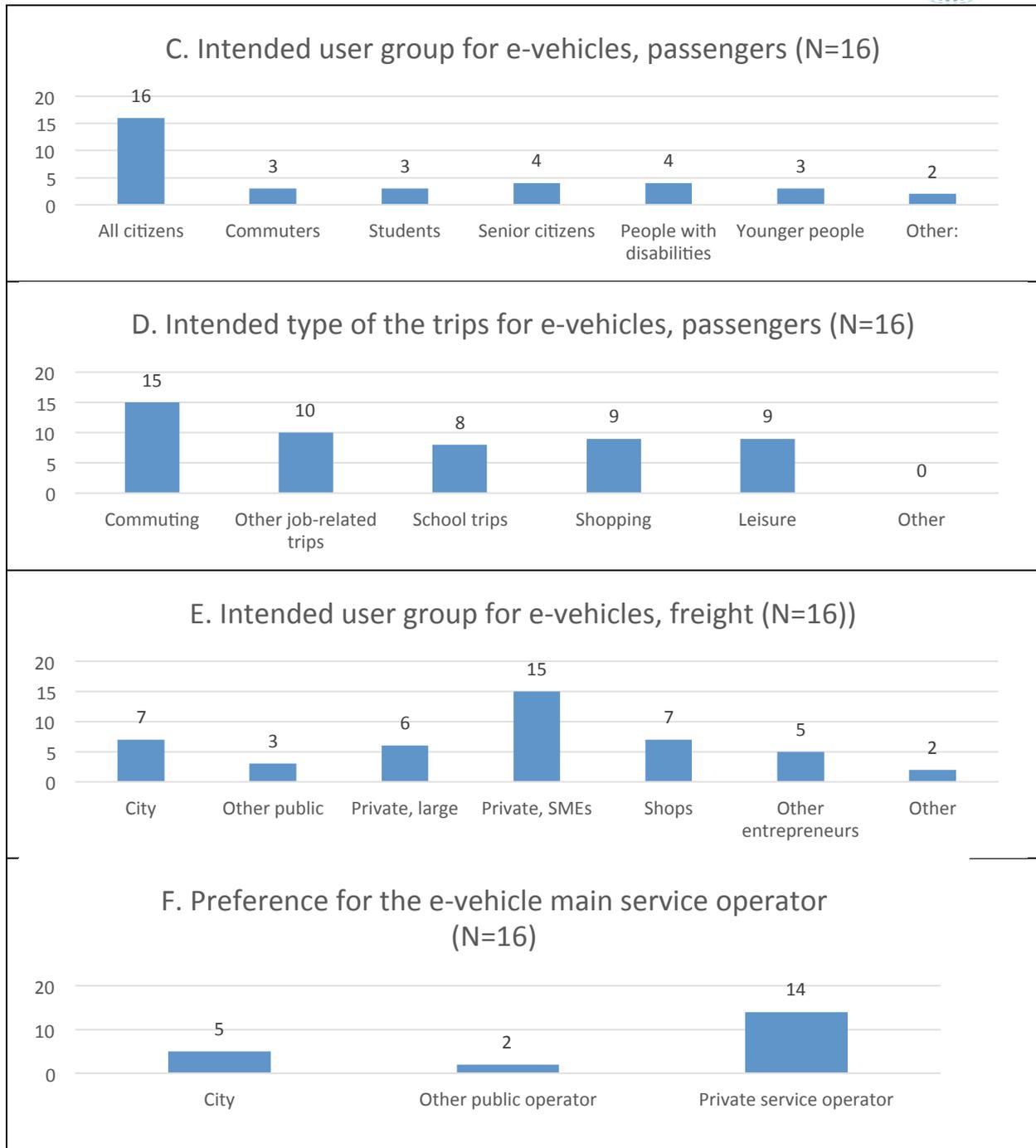


Figure 5. Intended use of e-vehicles

2.3 Obstacles, limitations and barriers

Figure 6 presents the stakeholder responses concerning factors that can challenge the successful implementation of e-mobility in Kathmandu. The lack of enabling policies appears as the most frequent factor having been selected by 14 of the 16 respondents. The lack of financial resources featuring in the second position is not surprising given the high capital requirements of EVs. What is rather surprising, however, is the lack of maintenance services, which ranks even above infrastructural requirements. It is interesting to note that low acceptance of EVs by stakeholders is considered more of a problem than low acceptance by passengers. Among the two 'other' responses,

one concerns the availability of charging facilities (should have been included under infrastructural requirements) and the other the lack of technical skills for manufacturing activities.

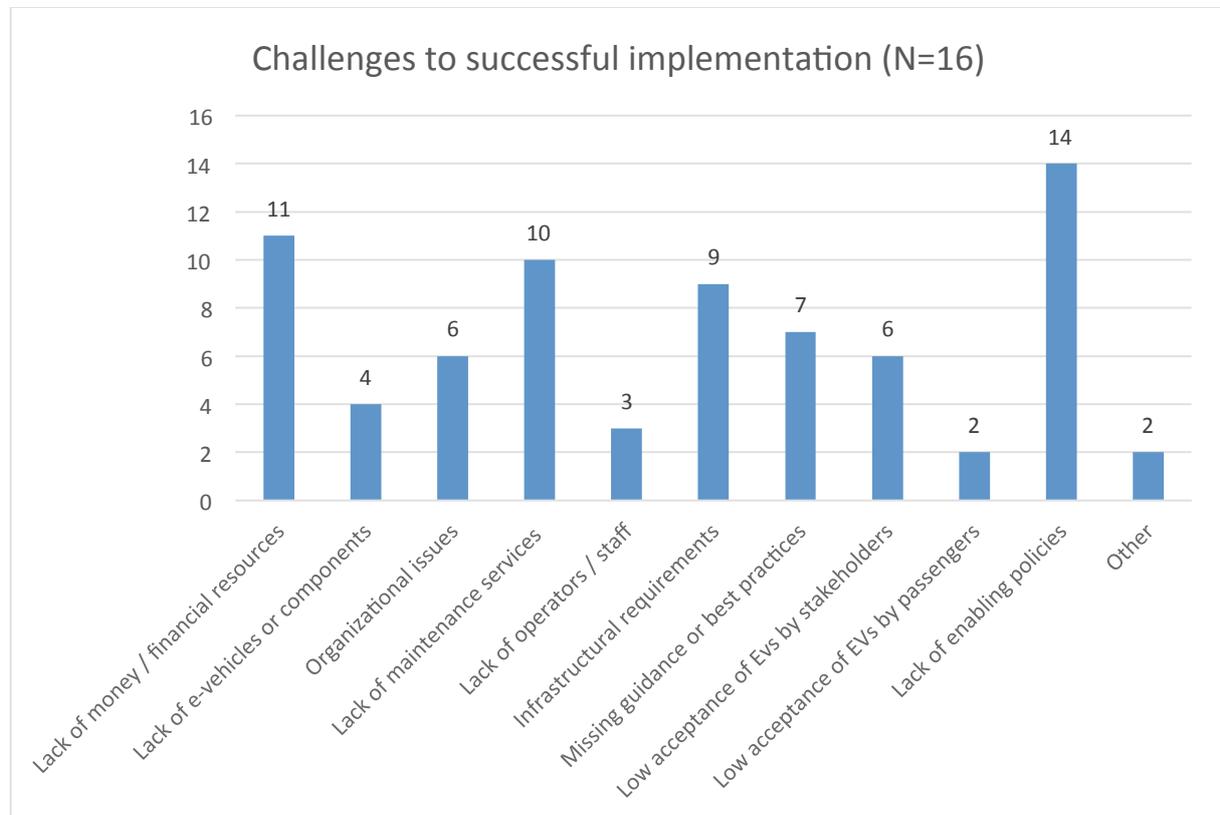


Figure 6. Challenges to successful project implementation

3 Results – Expert Interviews

3.1 Aims of the city and stakeholder expectations

3.1.1 Challenges to be addressed by e-mobility

Air pollution and effects to human health

All interviewees emphasized that the main environmental challenge in Kathmandu is air pollution (which is beyond the threshold of WHO). It is mainly due to the growing number of private vehicles and the resulting vehicle emissions (CO₂, PM_{2.5} and NO_x) that seriously affect public health. Interviewee D2 mentioned that the situation is aggravated by the vehicle condition (old and not maintained), which is not controlled sufficiently. According to public transport operator P1, the number and use of public transport is low in the city (27% of the total trips). About 80% of the vehicle fleet in Kathmandu is 2-wheelers, which is the cheapest option next to public transport. The city needs more ridership in public transport (at least increase by 50%) to reduce vehicle emissions and improve air quality. EVs for public transport are, thus, seen as a solution to this challenge. Therefore, public transport needs to become more effective, efficient and attractive to riders. The public transport operator (P1) is ready to take leadership to use the retrofitted conventional bus to e-bus and bring others along in demonstrating the future (transformation) of mobility.

3.1.2 Long term vision for sustainable transport (e-mobility)

Harness hydropower and decrease fossil fuel import

Nepal does not have fossil fuel reserves, meaning that it is 100% import dependent. On a positive note, the majority of Nepal's electricity is from hydropower generated within the country. In the near future, Nepal will have surplus electricity (mainly in the wet season and during off-peak hours) through new hydropower projects which are in different stages of development and construction. The government is encouraging the substitution of fossil fuels with electricity for cooking (presently) and for transport (in the future). All interviewees agree that EVs constitute a win-win solution protecting the climate in Nepal, and globally, while reducing the external trade deficit. Academia (A1 and A2), local manufacturers (M1 and M2) and donor D1 highlighted that Nepal needs to tap this electricity generation plan and go into the direction of an environmentally friendly transport system.

Lower operating cost and increase comfort

The high upfront cost has been highlighted by the interviewees as a challenge for the deployment of EVs in Nepal. Donor D2 mentioned that currently e-buses are very expensive compared to conventional buses (almost 7-8 times higher). Therefore, the operators are reluctant to invest in this technology. However, when considering the total life cycle cost of the electric vehicles (including the externalities related to the use of fossil fuels), it makes sense to embrace EV technology, a view shared by service provider S1. In addition, P1 states that e-buses will have lower operating costs and will increase the comfort level of the passengers. The improved comfort level could induce additional demand leading to higher revenues or lower total cost.

Support green mobility

EVs have a significant potential in Nepal that supports the transformation to green mobility. Donor D1 expressed the opinion that the country is still at a developing stage or in the path of development. As such, if Nepal plans well and is able to shift from fossil fuel to electricity, the new road infrastructure that is still to be built can incorporate charging facilities along the way in different areas in the country. National authority N1 and both local authorities (C1 and C2) mentioned that the government has a plan to promote EVs in Nepal and are developing plans and policies to support it. Other interviewees still think that the government effort on it is still not enough in adopting supportive policies. The service provider S1 argued that EV for mass transportation is a need but it is difficult to convince the government. However, the government is also planning to purchase 300 e-buses (budget has already been allocated). The procurement and operation responsibility was initially given to Sajha Yatayat but subsequently was revoked (in 2018). The government plans to take action soon. Other stakeholders are also supporting the promotion of EVs. The private sector is undertaking initiatives concerning local manufacturing supported by imports of EV parts, while academia, NGOs and international organisations (e.g. GGGI and ADB) are carrying out EV studies.

Transport authority

Various institutions are involved in planning and development of transport and road management in Kathmandu, but not in a cohesive manner. For example: Department of Road deals with developing road infrastructure; Department of Transport Management deals with regulating the transport system, licensing and managing routes for public transport (for public and private operators); Traffic police regulates and monitors the traffic; and local governments manage small roads in the respective municipalities. The national authority N1 and both local authorities (C1 and C2) pointed

out that this situation obstructs smooth planning and infrastructure development, despite the willingness of local authorities to support sustainable transport (e.g. bicycle lane development, pedestrianisation and charging infrastructure for EVs). In Kathmandu, it is mostly private operators that run public transportation. A recent study released by Donor D2 shows coordination problems resulting in overcrowding of operators in different modes competing on the same routes, adding to traffic congestion.

To address these issues, the government has constituted the ‘Kathmandu valley transport Authority’ through a special legal act. This authority will regulate and provide public transport services within the Kathmandu valley. The plan is to unify the public transport systems of three main metropolitan areas (Kathmandu, Lalitpur and Bhaktapur), identify all routes, integrate ticketing of different service providers into a single (cashless) system, and introduce vehicle standards. It is envisioned as the sole authority responsible for managing the public transport system. Currently, a preparatory committee has been formed to establish this authority. The relevant bill is in the Parliament pending approval, which might take 3-4 months (from the interview date –December 2020). Several of the interviewees (N1, C1, C2 and D2) think that once this institution is established and operationalized, the cohesiveness of transport management will improve. The government’s plan to purchase and operate 300 e-buses might get resumed through this authority. The environmentalist E2 thinks that it would be good if public transport was operated by private operators (as it is now) and the new transport authority provided the necessary policies (framework and financial incentives) for the smooth operation of EVs.

3.1.3 Opinion on SOLUTIONSplus objectives concerning vehicles and activities

Use of SOLUTIONSplus vehicles

The public transport operator P1 mentioned that the transformation of urban mobility requires more than just buses. The entire ecosystem of the city’s e-mobility needs to be considered, including all other vehicles such as 3-wheelers, 2-wheelers and cars. In terms of public transport, SOLUTIONSplus focuses on the conversion of a diesel bus to e-bus, the retrofitting of a mini bus to e-mini bus, the remodeling of e-3 wheelers, and plans to support vehicle integration. Safa tempos have been in operation for the past 25 years, but need redesign or remodeling in terms of comfort. Kathmandu also needs integrated services to promote the public transport system. All interviewees agree that the SOLUTIONSplus prototypes and planned activities in Kathmandu are very useful for promoting public EVs. Specific comments received on SOLUTIONSplus vehicles include:

- **Routing:** Local manufacturer M1 mentioned that Kathmandu has 3 types of routes (primary, secondary and tertiary). Larger vehicles (such as e-bus, e-mini bus and e-vans) could operate on larger routes, while smaller vehicles like Safa Tempos (e-3 wheelers) could be restricted in tertiary routes. This view aligns with the governmental transport plan for the city. The national authority N1 mentioned that the project ‘[Kathmandu Valley sustainable urban transport](#)’ advised the government to promote only large vehicles inside Kathmandu for public transport (mainly to reduce congestion and emissions). Therefore, smaller vehicles such as e-3 wheelers and micro-buses should be gradually discouraged from using the main routes and restricted to secondary and tertiary routes.
- **Vehicle integration:** Local manufacturer M1 pointed out that a mobile application for vehicle integration that provides information on trip plans and real time vehicle arrivals and departures would be useful and urgently needed.

- **Conversion of bus:** Donor D1 highlighted that the conversion of buses is a good idea. The success of the conversion from diesel bus to e-bus is yet to be seen. However if this research project succeeds, it would be very good for Nepal to replicate the concept. P1 and M1 explained that the cost of the converted bus would be one-third of a new one. As the operating cost of e-bus is low, the project would be cost-effective overall in addition to offering increased quality of service. The SOLUTIONSplus e-bus prototype will be a good example for raising awareness on the concept among private operators.
- **Technical standards:** Public transport operator P1 brought up the issue of lacking technical standards and operational guidelines both for e-buses (and EVs in general) and charging stations. SOLUTIONSplus could support the recommendation of such technical standards.
- **Prototypes:** The national authority N1 and the service provider S1 expressed concerns over the rationale of remodeling e-wheelers if the new law will prohibit their use on the city's primary routes. Alternatively, if these prototypes are converted into e-4 wheelers, Safa tempos could be rescued. Such a scheme will make licensing easier. In terms of smaller vehicles, the conversion of minibus or microbus would be very useful in Kathmandu. Some of the public transport operators are keen on this too.

SOLUTIONSplus as a platform for knowledge exchange

All the stakeholder groups acknowledge that the SOLUTIONSplus project with its numerous international partners and its variety of city networks provides a massive platform for knowledge exchange and diffusion. P1 added that learning from each other becomes even more important when it is about a new technology such as EVs. So, knowledge, networking and the demo project are all important for Kathmandu.

3.1.4 Charging solutions and standards

Overnight charging solution

In view of lower public demand for electricity overnight, several stakeholders pointed to the overnight charging as the optimal option for Kathmandu. Given a normal travel range of 120-130 kms per day for public transport in the city, local manufacturer M1 calculated that charging once a day (preferably at night) would be enough. However, in the dense Kathmandu valley, local authority C2 raised the issue of difficulties in finding appropriate locations for the charging system, due to the lack of sufficient public land owned by the government and the higher value of private land. As an alternative, C2 suggests leasing private land on a long-term basis.

Battery swapping

Local manufacturer M1 expressed the view that in the case of e-3 wheelers or e-2 wheelers there could be an option of a charging station or battery swapping system similar to the '[gogoro](#)' in Taiwan that would be sufficient (mainly for e-scooter) to reduce range anxiety. However, it should be noted that for normal usage in Kathmandu, charging the lithium ion battery more than once a day might not be necessary.

Charging infrastructure

The lack of a charging system is one of the main problems to promote EV in Kathmandu, as there are no charging stations in major highways and also inside the city. The charging supply is mainly at the household level and applies the slow charging process. The national authority N1 mentioned that Nepal Electricity Authority (NEA) is planning to provide charging stations. However, the process has been delayed due to COVID and other reasons. NEA is planning to operate its own station network.

They allow private actors to come up with plans for charging stations. The lack of common standards, however, remains a problem as the charging requirements of an EV type might be different to those of other vehicles. The need for SOLUTIONSplus to address this issue is repeated.

3.2 Regulation

3.2.1 Existing policies

Policies highlight e-mobility but implementation has to be improved

Several transport policies in Nepal address e-mobility and have set some targets but various interviewed stakeholder groups pointed out that the target has not been met and policies are not implemented well. As mentioned by the public transport operator P1, policies that concern e-mobility include the 15th 3-year plan by National Planning Commission, the national 5-year development plan, the environment friendly vehicle and transport policy, and the NDC (an enhanced NDC was submitted in December 2020 with stringent targets). The government needs to come up with supporting policies for successful implementation of planned actions. Regarding the vehicle components tax, the local manufacturers M1 and M2 mentioned that the tax for electric vehicle components is lower for them, a fact that supports local manufacturing (the normal import tax of EV components is 15% while for local manufacturing purposes, it drops to 5%).

3.2.2 Existing regulations that need re-thinking

Financial incentives

Given the higher upfront cost of EVs, financial incentives can play a crucial role. The local manufacturer M1 and environmentalist E2 stressed that entrepreneurs and operators should be able to obtain bank loans at suitable interest rates. Without this support, the investment process would not happen. Government can and needs to come up with Green Climate Funds to support investments in EVs. The academia A2 also identified the need for government subsidies and favorable tax treatment, which are crucial for the first few years until the technology matures and market penetration improves.

Fossil fuel tax

The national authority N1 mentioned that the government has accumulated a significant amount of pollution taxes imposed on fossil fuels and conventional vehicles. That fund has been idle for a long time. Government has not been able to utilize the fund to promote EVs until now.

EV tax

The custom duty on public transport vehicles is 1%, both for fossil fueled and electric. As the upfront cost of e-buses is higher than that of conventional ones, transport operators are reluctant to invest in the new technology. Supporting financial incentives are required. The national authority N1 mentioned that in order to promote public transport and/or electrify public transport, the government not only should keep import duties to the low level of 1%, but also needs to consider measures such as annual and/or income tax breaks (currently under discussion).

The very high total tax on fossil-fueled vehicles (248%) comprises a significant source of government revenues. In comparison, the total tax on EVs was much lower (around 30%). However, with the recent budget speech, this tax has been increased to 80%. All interviewees emphasized that the increased government revenues due to higher taxes have discouraged the sale of EVs. The environmentalist E1 stated that a mindset shift is required from the government.

Electricity tariff

Together with other stakeholders who favor the overnight charging option, the national authority N1 supports a reduced night tariff for electricity (under discussion).

Legalization of vehicle conversion

The conversion of existing vehicles to EVs is not clearly legalized. This creates licensing problems to this kind of vehicles. Public transport operator P1 mentioned that the government plans to change the relevant regulation in order to define technical and operational standards. However, for the time being this intention is just a plan.

3.3 Obstacles, limitations and barriers

Electricity Transmission

Nepal can harness the hydropower generated in the country to charge the EVs. However, academia (A2) points to the issue of reliability of electricity supply (transmission lines, distribution network and voltage fluctuations) that needs to be addressed to support the EV market uptake.

Financial resources/upfront cost

The higher upfront cost of EVs is a bottleneck for public transport operators, entrepreneurs and owners, which is intensified by the high interest rates on investment loans. The local manufacturer M1 highlighted the supportive role that lower interest rates on bank loan can have.

Lack of charging infrastructure

EVs are a new transport system in Nepal and the lack of charging infrastructure is an issue. Donor D2 mentioned that the government needs to support a network of charging stations. Unless and until charging infrastructure is in place, it will not be easy for the public to use EVs. Unlike easily accessible refueling stations for conventional vehicles, the number of EV charging stations is very limited. The charging duration is also an issue for the users.

Permission of SOLUTIONSplus prototypes

The SOLUTIONSplus prototypes might have to go through the complex process of getting testing and operation permissions. The service provider S2 is concerned that the conversion is still not legally accepted. However, an amendment draft is being processed. P1 also shared the same concerns and highlighted in addition that the provision of technical assistance and demonstration of good practices by SOLUTIONSplus can enhance the amendment process. In this respect, the project demos can showcase the technical and financial viability of conversions.

Technical expertise

The local capacity for operation and maintenance of EVs is a major concern for all interviewees. Donor D1 mentioned that the transition to EVs is expected to add more jobs on top of replacing existing ones. Qualified technicians are needed and so is the relevant capacity building. Likewise, the role of experts in e-mobility should also be gradually developed. In consideration of this need, academia (A1 and A2) is in the process of developing specific programs on EVs in order to train stakeholders, including public transport drivers. A1 highlighted the need of training curricula for workshop mechanics re-orienting them from maintaining gasoline vehicles to e-vehicles. A 'Train the Trainers program,' delivering knowledge in a simple and practical manner, would be useful to build

local capacity. The local manufacturer M2 identified difficulties in local production due to lack of qualified laboratories equipped with testing facilities.

Awareness

Many stakeholders are not aware of the benefits of EVs and, as such, are not keen to embrace them. The service provider S1 mentioned that the decision makers/policy makers/bureaucrats need to become aware of these benefits. This will support the formulation of the required plans and policies, as well as their implementation.

3.4 Sustainability of the e-mobility solutions to be implemented

All interviewees agree that SOLUTIONSplus has the potential to transform mobility in Nepal. Donor D1 agrees that SOLUTOPNSplus demonstration activities in Kathmandu address all parts of the e-mobility ecosystem – related stakeholders, technical needs and policy support. If SOLUTIONSplus demos are implemented and prove successful, they have the potential of scaling up through local manufacturers. However, this development needs to be combined with sufficient financing. It is necessary to look into who and how will take over the successful examples of converted e-bus and e-3 wheelers, as well as how will they be implemented and scaled up. A plan for developing bankable projects is necessary.

As mentioned earlier, D1 highlighted that although the government has adopted a lot of EV-related policies, their actual implementation is problematic. It is necessary to address this gap and SOLUTIONSplus can assist in this direction with some ideas.

3.5 Impact on existing business models

The public transport operator P1 was well aware of the necessity for extensive future investments on converted e-buses (after the development of a successful SOLUTIONSplus prototype). A new business model will have to accompany the new technology and investments. In preparation for these developments, they are involving technical staff in building the prototype and arranging training for mechanics.

In relation to the necessary investments in public transport, both local authorities (C1 and C2) and the local manufacturer M1 consider public-private partnerships as a good option and promising business case for private operators. In any case, supporting financial incentives are necessary from the government. D1 expressed the view that the current revenue stream determined by the government may not be able to support the necessary transition to e-mobility, signifying the need for external funds or the involvement of the private sector.

3.6 Implications for Planning and Urban Development

Public Transport system

The public transport operator P1 is determined to put in place a full transition to e-mobility in the long-term. However, a stepwise approach needs to be followed. The bus services of today will later be expanded in the tourist area. An integrated system will be needed to connect various public transport services. The local authority C1 is concerned about the need for charging infrastructure, which requires the support of Nepal Electricity Authority. Local government C2 contemplated the potential need to reorganize the assignment of vehicles to lanes according to differentiated priorities (special priority for EVs).

Urban development/planning

D1 pointed to the fact that e-mobility planning is still just on paper. In the future, the requirements imposed by e-mobility would need to be integrated in urban planning and infrastructure development (e.g. shopping malls should be designed to have charging systems in place, proper charging areas should be foreseen for future bus terminals, etc.).

Energy network

The local manufacturer M1 mentioned that the supply of electricity would not be a problem for EVs deployment in Nepal (although detailed calculations are needed). As Nepal does not have industry and the nighttime hydro energy is wasted if not used, there is the potential of using nighttime electricity for charging EVs (the electricity tariff is also low at night). D1 proposed the option of installing a smart metering system that enables electric vehicle users to take advantage of differentiated energy tariffs with the time of day. On the electricity supply system, there is the need for a massive upgrading of the network to bear the additional load on the grid associated with EVs.

User Needs Assessment – City Report

City: *Kigali*

Project SOLUTIONS+

Provided by WP1 team, responsible: DLR / Mirko Goletz, mirko.goletz@dlr.de

Version: 12.10.2020

This document complements the User Needs Assessment Guideline.

https://drive.google.com/file/d/12F3_C5g0doKrdDYdzgLQKFHj1c8VLbqV/view?usp=sharing

1 Approach

The User Needs Assessment was carried out in the months of November and December 2020 and in January 2021. The assessment was carried out in line with the concept that was provided by the SOLUTIONS+ project as described in Deliverable D 1.3, in order to harmonize the assessment approaches over the demo cities that are part of the project. As primary method interviews with key stakeholders were carried out and the results and findings of these are presented below.

The following team carried out the assessment:

DTU

Subash Dhar

Talat Munshi

ITDP

Christopher Kost

Vedaste Mazimpaka

UEMI

Emilie Martin

Edmund Teko

Moise Bitangaza

Judith Oginga-Martins

UNEP

David Rubia

The first list of stakeholders was prepared by DTU using earlier SOL+ submissions and using documents available on the internet. Stakeholders were grouped into public/paratransit companies, national, regional and local authorities, passengers and individual travellers, service providers, OEMs, associations, importers and exporters, academic and research organizations, and finally foundations and funders. Other city partners (ITDP, UEMI, and UNEP) vetted the first draft list of stakeholders. This included editing the contact list and also adding a significant number of new contacts. From the large list of stakeholders, some select stakeholders were contacted either by email or by phone calls by local city partners ITDP and UEMI.

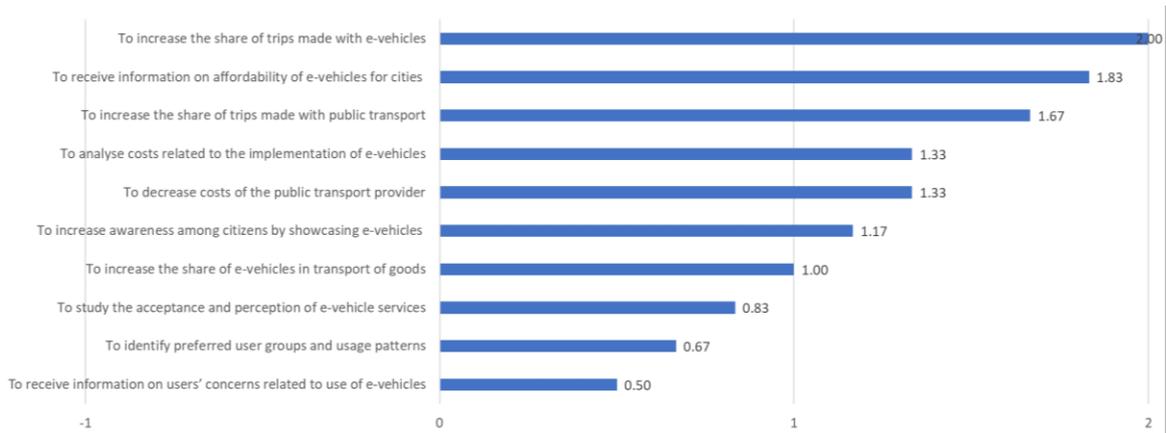
The email sent to the stakeholders included an offline version of the survey form was shared along with the questions for the interview. After an extensive follow-up, nine stakeholder interviews were possible. At least two members of the city team participate in most of the interviews.

Stakeholder groups	Stakeholder	Abbreviation	Method (Interview, Survey, KPI)	Date
Public/Para Transport Companies	JALI Transport (RFTC)	PT1	Interview + KPI	30-Nov-20
National / Regional / Local Authorities	Rwanda Utilities and Regulatory Authority (RURA)	G1	Interview + KPI	01-Dec-20
Service providers (Private and small- scale operators, also informal, energy companies)	Ampersand (motor-cycle taxis) (S1)	S1	Interview + KPI	11-Nov-20
	Gura Ride (e-bicycles) (S2)	S2	Interview + KPI	12-Nov-20
OEMs (i.e. vehicle companies, maintenance)	Volkswagen Mobility Solutions Rwanda (O1)	O1	Interview + KPI	20-Nov-20
Associations	Fédération Rwandaise des Conducteurs des Taxi Motos(FERWACOTAMO) (T1)	T1	Interview + KPI	11-Dec-20
Academia/ Research	University of Rwanda(A1)	A1	Interview + KPI	26-Nov-20
Foundation/Funders	Shell Foundation (F1)	F1	Interview + KPI	25-Nov-20
	GGGI(F2)	F2	Interview + KPI	16-Dec-20

2 Results – Survey

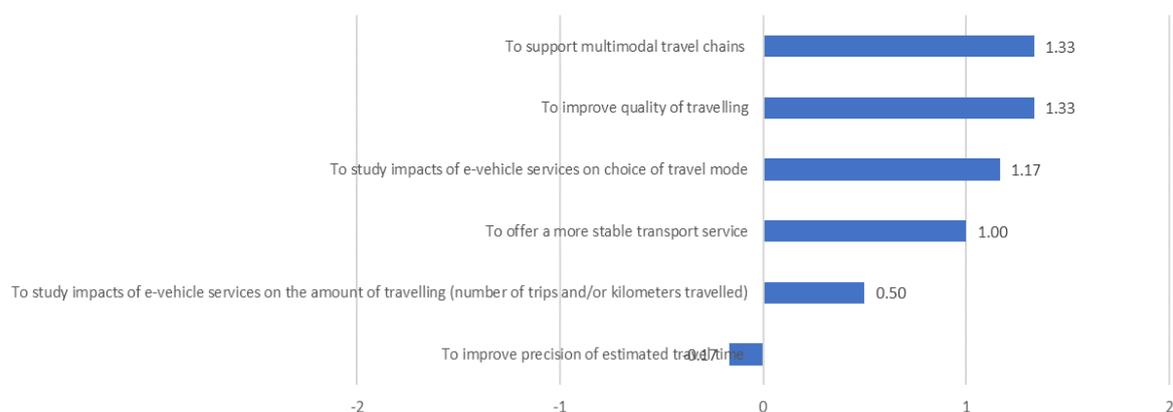
This section outlines the most important findings of the online survey. We received four responses: one from university staff, one from an OEM company, one from a foundation and one from the governmental organization. Respondents were asked to evaluate the importance of the city. The following aspects, using a scale from -2 (not important at all) to +2 (very important). Even though the number of responses is low (6) to present any statistically significant quantitative analysis, we have presented the data as initial analysis and will be updated as more responses will come in.

City aims- Usage and user acceptance of e-vehicles



Regarding the usage and acceptance of e-vehicles, respondents rated the need to increase the share of trips made with e-vehicles with the highest score (score 2 out of 2). The need to analyse costs related to the implementation of e-vehicles and the need to receive information on affordability of e-vehicles for cities were the next most important factors (score of 1.83 out of 2). The respondents also considered the need to increase the share of e-vehicles in the transport of goods and need to increase the share of trips made using public transport with a high priority. The other factors rated above 1 (out of two) were the need to decrease the cost of public transport providers, the need to increase awareness among citizens by showcasing e-vehicles, and the need to increase share of e-vehicles in goods transport. Needs to increase awareness, receive information and to study acceptance and perception of e-vehicle services were considered necessary (with a score above zero) but comparatively less important.

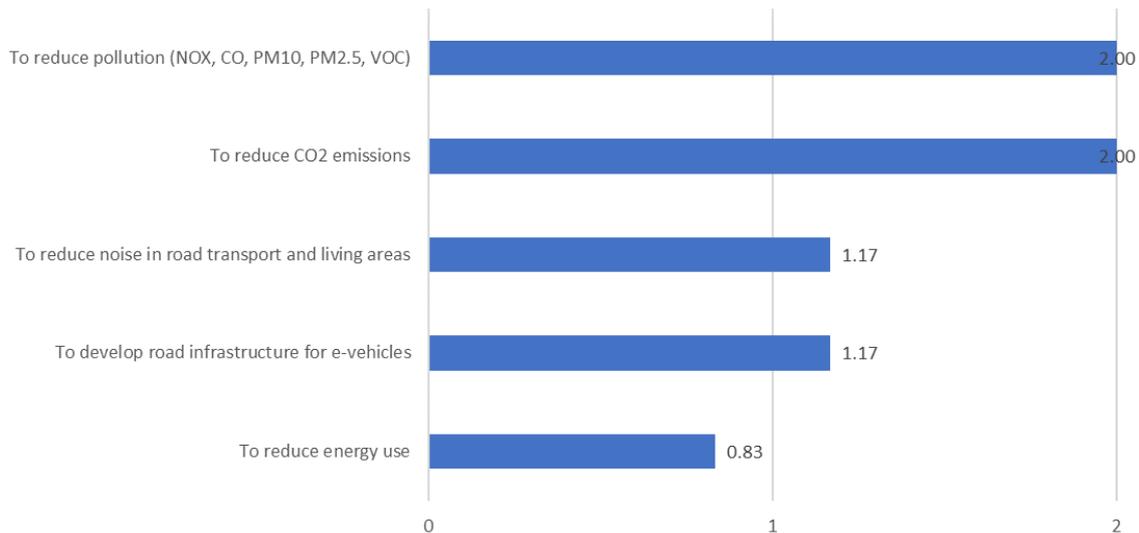
City aims: mobility patterns



The focus on the need to improve overall travel quality, multi-modality as identified in the question above – was confirmed in this question: supporting multimodal travel chains was considered most important (score: 1.33 out of 2)—the focus on multi-modality augers well with the demo project of e-motos and e-bikes in Kigali. The respondents also considered the need to improve quality of travelling equally important. The respondents also found the need to study the impacts of e-vehicles on travel mode choice as an important need (1.17 out of 2). Thus the focus for mobility patterns is to improve the quality of travel by providing the user options for multimodal transport and study the impact of e-vehicles on the choice of travel modes for better decision making.

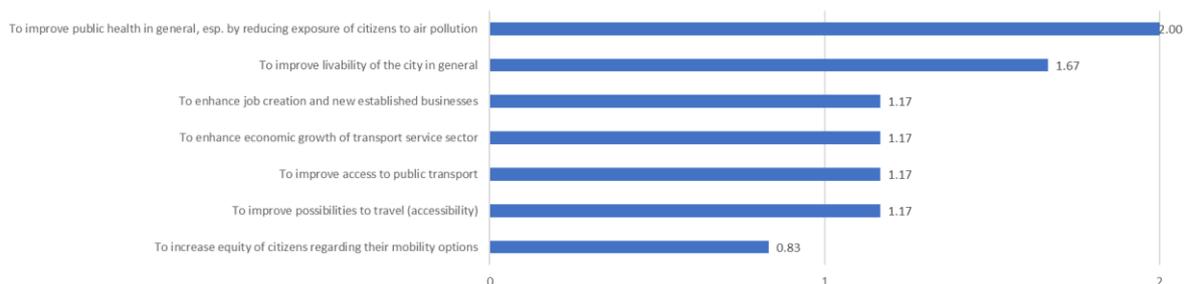
The respondents also considered the need to study the impacts of e-vehicles services on the amount of travelling and need to offer a more stable transport service as important (score of 0.50 out of 2). However, the need to improve the precision of estimated travel time was not considered necessary.

City aims: city environment



Concerning the city environment, the need to reduce pollution (NOx, CO, PM10, PM2.5, VOC) and reduce CO2 emissions were rated very important (rating between 2 of 2). The next most important consideration was developing infrastructure for e-vehicles and reducing noise on the road. Reducing energy consumption was also considered relevant, although with lower ratings (<1).

City aims: quality of life in the city



For the city's quality of life, the contribution of reduced air pollution in improving public health was considered very important (score of 2 out of 2). Likewise, the second most important aspect was improving liveability in the city (1.67 out of 2) and third need to enhance job creation and new established business. Thus stakeholder suggests that quality of life in Kigali can improve if the air is clean, there are more and better job options, and overall livability is good. The need to improve the transport system (increase the possibility to travel, better public transport and improve the transport sector's economic growth) was also considered necessary (score of 1 out of 2).

Implementation and obstacles, limitations and barriers

Regarding the implementation (questions 12-17), the most important findings are:

- (6 / 6) respondents rated transport of people and (4/6) rated last and first-mile connectivity as the most relevant use case for Kigali's e-mobility solution auguring well with the demo projects.
- city centre (5/6) and Suburban areas (3/6) and the were identified as the locations where the e-vehicles most likely to be used.
- Main target groups of e-vehicles in Kigali are 'all citizens' (5/6) One out of six respondents also mentioned each commuter, students and younger people as target groups.
- E-vehicles may be used most for commuting (6/6), followed by trips related to shopping (4/6) school trips (4/6), leisure(4/6) and other job-related trips (3/6) .
- For transport of goods, e-vehicles are most likely to be used by city (5/6), they by shops (4/6), city and small and medium private companies (4/6), followed by other entrepreneurs, large companies, other public actors and other entrepreneur (3/6).
- Most respondents suggested that e-vehicles should be operated by private service operators (6/6) and to a lesser extent by the city (2/6) and other public service operators (1/6).
- The most challenging factors for successfully implementing the e-mobility solution were: lack of money or financial resources and investment in infrastructure (5/6). Some respondents also felt that lack of maintenance service (4/6), lack of enabling policies and e-vehicle components (2/6). One out of six stakeholders felt the lack of acceptance of e-vehicles among stakeholders/users and low acceptance of e-vehicles as important challenges concerning successful implementation of e-mobility solutions.

3 Results – Expert Interviews

In this section, please report about the findings from the interviews. Interviews should be carried out based on the interview guideline. Please report per topic about the findings, if so please also indicate possible differing opinions, strong common views.

A total of 9 interviews were carried out and included service providers ((e-motos),(e-bikes)), moto-taxis federation, public transport operator, original equipment provider(OEM), foundation (F1, F2), national regulatory authority and university. In all a breadth of stakeholders was covered.

3.1 Aims of the city and Expectations of Stake-holders

Challenges to be addressed by e-mobility

Reduce air pollution, vehicle emission and affect human health

All interviewed stakeholders highlighted the environmental advantages of e-mobility, especially in reducing air and noise pollution. Interview E-bikes service provider identified a plurality of goals pursued via e-mobility, including reduced carbon emissions, reduced air pollution, the introduction of innovative mobility options such as e-bikes, and fuel reduction imports. The interviewee from the moto-taxis federation also believes that e-mobility and more specifically e-motorcycles will bring many advantages. These include improved air quality and reduction of CO₂ emission from the ICE motorcycle engines. The representative from foundation-F1 stated that the pollution level of current motorcycles is not controlled and the introduction of e-mobility in the city centre and peri-urban areas would

improve air quality. The interviewee from the public transport operator also stated that the introduction of e-buses would help in the decarbonization of transport in Kigali. The interviewee from the national regulatory authority mentioned that e-mobility in Rwanda will help the country reduce imports of old vehicles that harm the environment and help the country avoid being a dumping site for old vehicles. The respondent feels that most developed countries are shifting from internal combustion engine (ICE) vehicles to EVs, so the authorities intend to act as soon as possible so that Rwanda does not lag with old ICE vehicles.

Long term vision for sustainable transport (e-mobility)

Decrease fossil fuel import

Rwanda imports all its petroleum products via Kenya. There is also an electricity surplus in Rwanda, and more than half of the total electricity is sourced from hydro and solar power sources. There is also a push to increase the share of renewable electricity. Thus, most stakeholders also opined that the introduction of e-mobility solutions in Kigali would reduce fossil fuel imports. National regulatory authority interviewee felt that EVs' adoption would reduce dependence on imported fuel. The E-bikes service provider also supported the introduction of innovative mobility options such as e-bikes and reduced fuel imports. The interviewee from the national regulatory authority mentioned that e-mobility would help the transport sector increase its dependence on locally produced energy rather than imported fuel.

Lower operating cost and increased comfort

It is expected that the introduction of e-mobility will reduce the operating cost and also increase comfort levels. The cost is likely to fall, as most stakeholders, including the interviewee from national regulatory authority, feel that e-mobility will increase electricity demand, spurring local production, and reducing tariffs. With increased electricity demand, Rwanda has moved away from dependence on heavy fuel oil power plants to new sources of electric supply and have also negotiated better tariffs with power producers. This is only going to get better as the demand for electricity increases in future. The interviewee from the moto-taxis federation stated that electric motor-cycles are better in terms of speed and comfort as compared to ICE motor-cycles and the interviewee is hopeful that the uptake of the new technology will be high. The interviewee from moto-taxis federation also mentioned that current study with Ampersand and REM showed lower cost (700 Rwf / swamped battery/ 60-70km) compared to fuel cost per litre (960 Rwf/litre/ 50km).

How can SOL+ support

The interviewee from the e-motos service provider identified three types of support that SOLUTIONS+ could bring in, including financial support to deploy additional EVs and financial support to extend the driver typology, from men only to women and lastly material support from the SOLUTIONS+ expert network (e.g. Valeo powertrains).

The interviewee from e-bikes service provider had a broader range of expectations towards the SOLUTIONS+ project. They expect that the SOL+ project will increase EVs' visibility, translating into easier adoption of e-bikes in the long run.

The project also will support policymaking on sustainable mobility (e.g., bike lanes integrated with the planned BRT system) and lastly bring in financial and technical support for e-mobility providers, not only for demonstration action but also to scale-up.

The foundation-F2 Interviewee identified three roles for SOLUTIONS+: improved coordination between the multiple e-mobility projects and stakeholders, improving the image of non-motorized transport via the support to e-bikes, and facilitating access to funding.

The moto-taxi federation interviewee observed that current e-motorcycles under demonstration by Ampersand and REM were found to require less maintenance than regular ICE motor-cycles. Nevertheless, the respondent expects SOLUTIONS+ project to bring advanced solutions to ease maintenance of e-motorcycles, for instance, via an e-motorcycle demonstrator and training to local maintenance operators at local stations and garages. Further areas of support could include training in business operations and road safety.

Electric vehicle type and use cases

The interviewee from public transport operator showed ample willingness to comply with government guidelines on transport regulation, in general, including on electric mobility and has the impression that the process of promoting electric mobility will result in an attractive business for environmentally friendly public transport service. The stakeholder also sensed that e-buses would contribute a lot to environmental decarbonization. The bus operator is ready to comply with all the current and upcoming regulations about e-mobility.

The e-motos service provider interviewee believes that e-mobility solution will be mainly used by former (male) ICE moto drivers, but they intend to broaden the use to new female drivers. The solutions will be mainly used for passenger transport. Transport of goods and deliveries is a growing segment but is considered to have less potential in Kigali when compared with other East African cities with a bigger population or more congestion. In Kigali, today the motos provide a lot of door-to-door service, however in the long run interviewee from e-motos service provider sees most of the solution as a feeder to BRT or MRT services.

The interviewee from e-bikes service provider expects a variety of uses, including commuters, youth (students) targeted with a special tariff, but also partnerships with businesses, organizations of events and sports activities. They also see the e-mobility solution as a feeder to upcoming BRT services. An interviewee from the foundation-F2 stated that Rwanda is seen as a cycling country, similarly to the interviewee from ebikes service provider. This interviewee also feels that e-mobility will reduce air and noise pollution. Given that Kigali's topography is difficult for conventional bicycles, e-bikes could increase bicycles' use.

The interviewee from foundation-F1 mentioned about the range of e-mobility solutions that have been deployed. The interviewee also said that Volkswagen (VW) and Siemens are engaged in the four-wheel vehicle space, including charging. Two-wheelers are taking off quickly, and there are providers like Ampersand, Orion, Savi. In the case of two-wheelers, both fixed batteries and battery swapping (single /double battery) are being considered. E-rickshaws and e-buses are also attractive e-mobility options. Likewise, e-matatu is also an interesting e-mobility solution, mainly based on retrofitting.

The stakeholder interviewed from university feels that the Government of Rwanda is very positive about implementing e-mobility solutions; therefore there is a very good chance that many residents of Kigali will use e-mobility solutions in the coming ten years. The interviewee feels that it is likely that e-mobility solutions will come in the form of public transport e-buses, motor-cycles, and moto-taxis. The private car could also come as a Volkswagen is working on encouraging e-mobility in Rwanda.

The geographic coverage for e-mobility solutions

In terms of geographical coverage, the e-motos service provider feels that it will be mostly used peri-urban and in the city's central areas. Data from their vehicles tracked in the last two years (circa one million km driven) indicate that most of the motor-cycle traffic is within a 12 km radius from the city centre. Drivers travel an average of 165 km a day as they move around the city to look for customers (no staging system as in Kenya). The interviewee from foundation-F2 also feels that e-motos are a solution for both city centre and peri-urban areas.

E-bikes service provider thinks that the solution will be mostly used in the city centre. He also sees the use of e-vehicles in some suburban areas and around all dock stations located in the vicinity to bus stops. The interviewee from university opines that the initial use of e-mobility solutions will mainly be in urban areas. E-motos service provider indicates that it is a low-hanging fruit in urban areas, as the concentration of vehicles is higher. Like interviewee from university, Interviewee from OEM observes that E-mobility solutions will mainly be used in urban areas, mainly for the transport infrastructure and electricity infrastructure (grid requirements).

As a solution to provide electric infrastructure in a rural area, the Interviewee from OEM feels that off-grid solution might not be a preferred option in Rwanda as there is an electric surplus in Rwanda and therefore, governments might not be very keen to promote off-grid solutions. For e-mobility shared-mobility solutions are likely to work in Rwanda. Shared mobility solutions are already there, and it needs to be seen how these can be translated into e-mobility solutions. OEM interviewee felt that motor-cycles are not a long term sustainable solution as these are not all-weather, not geared toward use by all users (especially women), and not safe as they are subject to many road accidents. The interviewee from moto-taxis federation expects that the range of batteries will improve and e-motos will be able to operate for more than 100 km range to suit the hilly terrain of Kigali and Rwanda, especially in the peri-urban areas of Kigali.

While considering that e-motos will be deployed in both urban and peri-urban areas, foundation-F2 interviewee stressed the need to improve bicycles in peri-urban areas, used for cargo and as bicycle-taxis, via electric mobility.

3.2 Regulation

Existing Regulation

E-Mobility policy

There is no e-mobility policy nor are specific regulations in place yet. The public transport operator interviewee confirmed that it was not aware of any available e-mobility regulation, policy, or guidelines.

Despite the current absence of policies, several stakeholders highlight the strong governmental support on e-mobility. The OEM interviewee stated that there is a push from a supportive government towards e-mobility, but the situation arising from the COVID -19 pandemic has led to delays in policy formulation. The moto-taxi federation interviewee also mentioned that, even though there are no written regulations, there is a verbal agreement to adapt and shift to e-moto taxi as per a request from the President's speech during a youth forum. The foundation-F2 interviewee stated that Rwanda's government is putting pressure on the national Ministry of Infrastructure MININFRA, the key focal point for e-mobility, to deliver supporting policies.

According to several interviewees, E-mobility policies are being prepared and are currently at a draft stage, with much ongoing speculation over their content, number (one or several documents) and the schedule for adoption (foundation-F2 interviewee, OEM interviewee, e-motos service provider interviewee). Stakeholders are eager to see these policies adopted; there is a hope that they will be all-encompassing and will come with bold measures. The university interviewee said that a national transport policy is at an advanced stage, and the government needs to approve it to adopt a regulation related to e-mobility. The interviewee from e-motos service provider mentioned a draft e-mobility policy prepared by MININFRA, pending Cabinet approval. According to him/her, this policy would provide financial incentives as well as non-fiscal ones such as the possibility for EVs to use bus lanes, free license plates, and special green license plates for EVs. Generally speaking, the national regulatory authority's interviewee mentioned that the government is ready to provide related regulations.

Several studies are ongoing alongside the ongoing preparation of policies, including from the startups themselves looking at how the e-mobility solution is best provided in Kigali. The interviewee from university also felt that the present challenge is the newness of the e-mobility technology, leading all stakeholders to learn along the way while upscaling. He mentioned that studies have also been a commission that will look at what is required to support Rwanda's e-mobility. For instance, the Global Green Growth Institute office in Rwanda just finalized a study on electric buses, including the identification of 3 lines, length, depot charging, the total cost of ownership, and grid impact.

Further information regarding policies on power tariffs and regulation of charging infrastructure are provided below in subsection 2.3 (Obstacles, limitations, barriers).

Implementation issues

The interviewee from university and the foundation-F1 Interviewee felt that the policy landscape is very dynamic, and there is a need for testing policies before they are implemented at large scale. The foundation-F1 interviewee suggests creating a regulatory sandbox, mentioning previous application of this approach by the Shell Foundation in Hyderabad, India (note from the team: sandboxes are frameworks set up by a regulator that allows FinTech startups and other innovators to conduct live experiments in a controlled environment under a regulator's supervision). Like these two interviewees, the OEM interviewee also feels that there is a general lack of knowledge of what policy will work and what will not work. Policies will have to consider that solutions may need to be differentiated for

various vehicle types. For example, a good solution for a two-wheeler might not work as well for cars. In addition, the e-motos service provider (e-motos) also warns against standards that would be too prescriptive since they could have unintended consequences as R&D is still ongoing.

An example of companies' testing and iteration process was given by the interviewee from moto-taxis federation interviewee, working with REM (and possibly Ampersand in the future) to study e-motos. The first batch of batteries of REM (currently having 150 e-motorcycles, 70 operating) failed as their capacity were below about 40km per one swapped battery, which led REM to buy other batteries that enable covering about 60km before recharging.

Lastly, the foundation-F2 interviewee stated that there is little coordination of the many different projects and suggested having regular meetings between e-mobility stakeholders to avoid overlaps.

3.3 Obstacles, limitations, barriers

Main barriers towards adoption of e-mobility solutions in Kigali

Charging infrastructure and standards

Charging stations. The public transport operator interviewee stated that the lack of charging facilities and increased charging time could be a limitation. Currently, the bus operator gives four hours of layover time when the buses are maintained, washed, and refuelled. If the operator were to add charging to these four hours, the business could be affected by the high duration of charging compared to refuelling. According to him, many charging depots will be required, and the need for additional space will be required. This interviewee stressed that Rwanda is a hilly country, which would require more electricity and induce high charging costs for e-buses. The moto-taxi federation interviewee also raised concerns about charging infrastructure and mentioned that more charging stations would be required for e-moto taxi implementation. The charging process should not take more time. It currently takes 2 to 3 minutes with battery swapping options. Battery swapping and scale-up of charging infrastructure is needed. In general, the foundation-F2 interviewee suggested incentivizing the provision of charging infrastructure via policies. For instance, the building code can be modified to mandate charging at public buildings).

Standards. The e-motos service provider mentioned the absence of charging standards. However, they could deploy charging stations without facing legal challenges, cooperating with the Rwanda Energy Group (REG) on the location of charging points. Yet, the interviewee felt that the absence of regulation could lead to safety issues as competitors intend to establish charging points at petrol stations without assessing the risks associated with the proximity to combustible fuel.

The national regulatory authority interviewee mentioned that there is currently no clear masterplan, guideline, regulation related to the installation and operation of electrical charging stations for e-mobility. RURA regulates the fuel stations and has the mandate to regulate both station installation and operation. So far bus terminals and depots are owned by private operators.

In general, the interviewee from university also found charging infrastructure as a significant barrier. The OEM interviewee felt that a policy will be needed on how the new charging infrastructure will be provided, including what happens to the existing fuels station.

Financial resources/ Upfront cost

Challenge of access to finance. The e-motos service provider felt that there is a need for capital to be invested in e-mobility, but that private investments in e-mobility in the region are still limited as compared with other sectors, such as solar energy. The technology investment community in the region is seen as particularly conservative, with very high financial expectations put on companies. The foundation-F1 interviewee stated that access to finance (debt and equity) is a barrier. The foundation is working with enterprises such as JALI Transport to provide asset financing and finance companies to provide guarantees that reduce risks. Access to funding was also considered one of the most significant barriers by the foundation-F2 interviewee. This interviewee stressed that there are interested investors for electric cars, but none for electric buses given a too high price tag for domestic funding sources.

Upfront investment cost for buses. The public transport operator interviewee identified a financial challenge as the urban bus transport sector is only financed by private transport operators and lacks government subsidies, while the transport service has to be affordable (note from the team: not fully accurate as the government pledged to start subsidizing bus service so that operators would keep their fares at pre-COVID levels). This private bus operator has no plan to shift from ICE buses to e-buses unless the government policy requests them to do so. The national regulatory authority interviewee observed that financial challenges might affect the development of e-mobility if these solutions are on board soon before post-Covid-19 economic recovery. For instance, public transport operator companies are young, and some are still in payback periods of the previous investment and improvement. Due to financial problems brought by Covid-19, public operators are still under desirable qualification in terms of fleet size as traffic demand is still growing. These could not initiate the risk of an additional loan.

Upfront investment cost for moto-taxis. On the moto-taxi side, the moto-taxis federation interviewee feels that to run e-moto taxi business profitably, the upfront cost of e-motorcycles will have to be reduced and affordable for motor-cycle drivers, who prefer to own a motor-cycle rather than leasing it. The high cost of motor-cycles would be a barrier, and many motor-cycle riders will need a loan to own e-motorcycles. The financial option offered by Ampersand currently the most frequently selected among ICE moto-taxi drivers is lease-to-own (see below Impacts on business models).

Upfront investment cost for cars. The OEM interviewee said that for cars, the most significant barrier is the cost barrier, especially in an unsubsidized market in Africa, which might inhibit cars' use as a private means of transport. Therefore, this could happen mostly through companies for mobility solutions like shared fleets.

Electricity tariffs

Several interviewees felt that the high electricity tariffs are a substantial barrier (Interviewee from foundation-F1, Foundation-F2, e-motos service provider, and e-bikes service provider). The e-motos

service provider hopes that the new e-mobility policy prepared by MININFRA (pending Cabinet approval) will tackle this significant barrier. Currently, the high electricity tariffs would be the most significant challenge to financial viability (stated by both service providers 1 and 2. Note from the team: \$0.277/KWh in Rwanda versus a global average \$0.15 according to Ampersand's information from April 2020), followed by the value added taxes on EV charging services (note from the team: no figure on current VAT level; at the 25.02.20 February workshop, the e-moto company Ampersand requested VAT exemption on EV charging stations, and a reduction of the VAT reimbursement period from the current 9 months or more to 30 days). The foundation-F1 interviewee stressed that power tariffs need to be attractive, similar to industrial tariffs.

According to both service providers, this would have been resolved through the draft policy pending approval. Similarly, the interviewee from moto-taxi federation expressed confidence, stating that this issue is under government consideration and that the cost will be regulated. According to this Interviewee, even with currently high tariffs, the shift to electricity is still financially attractive (lower costs with Ampersand and REM of 700 Rwf/swapped battery/60-70km, as compared to fuel costs (960 Rwf/litre/50km). The foundation-F2 Interviewee was less confident on this aspect being included in the draft policy (persisting uncertainty on the content).

Supply Chain and Importation

The interviewee from e-motos service provider observed that the Covid-19 pandemic resulted in delays and disrupted supply chains. Quality issues are also faced with supply chains and products from China, although incremental improvements have been achieved. In the long run, the provider intends to shift towards working with ICE moto OEM partners. The university interviewee also observes that as EVs is a new technology, switching from ICE engines to EVs will need many changes in the value chain.

Regarding import policies, the national authority's interviewee observed that there are currently no particular regulations and guidelines on how EVs will be imported.

A barrier of high import duties seems to have been partially resolved according to the e-motos service provider and e-bikes service provider. Both Service Providers received tax exemptions, e-motos service provider got it on the second batch of vehicles. The E-bikes service provider specified that the Rwanda Development Board issued tax waivers (RDB) (no detail was provided on which tax, or if was full or partial exemption). Issues regarding paperwork and internal arrangements between various ministries and departments were faced; it is not fully clear if this has been completely cleared now.

The issue could still remain for buses, as the public transport operator interviewee points out that ICE buses are imported with tax exemption (no tax paid to import bus). Regarding e-bikes, the foundation-F2 interviewee indicates that parts for EVs are prohibitive due to taxes, especially for e-bikes. However, this information may be outdated as from 2018, and the e-bikes service provider did not mention this issue.

EV adaptation to topography. The national authority's interviewee pointed out the necessity of pre-assessment on the adaptability of EVs to Rwanda topography. This concern of operations in hilly terrains was expressed by several interviewees.

Lack of technical expertise. The public transport operator interviewee is concerned about the availability of skills and knowledge to support the new technology. He observed that the operators do not have experience with e-buses, charging systems, and e-vehicle maintenance. On the moto-taxi side, the federation identified the need to provide training to local maintenance operators.

Safety. Interviewee Service Provider A (e-motos) alerts on quality and safety issues, criticizing competitors for importing vehicles from India not respecting the Bharat emission standards and possibly neglecting safety considerations when establishing charging points at petrol stations regarding proximity with combustible fuel.

General: insufficiencies of public transport infrastructure of services. The national authority's interviewee mentioned that private operators mainly own public transport depots and terminals, and they are not controlled or regulated by the government. RURA has provided a license of one more year to the current bus operators while planning for the second-generation public transport contracts. Governments need to put some facilities like dedicated bus lanes to enhance a well scheduled public transport system in the second generation contracts. The interviewee highlighted the current challenges of the transport operation. Those are dedicated bus lanes included in planning documents but not yet implemented, appropriate transport fares that reflect different road conditions (paved, gravel, and earth roads), and transport fares suitable for both passengers and transport operators.

More disputed: grid capacity. The public transport operator interviewee had concerns about electricity availability and felt that more electricity would be required for e-buses while other electricity-dependent services such as industries and residential are also growing. Nevertheless, this opinion was not shared by the foundation-F2 interviewee (foundation having done a recent study on electric buses), stating that its grid analysis showed that grid capacity was not an issue, except for large charging depots for buses in certain areas of the city. The interviewee stressed that electricity is in surplus, though electricity distribution is not equitable. The REG would be transparent in terms of grid analysis. The e-motos service provider indicates that even in the scenario of 100,000 e-motorcycles in the country, there would be enough additional capacity in the grid (surplus between 60 to 75 mW on installed capacity). Extra demand at peak times in the evening would not be a problem by the time e-mobility reaches grid scale as new power plants will be open in the next 2 to 3 years.

More disputed: knowledge and awareness on EVs. The public transport interviewee PT1 mentioned that as this technology is new, there is no information about e-buses, which are not yet operating in Rwanda. Yet, the operator states to be aware of how environmentally friendly it is, contributing to the green city and decarbonization of air in Kigali. The university's Interviewee A felt that there could also be behavioural barriers because people's mindset set to traditional ICE vehicles, making the switch to EVs difficult. However, the moto-taxi federation interviewee felt that there were no such issues regarding user acceptance. Both service providers e-motos and e-bikes did not either identify such issues, the latter (e-bikes) strongly emphasizing very positive feedback and enthusiasm from Kigali residents.

Gender Parity. Interviewee e-motos service provider saw barriers for bringing women as drivers, about the lack of an inclusive driving curriculum, lack of sensitization of driving instructors, and cultural barriers.

Not an issue anymore: vehicles registration. Interviewee from e-bikes service provider said that, initially, the vehicle registration system only saw the possibility of registering ICE vehicles (for instance,

an indication of CC requested). Interviewee e-motos service provider (e-motos) states that this issue has been resolved. E-motos are registered with RURA.

Interpretation of interviews: the main challenges with regard to SOL+ project implementation

As the policy environment seems to evolve rapidly with an expected policy on e-mobility, some of the main barriers could be lifted in the near future, such as high electricity tariffs. The political support for e-mobility solutions is a further facilitating factor, having led to flexible resolution of issues (e.g. importation duties) in the past.

Yet, some context elements could turn as challenges for the implementation of the SOL+ demonstration action, such as the lack of coordination between initiatives and the absence of clarity on the involvement of the city authorities, as opposed to Mininfra. For the upscaling phase of the Kigali demonstration action, access to finance seems a persisting hurdle which should be addressed early, in coordination with other stakeholders. Generally, it seems that e-motos and e-bikes are well supported and with some positive results already (e-motos), while the amount of hurdles and uncertainties faced by electric buses seems much higher, especially on the financial side. Lastly, the lack of technical knowledge and of information on pertinent policies does not appear as a barrier, but as an opportunity for SOL+ to fill a gap and answer well-expressed needs.

3.4 Sustainability of the e-Mobility solutions to be implemented

E-mobility is seen as a part of strategies for improving public transport and parking in Kigali according to interviewee from university, and therefore the interviewee believes that these solutions will improve urban mobility. Most stakeholders indicated the need for strong Government support for e-mobility. However, there are good hints from the discussion with interviewees from university, OEM, and others that the government will come up with strong policy and regulations that will support e-mobility and charging infrastructures in Rwanda. The interviewee from university informed that the urban development plan is very supportive of transit-oriented development and this could lead to the densification of locations around bus stops, which will be a good support for public and shared transport modes like e-motos, e-bikes and e-buses that are proposed in this program.

The interviewee from foundation-F2 feels that the government works mostly on e-motos, followed by e-cars and e-buses, and not much on e-bikes. E-bikes were not included in their initial rollout strategy. The foundation also opines that focus on e-bikes, especially in peri-urban areas, will impact the lowest income groups and mobility will be good to save on maintenance costs for smaller vehicles, more challenging to have economic opportunities with e-buses given the Capex. eMobility as an excellent opportunity for transport hubs, to improve connectivity and to address challenges of steep terrains

3.5 Impact on existing business models

Most stakeholders were aware of impacts e-mobility will have on existing business models. We cover impacts on buses and motos that are currently used for public transport.

The interviewee from public transport operator said that since the public transport in Kigali is fully financed by the private operator, the operators currently own buses using internal combustion engines

and shift only when the government provides funding. Introduction of e buses was seen by the bus operator to be complemented by improvement in road conditions, better tariffs, and real-time information on schedules to improve economic returns for e-buses and can be deduced will be beneficial for the bus operators.

The e-motos are essentially converting the ICE motos into electric and interviewee with e-motos service provider (e-motos) stressed the positive impact of electric mobility on ICE moto drivers' revenues. The pricing structure is periodically reviewed, contingent on external factors such as electricity prices. This company offers three options to ease the transition for drivers: direct purchase (usually not selected by drivers), simple rental, and lease-to-own (most popular option). Batteries are rented to drivers.

The interviewee from e-bikes service provider sees e-bikes (US \$0.22 (RWF200) every 30 minutes (can ride about 6-8 km)) as a cheaper alternative to moto-taxis (about 300/400 RWF, i.e., US \$0.30-0.40 for circa 1km). It particularly targets students, with 100 RWF (about 10 cents USD) for 30 minutes. Further details regarding its pricing policy were not communicated, and the difference in prices for the two types of bicycles is unclear. The interviewee from moto-taxi federation also mentioned that e-motorcycles under test in cooperation with Ampersand are on the good stage of profitability where for one swapped battery, moto-taxi driver pays 700 RWF and battery operates up to about 70km while for 1 litre of fuel costs 960 RWF/litre and operates for about 50km. The interviewee also believes that current motor riders will use e-motorcycles. The business will continue and shift from using ICE motorcycles to e-motorcycles. If the e-motorcycle cost will be affordable, high profit is expected as the e-motorcycle was previously found to have less cost in terms of maintenance and transport energy than regular motor-cycles that use fuel.

Interviewee national regulatory authority opines that e-mobility will change the existing business model as it will increase energy demand; the energy sector will get further developed. Vehicle maintenance business will shift from ICE vehicle maintenance to EV maintenance. Electronic transport fare collection system will need improvement and integration, and transport fuel energy-based business will shift to electricity dependence that is locally produced energy.

The interviewee from foundation-F2 finds it challenging to identify the impact on users and business models without addressing costs for owning and operating EVs. Spare parts for EVs are prohibitive due to taxes, especially for e-bikes. For e-bikes, it also relates to the way e-bikes are classified, resulting in higher custom duties. There is a need to incentivize the provision of charging infrastructure, work on recommendations on the building code to introduce charging at public buildings (green building minimum compliance standards)

3.6 Implications for Planning and Urban Development

Master Planning

The interviewee from university mentioned that the new master plan has e-mobility as one of its components. In Kigali when implementing e-mobility solutions, topography is an essential consideration. In the updated master plan, there are provisions for parking that prioritizes e-vehicles. The city of Kigali is also planning to locate charging stations without costs, where the government will

give the land for private operators to operate charging stations. Urban regulation will have to start planning for charging infrastructure.

Public Transport Planning

The interviewee from university mentioned that the World Bank also has a project for dedicated bus lanes, which EVs have a right to use. There are also plans to use e-buses for CHOGM 2021 to be held in Rwanda. There is a strong focus on the use of public transport and transit-oriented development. The master plan encourages high-density commercial+residential along mass rapid transit corridors. Transport Association A also mentions that parking spaces need to be increased, providing a moto-taxi riders station for passengers. The interviewee from OEM mentioned that In Africa, urbanization is not triggered by industrialization. Therefore cities experience a lot of cross commuting. This is unlike European cities, where it was possible to connect industrial areas with public transport in Rwanda, many people walk for about 20 minutes to access public transport. He feels that the e-mobility solution will have to be integrated mobility solutions, which solutions like e-shuttles, and other mobility solutions for the last mile connectivity all hinting towards a transit-oriented development

Infrastructure Planning

Interviewee from foundation-F1 felt that there is a need for an integrated approach. There is a need to understand consumer behaviour and needs for charging, tap and go buses (cashless system) can help in targeting e Buses with subsidies. Ride-hailing apps can help the boda industry reduce use of fuel. She also feels that data from e mobility can help in better urban planning. Interviewee from moto-taxi federation mentioned that the ongoing e-motorcycles operation is working in the limited space of Kigali due to few swamping stations. Therefore there is a need for urban plans to include these.

Interviewee from OEM states that in Kigali, Bus operators have challenges of narrow roads and some roads that are in poor condition (earth roads). Therefore the new urban plans could come up with improved roads to facilitate e-buses' smooth operation and operating up to their life expectancy and enhance an economic return.

Interviewee from e-motos service provider mentioned about the need to incorporate the additional spaced need for infrastructure needed for electricity distribution and charging in urban plans.

Parking

Interviewee OEM observes that parking function is vital for charging; therefore, in a city where there is very little space, parking management will also be essential. The interviewee was of the opinion that in Rwanda it is possible to use the parking places as charging stations.

Annexure 1:

List of Stakeholder Considered and Contacted

Stakeholders marked as green were considered and contacted. Stakeholders marked as blue were

Stakeholder groups	Stakeholder	
Public/Para Transport Companies	Kigali Bus Service (KBS)	
	JALI Transport (RFTC) (PT1)	Interview Survey and KP1 weighting
	Rwanda Interlink Transport Company (RITCO)	
	Royal Express	
National / Regional / Local Authorities	Ministry of Infrastructure	
	Rwanda Transport Development Authority (RTDA)	
	Rwanda Utilities and Regulatory Authority (RURA) (G1)	Interview Survey and KP1 weighting
	The city of Kigali	
	Rwanda Urban Development Program(RUDP)	
	REMA, Rwanda Environment Management Authority	
	Rwanda Standards Board	
Service providers (Private and small-scale operators, also informal, energy companies)	Gura Ride (e-bicycles) (S2)	Interview Survey and KP1 weighting
	Ampersand (motor-cycle taxis) (S1)	Interview Survey and KP1 weighting
	REM (Rwanda Electric Mobility)	
	Rwanda Energy Group	
OEMs (i.e. vehicle companies, maintenance)	Volkswagen Mobility Solutions Rwanda (O1)	Interview Survey and KP1 weighting
Associations	Fédération Rwandaise des Conducteurs des Taxi Motos(FERWACOTAMO) (T1)	Interview Survey
	Public Transport Association, ATPR	
Importers & exporters	Association of Manufacturers	
Academia/ Research	University of Rwanda(A1)	Interview Survey and KP1 weighting
	International Growth Centre (IGC)	
Foundation/Funders	GGGI(F2)	Interview Survey and KP1 weighting
	Shell Foundation (F1)	Interview Survey and KP1 weighting
	World Bank	

User Needs Assessment – City Report

City: *Dar es Salaam*

Project SOLUTIONS+

Date: 18th of January, 2021

Authors: Mirko Goletz (DLR), Jacqueline Senyagwa (UEMI), Edmund Teko (UEMI), Shauri Shau (ITDP)

1. Approach & Team

The User Needs Assessment was carried out in the months of November and December 2020 and in January 2021. The assessment was carried out in line with the concept that was provided by the SOLUTIONS+ project as described in Deliverable D 1.3, in order to harmonize the assessment approaches over the demo cities that are part of the project. As primary method interviews with key stakeholders were carried out and the results and findings of these are presented below. Due to a very low response rate at the time of writing this report (n=2), the results of the complementary online survey are not considered in this report.

The following team carried out the assessment: Jacqueline Senyagwa, Edmund Teko (both from UEMI), Shauri Shau (ITDP) and Mirko Goletz (DLR Institute of Transport Research). All team members were involved in the assessment process and carried out stakeholder Interviews, the KPI assessment and report writing.

Stakeholder Group	Stakeholder name	Stakeholder abbrev.	Method (Interview, Survey, KPI)	Date
National & regional authorities	Dar es Salaam City Council	a1	Interview	10 Dec 2020
	TBS	a2	Interview	11 Nov 2020
	LATRA	a3	Interview	27 Nov 2020
Public transport companies	DART	b1	Interview, KPI	11 Dec 2020
NGOs and Eco-Organisations	TATEDO	c1	Interview	12 Nov 2020

Academia	NIT	d1	Interview	24 Dec 2020
OEMs, Private companies, Start-Ups	ELICO	e1	Interview, KPI	26 Nov 2020
	RISE / Sollatek	e2	Interview	20 Nov 2020
	Jiwe Kubwa	e3	Interview	13 Nov 2020
Service Providers	TANESCO	f1	Interview, KPI	17 Nov 2020

1.1 Results – Expert Interviews

1.2 Aims of the city and Expectations of Stakeholders

a. Expectations:

On a demo level, Stakeholders b1, c1, e3, b1, d1 expect that the demo project will create awareness, open opportunities, build capacities and will be a source for stakeholders networking. Furthermore, stakeholders b1, a3 expect the project to help integrate the various transport modes in the city with e-mobility feeder services and thereby promote sustainable transport. Stakeholder e1 expect the demo to increase the private sector involvement in e-mobility, thereby promoting it as a whole in the country. Stakeholders a3, e3 expect that at the demo level, the project will be a catalyst/stimulus to the business community to venture into e-mobility.

On a scaled-up level the project will reduce emissions, fight climate change, reduce importation of fossil fuels, venture/spill into other cities, reduce pollution, efficient use electricity/energy, and create employment (Stakeholders a1, c1, a3), create new business opportunities and allow for investments (a1, a3, c1, e3,) and also lead to improved health conditions (Stakeholders a3, d1). It will furthermore generate economic benefits – more jobs, reduce transport cost, generate profits for operators, and also increase reliability due to the use of electricity (Stakeholders a3, b1, d1, e3).

Stakeholders b1, f1 made suggestions how the above-mentioned expectations could be met, for instance by creating an enabling environment (rules and regulations, policies, guidelines, also mentioning the need for collaboration between private and public sectors on e-mobility infrastructure development and investment, while ensuring that all all key stakeholders and players from the transport sector are involved at the very beginning/start of the project. This will also create the need for training on necessary aspects of e-mobility for local stakeholders – vehicles, operations, maintenance. Stakeholder b1 particularly mentioned the need for a proper institutionalization to manage the e-mobility services.

b. Users

Regarding users of the proposed e-mobility solutions under the demonstration, stakeholders a2, c1, d1 expect that it will be used by people of all classes in the business industry community, public sector servants, commuters and the general public. Apart from passenger transport, delivery services will increasingly use bajaj services as online business is booming, where motorbikes are currently used but are regarded as an unsafe mode (d1). Special user groups might be school children who currently face the challenge of the timing of the school buses, with children leaving home very early and coming back very late; in a scaled-up scenario, the electric bajajis will offer an option to such parents (d1). Furthermore, public services may use e-bajaj that are owned by institutions as an official transport means to serve their employees, something which is already done by Stakeholder d1 and was suggested to be applied on a wider scale by a2, e1. Stakeholder e1 also stated the high price sensitivity of users in Dar es Salaam, meaning that the price will determine who will end up using e-bajaj.

In general, e-bajaj were considered as a means of passenger transport and for freight (delivery services and logistical services) with equal importance in the future, despite freight not being part of the SOLUTIONS+ demo project.

c. Where

For the demonstration as well as a scaled-up scenario, stakeholders opined that e-bajaj could be used in urban as well as in peri urban areas (outskirts of the city). Due to the ban of 2- and 3-wheelers in the CBD of Dar es Salaam, stakeholder b1 however indicated that currently a service provision there would not be possible. Stakeholder b1 also stated that areas in the city where the operation of busses is not possible due to narrow or other improper road conditions could be considered to be served by e-3-wheelers. In the future, e-bajajis may become popular in port authorities to facilitate movement of staff within the area, in industries to deliver goods (Stakeholder a2). Looking beyond the city scape, e-bajaj may be highly suitable to be used in rural areas, where there is electricity and/or renewable energy available (Stakeholders a2, b1, c1, f1).

1.3 Regulation

In Tanzania or Dar es Salaam, at the time of the interviews there was no regulation in place that addresses e-mobility directly, however there are current regulations that implicitly address questions related to e-mobility. Generally, policies and regulations exist that promote sustainable urban transport modes such as BRT (Stakeholders a3, b1, f1). Another example is the Tanzania Energy policy, that generally mentions that renewable energy should be diversified to reduce dependence on conventional energy sources, whilst investing in clean technologies for environmental protection (Stakeholder d1).

Positive examples however do already exist, and there are already private persons that have imported a limited number of e-mobility vehicles to Tanzania, showing that its theoretically possible (e2). But despite these positive examples, the current regulations have several drawbacks that may not encourage e-mobility in the country, such include absence of tax exemptions for the import duties or running of e-vehicles (Stakeholder e2).

Regarding the energy side, existing policies and regulations generally allow using “clean” energy sources such as electricity and natural gas in the transport sector/system (Stakeholder d1, e3). Stakeholders in the field of transport are becoming more and more active towards the topic of clean energy sources in transport, with DART having signed an MOU with UNEP recently to help develop guidelines on different energy efficiency technologies including e-mobility, that is also supported by the Ministry of Finance (Stakeholder b1). Also, Tanzania’s Bureau of Standards (TBS) already has a standardized process to certify new vehicles, that could also be applied to electric vehicles leading to a control of quality of the vehicles themselves and their spare parts (Stakeholder a2).

Stakeholders agree that, despite the fact that policies generally allow for e-mobility to be brought in, there is the need for specific e-mobility regulations and rules that cover topic such as import and duties, standardization, incentives that would allow a commercial, large scale importation and usage throughout the country. Further topics mentioned that need regulation are tariffs, tax exemptions / overall tax regime, licensing and creating awareness. Stakeholder e2 mentioned that the ban of bajaj in the city center, that is being enforced today, should be revised for e-bajaj thereby creating a strong incentive for adoption (Stakeholder d1). Highly important, also is the issue of recycling of old vehicles which should be addressed as soon as possible, especially regarding batteries (Stakeholder c1, e1). Already happening is an import of 2-wheelers, mostly originating from China, that however is not sufficiently regulated to date (Stakeholder e1). Future policies should therefore touch topics related to training as well as charging infrastructure and energy grid development (Stakeholders a3, b1, f1). As an ongoing activity, Tanzania’s Land Transport Regulatory Authority (LATRA) is in the process of reviewing their regulations to accommodate other cleaner technologies in the transport sector (Stakeholder d1). Stakeholder e2 suggested a KPI for the project that measures the clarity for businesses how importing vehicles works, how much it costs, what’s happening if you import them.

1.4 Obstacles, limitations, barriers

Challenges

One of the main challenges that needs to be overcome is the adoption barrier that typically comes with new technologies, such as e-mobility. Overall, it was stated by all stakeholders that there is currently limited knowledge on EVs and associated technologies. As such, there is almost no e-mobility existing to date in Tanzania, meaning a lack of experience and no positive examples showcasing that it works. For the case of our demo project, Stakeholders a2, c1, e1, e3 mentioned this adoption barrier that would lead to resistance to adopt e-mobility. Furthermore, challenging weather conditions (hot climate, wet rain season) in Dar es Salaam were mentioned (Stakeholder a1, d1), maybe requiring a special robust vehicle design. Stakeholder d1 also mentioned that e-bajaj should accommodate the fact that it is not uncommon to overload bajaj today, for instance by carrying up to four passengers in vehicles that have been designed for two passengers, thereby requiring a sturdy vehicle design and sufficient power of the electric drivetrain.

Another challenge mentioned is associated with the high initial investment cost to buy EVs, compared to conventional vehicles (Stakeholders a2, c1, e1, e2, e3, f1). Making this even more costly is the need to build up a public charging infrastructure (which is currently not existent, Stakeholder c1, d1, a3). Additionally, Stakeholder c1 mentioned that the high initial cost of investment into electric vehicles

could be adequately addressed if financial institutions see a strong business case, nevertheless, this is not yet the case in Dar es Salaam and Tanzania. Another obstacle mentioned is the non-reliability of the energy grid (a1), due to frequent blackouts. However, the overall power of the current electricity grid was also described as being sufficient in most cases for home-charging single e-bajaj overnight (Stakeholder e2). There is therefore a strong need to build up a public charging infrastructure in Dar es Salaam.

Stakeholder a1 expressed the opinion that a possible dominance of the EV sector by a few companies could lead to limited competition in the future. Stakeholder b1 expressed that the multiplicity of institutions involved in the urban transport sector could hinder a proper project coordination. Stakeholder e2 mentioned that the planning of the project would be very challenging in relation to deciding which routes should be served, which ownership model for the vehicles would be adopted, how drivers should be selected and the overall business model development.

Solutions

To overcome the aforementioned obstacles, a number of suggestions were given by the stakeholders. Stakeholders a1, d1, e2, e3 mentioned the need for political support for a successful project implementation, the need to engage the government for assured commitment towards the project and ensure well-established project management structure. Furthermore, the involvement of all stakeholders at an early stage of implementation was suggested (Stakeholders a2, d1), such early engagement could be fostered by creating a stakeholder platform for the exchange of information and knowledge sharing about challenges and solutions (Stakeholder b1).

Looking at the institutional landscape, the establishment of a department under an existing institution or even a separate institution that is responsible for urban mobility was suggested by Stakeholders b1, e1. Creating a framework of a free market environment where competition will thrive to improve services in the sector was suggested, likewise the institutionalization of laws, by laws and regulations to support e-mobility (Stakeholder a1). This would hopefully lead to the presence of investors who will ensure availability of EV and spare parts (a1) and create an enabling environment for businessmen in terms of financial resources, allowing them to shift/venture in the newly emerging business opportunities (Stakeholder c1). Having lower fares for e-bajaj over regular fueled bajaj was also suggested (Stakeholder e1).

Another topic mentioned was awareness raising at all levels of the community, from national leaders to community members and the advocacy of e-mobility (Stakeholders a1, a2, a3, b1, c1, f1). Campaigning at bus stations was suggested by stakeholder e1. Testing the e-bajaj during the demonstration phase for comfort, safety and performance to suit the needs of the users was suggested by Stakeholder d1.

The overall topic of training was frequently mentioned: Stakeholders b1, a3, f1, e1 suggested to provide the necessary training on e-mobility for key stakeholders, stakeholder c1 added the need to retrain current workers of the 3-wheeler market.

Stakeholder a2 mentioned the need to have a survey on this project to end up with a mobility solution which accommodates owners and users' needs, leading to a robust product with the same or better

requirements, capacity in terms of space and energy that can deal with the situation of the existing infrastructure (poor roads).

1.5 Sustainability of the e-Mobility solutions to be implemented

a. Achieve sustainable mobility

Amongst the stakeholders, there was a general consensus that the planned e-mobility solutions are useful to contribute to the goal of sustainable urban mobility in Dar es Salaam. As at the moment all bajaj running in Dar es Salaam are driven by combustion fuel; therefore, switching to electricity as a power source will help to significantly reduce CO₂ emissions and air pollution.

Stakeholders also mentioned the aspect of safety, with 3-wheeled bajaj are considered to be safer than 2-wheelers (Stakeholders a1, d1), that are currently very frequent. Stakeholder e1 expressed concerns that e-vehicles due to being very silent may lead to more accidents. Furthermore, improved accessibility, also to social services, and a reduction of equity related issues in access to transport were named (Stakeholders a2, a3, d1, b1, f1). Bajaj were named as being particularly inclusive as they easily allow for the transport of people with special needs (e.g. disabilities, elderly, children) much better than with 2-wheelers or in crowded buses (Stakeholders d1, f1).

b. Contribute to plans and schemes

In Tanzania, government efforts have been geared towards promoting cleaner fuel for the transport sector such as CNG for hybrid-vehicles, electricity for trains and mass transport systems such as the BRT system in Dar es Salaam. Stakeholders were of the view that the planned e-mobility-solutions will contribute to these government initiatives and plans. (Stakeholders a2, b1, d1, e1) Specifically, the integration with other modes was mentioned by Stakeholder b1, as the demonstration activities will link feeder services with the BRT in Dar es Salaam.

1.6 Impact on existing business models

The current 3-wheeler market in Dar es Salaam is dominated by private operators that are engaged by various forms in the market. Ownership is horizontally fragmented, with lots of different owners of bajaj being active in the market today, ranging between owners who are also drivers and only own one vehicle up to owners who own dozens up to hundreds of vehicles and rent them out. Typically, drivers of vehicles are organized in associations that try to control access to the market on a geographical basis, for instance by claiming certain street junctions exclusively. The implementation of a feeder service may therefore directly challenge the business models of those operating in the area it is being implemented in, creating the need to consider how to deal with that.

To increase the acceptance of the demo project, bringing on board all stakeholders who are involved in the business is required (Stakeholders a2, a3, e1, b1, e3). Stakeholders brought up concerns that all people working in the current 3-wheeler market, ranging from drivers, mechanics, spare part dealers, fuel sellers will be threatened. Stakeholders a3, b1, e3, f1 expect jobs lost in the "old" bajaj sector will be compensated by newly created jobs, for instance fuel attendants' posts will be replaced by jobs for people working at charging stations. Stakeholder d1 mentioned that e-bajaj may also affect

investments into other means of transport, as more people will move to EVs leading to negative effects and business failure for instance in the dala-dala minibus sector.

To overcome this, Stakeholders b1, e3, f1 for instance proposed that the project can engage mechanics on the type of technologies they can work with, and provide training to them to deal with e-bajaj. Stakeholders a2, c1, f1 mentioned that the current distributors of conventionally fueled bajaj should be helped to become e-bajaj distributors to speed-up the transition. Stakeholder e3 suggested that existing groups of bajaj drivers could be surveyed before the implementation of the project.

Stakeholders e1, e2 proposed to test and monitor different business models during the demonstration phase. Three different operating models were proposed by Stakeholders e2: (1) proof-of-concept with DART where operators bid for concessions, (2) keeping the current ownership-driver-structure for a small group of drivers and (3) to offer a small group of drivers e-bajaj with a loan (good conditions), thereby mitigating cannibalization of their current business model. Stakeholder b1 suggested that e-bajaj should not face competition from conventionally fueled bajaj, similar to BRT which is not allowed to face competition from dala-dalas.

1.7 Implications for Planning and Urban Development

The interview touched on implications of the demonstration and an upscaled project on planning and urban development.

a. urban development

Stakeholders a3, f1 reflected on the fact of urban growth, where e-bajaj could make cities become more liveable, open transport opportunities and provide better access to public transport, however both stakeholders as well as stakeholder d1 were concerned that this could lead to urban sprawl. Stakeholder d1 reflected on the problems that came up when new means of transport, 2- and 3-wheelers for instance, came up in the past in the city without proper allocation of parking space. Stakeholder b1 mentioned that they are aware of such effects when planning the BRT and the entire transformation of the urban mobility sector towards e-mobility. For instance, the Dar es Salaam Transport Master Plan is designed with the concept of transit-oriented development, whilst the city's service plan is designed to accommodate trunk lines and feeder services, that could also comprise the location of charging points (Stakeholder b1). Increasing charging points, according to stakeholder a1, could trigger demand for electric vehicles, but will also change the cityscape (Stakeholder a1, e1). Stakeholder e2 suggested that building charging infrastructure for e-bajaj at BRT stations could also allow upscaling these charging stations to accommodate for e-BRT in the future.

b. transport system

Regarding implications for the city's transport system, stakeholders were of the view that the demonstration and a scaled-up scenario will require that the existing road transport infrastructure is designed to accommodate the different means of transport, including the e-bajaj. Expanding the road infrastructure to the outskirts to accommodate all modes of transport, including cars, bajaj,

motorcycles and buses was mentioned by Stakeholders a1, a2, a3, b1, d1, f1. Stakeholder b1 mentioned that in phase 2 of the BRT development, plans already exist to include bajaj terminals.

c. energy system

Energy systems are key for the development of electric mobility. In Tanzania, ongoing projects seek to expand the electric power generation and distribution capacities (Stakeholders a2, b1, f1), also for renewable energies (Stakeholder b1). In Dar es Salaam, there are no notable external implications as reliable power is now available in many areas of the city (Stakeholder a3). Stakeholder f1 expressed the view that the country's energy policies encourage use of electricity for economic purposes, which stakeholder d1 said could help increase government revenues. Stakeholders a1, a3, b1 indicated that the development of the e-mobility sector could engender the need to expand other energy sources such as CNG and foster the development of micro-grids. Stakeholder d1 furthermore mentioned opportunities for the private sector to supply energy for e-bajaj through solar and small hydro's in other parts of the country.