FRIEDRICH NAUMANN FOUNDATION For Freedom.

Philippines

RECEPTIVITY OF THE PUBLIC SECTOR IN THE PROMOTION OF E-TRANSPORTATION IN METRO MANILA

A baseline study for Pasig City, Metro Manila

CASESTUDY

Submitted to:
Rebecca Zistel
Country Director
Friedrich Naumann Foundation for Freedom

Submitted by:
Maria Concepcion Garcia
Jasmine Alviar
Sylvia Sueno

Table of contents

LIST OF TABLES

LIST OF FIGURES

Executive Summary 1

Pasig City is one of the fast-rising areas in Metro Manila. There is new blood at the helm of the executive branch, and numerous foreign businesses and investments. By studying this city in this unique time of its trajectory and intersection with the COVID pandemic, the study gives a glimpse of the transport problems in shifting to e-vehicles faced by this dynamic city.

The introductory part shows the national effort of the Department of Transportation and Communication and Department of Energy, as well as other agencies to shift to renewable energy.

This comes at the heel of international consortiums from the United Nations Framework Convention on Climate Change (UNFCC) and its adaptation into Pasig City through the Low Carbon Urban Transport Systems (LCT) Project. The study touches on Pasig City's effort to adapt smart city initiatives into its local e-mobility policy. A section describes its demonstration projects in comparison to other ASEAN countries.

The perception studies give insights of residents and those working within Pasig on the recently adapted e-vehicle routes. These innovations are assessed in terms of reliability, safety, accessibility, environmental soundness and comfort.

2 Introduction

In January 2009, Administrative Order 254 2009 mandated the Department of Transportation and Communication to lead in Formulating a Nationally Sustainable Transport (EST) for the Philippines[1]. The initiative to transition to a low-carbon urban transport system is aligned with the Philippine Government's pledge to the Paris Agreement reduction of Greenhouse Gas (GHG) emissions, as part of its Nationally Determined Contributions.

In 2020, the Department of Energy accounted that renewable energy comprises only 34.22% of the total primary energy in the country and the remaining 65.77% are from non-renewable energy sources[2]. The transportation sector has the largest share in energy consumption among the industry, agriculture, services, and household sectors, with 95% of its fuel source coming from oil followed by biodiesel with 0.98%, bioethanol with 3.29% and electricity having the lowest share of 0.07%[3]. Its consumption of oil-based fuels comprise 47.9 percent share in the GHG mix in the country[4].

Given the dependency of the transportation sector in non-renewable energy resources, initiatives to transition to a low-carbon future consists of shifting of not only fuel sources from oil to renewable energy sources, but also the transportation sector's infrastructure itself. To date, the initiative is still in the inception phase in the country, with modeled pilot cities identified for the Low Carbon Urban Transport Project by the Department of Transportation and the United Nations

1 *Mandating the Department of Transportation and Communications to Lead in Formulating a National Environmentally Sustainable Transport (EST) for the Philippines*
2 Department of Energy. Key Energy Statistics 2020. https://www.doe.gov.ph/sites/default/files/pdf/energy_statistics/doe-key-energy-statistics-2020-pocket- size.pdf/ (accessed 07 November 2021)
3 Ibid.
4 Department of Energy. Philippine Energy Plan 2020-2040. https://www.doe.gov.ph/sites/default/files/pdf/pep/pep_2020-2040_signed.pdf (accessed 07 November 2021)

Development Programme (UNDP)[5] . Considering that these initiatives are on-going during the COVID-19 pandemic, it is accelerated with incentives towards a 'Green Recovery' in the post-pandemic world.

Through this study, the researchers worked on the following objectives:

a. Identification of key policy instruments involved in the study - both international and local
b. Explore and map linkages of the study with smart cities and e-mobility initiative and corresponding frameworks
c. Investigate the push and pull factors for promoting e-mobility
d. Analyze the impact of COVID-19 on the perception of e-mobility from the managers, operators, users, and stakeholders of public transport services and infrastructure
e. Determining receptiveness of public stakeholders in the promotion of e-transportation

Figure 1. Objectives of the study

5 Low Carbon Urban Transport Project by the Department of Transportation and UNDP. See https://lowcarbontransport.ph/about/

3 Methodology

The methodology used was a mixed qualitative-quantitative method. This is to acquire a comprehensive understanding on the acceptance of e-transport.

The qualitative part used desktop research for the identification of key policy instruments and its linkages with smart city initiatives. Key informant interviews (KII) will also be utilized to surface important issues from different sectors and perspectives in order to complement the desktop research to be conducted.

Perspectives from local governments, those working in the transport sector, and the daily commuter were explored through interviews, review of related articles and policies. This is to facilitate knowledge generation on transport policy, adaptation and mode choice[3].

The quantitative study was conducted through a questionnaire survey on why commuters would prefer electronic transport over its traditional counterpart. An opinion scale will be used to see if there is hesitancy or what components (transport hubs, type of payment, comfort) The major topics for comparison are reliability, safety, accessibility and environmental soundness, will make users favor it more[4].

Figure 2. Potential factors that may affect public perception and receptivity of e-transportation in Pasig City.

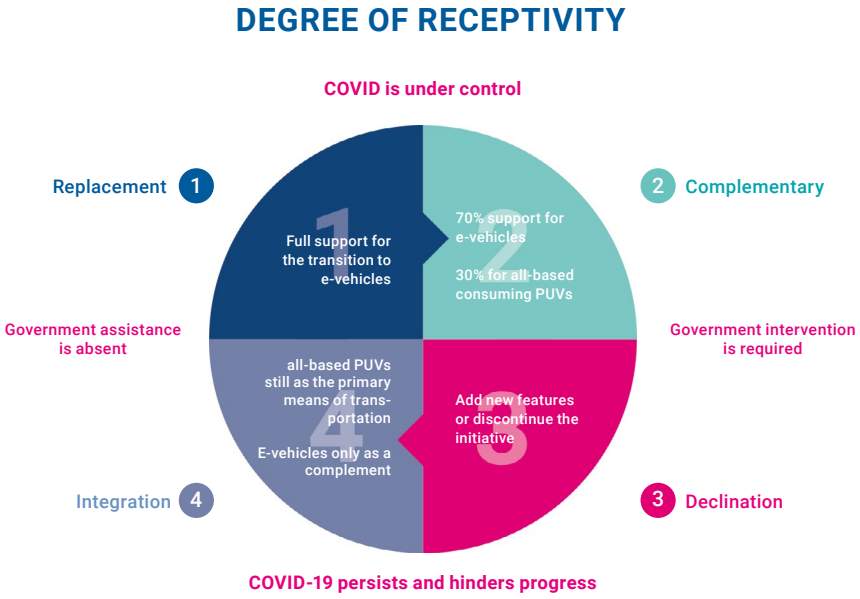

Figure 3. Illustration for determination of the degree of receptivity.

DEGREE OF RECEPTIVITY

Selya works at a cellphone repair shop in Greenhils. She commutes to work everyday.

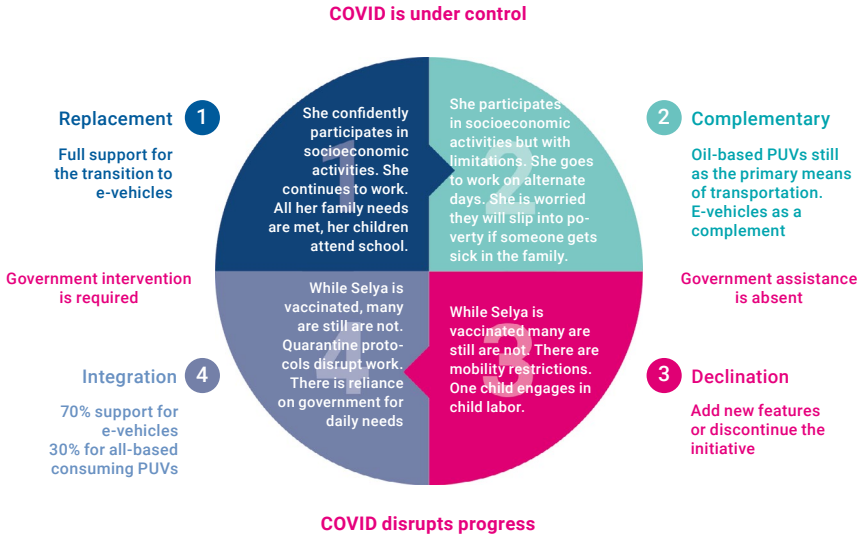

Figure 4. Illustration for determination of scenario-based degree of receptivity.

Scope of Work 4

The following work packages shall be implemented to achieve the objectives of the project:

a. Baseline studies and policy review

b. Perceptions survey on traditional vs e-vehicle route of key stakeholders (operators, jeepney associations if applicable, and public receptivity for both commuters and private vehicle owners)

- Government Policy
- Routes
- Management
- Public receptivity

5 Results and Discussion

Pasig City has been called "A Smart City with a Green Heart"[6] by the United Nations Framework Convention on Climate Change (UNFCC). Pasig has an integrated ICT network surveillance camera monitored for safety and 24-hour phone and text hotlines for hospital services[7]. An indispensable tool that improves citizens' access to essential services especially during the COVID-19 pandemic.

Lowering carbon emissions is an advocacy of Pasig City. Regulations such as the Local Green Building Ordinance and Rainwater Catchment Ordinance are geared towards creating climate resilient communities, in addition to participating in the Low Carbon Urban Transport Systems (LCT) Project[8] in the Philippines. Moreover, it demonstrates a commitment to environmental sustainability by promoting active transportation such as walking and cycling, through car-free streets on Sundays, bicycle sharing programs, and creating a network of pedestrian walkways in the central business district. Pasig is proactive on sustainable urban transportation with a dedicated Transport Development and Management Office called Pasig Transport[9].

5.1 E-mobility and Smart Cities

A "Smart City" uses innovation to enhance the quality of life (QoL) for its citizens. At its core is smart transportation, which can refer to electric vehicles (e-vehicles), intelligent transport systems (ITS), and new business models such as car-sharing, and new transport

6 UNFCC (2021). "Pasig City - A Smart City with a Green Heart – Philippines". Accessed at https://unfccc.int/climate-action/momentum-for-change/activity-database/pasig-city-a-smart-city-with-a- green-heart.

7 Pasig City (2021). Accessed at https://www.pasigcity.gov.ph/.

8 Promotion of Low Carbon Urban Transport Systems in the Philippines (2021). Accessed at https://lowcarbontransport.ph/pasig-city/.

9 Pasig Transport (2021). Accessed at https://www.facebook.com/PasigTransport.

planning and policies[10]. The objectives of smart cities are met when these efforts achieve reduction in vehicle pollution, reduced traffic congestion, increased safety, improved transfer speeds, and reducing travel costs[11].

Technology is often at the forefront of smart cities, where data is collected from travel demand and trip patterns are analyzed and used to create data-driven policy actions to meet specific objectives. E-mobility and e-vehicles are often associated with technology-driven solutions to improve the ability of people, goods, and services to move in smart cities. E-mobility serves multiple benefits in sustainability as it impacts the dimensions of environment, economy, and society.

This section of study is focused on 1) identifying key policy instruments that can support e- mobility as demonstrated from international and local cities and 2) exploring and mapping linkages of existing initiatives related to smart cities, e-mobility and corresponding frameworks that will contribute insights to the promotion of environmentally sustainable transportation.

Secondary research methods were employed to explore the progress of e-mobility in Pasig City. The study outlines key policies and programs that support the research objectives. Due to time constraints, integration frameworks are not examined in extensive detail. Moreover, this study recognizes that a wealth of policy information, technical studies, and programs relating to low carbon initiatives, e-vehicles, and sustainable urban planning, and related

---

10 Chen, Y. and Silva, E. (2021). Smart transport: A comparative analysis using the most used indicators in the literature juxtaposed with interventions in English metropolitan areas. Transportation Research Interdisciplinary Perspectives. Vol.10 June 2021. https://doi.org/10.1016/j.trip.2021.100371.

11 Benevolo, C., et.al. (2016). Smart Mobility in Smart City Action Taxonomy, ICT Intensity and Public Benefits. Empowering Organizations: Enabling Platforms and Artefacts, pp.13-28.

efforts have already been coordinated with Pasig City. To complement these efforts and avoid duplication, reference documents have been collected in Appendix A.

5.2 Urban Challenges in Pasig City

Pasig City is a champion in promoting active mobility through walking and pedestrian network facilities, bicycle sharing programs, public transport services, and car-free streets. Pasig Transport is an innovative and pro-active unit of the city which is responsible for initiating research and data-driven programs that support sustainable transportation systems.

Similar to urban transport mobility problems in Metro Manila, inadequate and low-quality public transport services are among the City's problems. As a response to insufficient public transport options, high motorization rates, especially motorcycles, is observed. The COVID-19 pandemic saw rapid increase in e-commerce and delivery, urban cargo and goods movement which mainly uses conventional motorcycles that are not meant to transport goods. And this has resulted in increasing vehicle carbon emissions.

In terms of promoting e-mobility, there is a challenge on the adoption of e-vehicle technologies due to the unfamiliarity of the general public in relation to e-vehicle options that are currently available in the local market.[12] Adding to barriers on access to information is the lack of investment in e-vehicle support infrastructure such as charging stations.

Key points that need to be addressed in relation to supporting e-mobility include:

- Creation of an enabling environment to adopt e-vehicle technology

12 Siy.A. (2021). Pasig Transport.

(ex. regulatory measures and fiscal incentives)
- Improving access to information on e-vehicle options, cost, and performance benefits, for businesses and the general public
- Providing support infrastructure to promote environmentally sustainable transport modes (ex. protected bicycle lanes, EV charging stations)

5.3 E-mobility Policy Instruments

The goal of e-mobility is to integrate people, culture, technology, urban planning, and sustainable transportation systems to bring about better quality of life13. The policy instruments presented in Table 1 have been divided into four categories: regulatory measures and legislation; financial instruments; communication; and organization or institutional measures. Different applications of each measure as from city experiences in the global north are presented in the rows. Before selecting policies from this matrix, it is important to consider the local context of the city. Note that measures and tools can be combined to achieve the desired results.

Regulatory and legislative frameworks are the foundation of e-mobility policies. Regulations and laws need to have a clearly defined vision of the desired outcome. These should define the permitting rules and guidelines of how e-vehicles will be used within the city. Laws and regulations are formulated from data-driven analysis of travel demand and must incorporate existing transportation networks and services available. Fiscal measures create the push and pull mechanism for encouraging e-vehicle use. Examples of push measures can relate to registration fees and taxes for traditional internal combustion engine (ICE) vehicles and pull measures on e-vehicle subsidies and try-before-you-buy leasing for potential e-vehicle users.

13 Mejia, A. (2021). Overview of E-mobility Policy Tools for Local Authorities.

Table 1. Policy instruments on e-mobility

Regulatory/Legislative	Financial	Communication	Organizational
EV legal requirements and standards	Registration fees/tax	Supporting safety	Procurement (eg. electrifying local fleet)
Legislation for standards for charging station accessibility	License tax/ fees	Fuel economy/ CO2 labelling schemes	Award criteria for cleaner vehicles
Limited access to urban areas or roads	e-vehicle subsidies try- before- you buy leasing	Social campaigns promoting the use of clean vehicles and modes	Request sustainable mobility concept
Low emissions zones		Utilization of proper infrastructure- related signages	Increase contract lengths
Local parking legislation		Online tools to communicate information and access to charging networks	Require transportation data monitoring
Permitting rules and guidelines			Provide guidance to companies
Rules on creation of e- mobility infrastructure			Sustainable fleet certification
Zoning and building codes			Provide on-site charging and infrastructure/ storage space

Source: Mejia, A. (10 Nov 2021) Overview of E-mobility Policy Tools for Local Authorities. Wuppertal Institute.

Public communication and providing access to correct information is an essential component of these policy instruments. Increasing public awareness, not only on the environmental benefits of e-mobility, but also on the economic, and health and safety benefits of these technologies need to be properly communicated to the public. Communication tools such as social marketing campaigns that promote clean vehicles can be utilized to gain public support. Another essential component is the organizational structure within the city. Demonstrating the benefits of e- vehicles, active mobility, and alternative modes of transport can be started within the local government. Examples include electrifying the motor vehicle fleet by requiring e-vehicles at procurement and providing charging stations

at government owned facilities. The policy instruments presented have come about from experiences in the global north in creating enabling measures to promote e-vehicles in their cities. There are certain limitations that developing country cities are facing, and these tools can be explored in consideration of these limitations.

5.3.1 Selected country initiatives on e-mobility

India[14]

FAME Scheme supports the electrification of public and shared transportation through fiscal subsidies and charging infrastructure policies. Targets include e-buses, electric 2-3-4 wheeled vehicles. It includes a Phased Manufacturing Program (PMP) that incentivizes the manufacturing of low value accessories of electric vehicles, that are later scaled-up to higher value components. The PMP created the enabling environment by increasing customs duties of imported accessories or components. In 2021, FAME registered 98 electric vehicle models and generates an estimated savings of 95 million liters in fossil fuel and 234 million kg of CO2 emissions. Another fiscal policy is the Production Linked Incentive (PLI) scheme advanced cell chemistry battery storage that pays manufacturers on sales, energy efficiency, battery life cycle and localization levels. The PLI scheme is expected to increase India's manufacturing output in the next five years.

Regulatory measures are also in place. The Ministry of Housing and Urban Affairs made amendments to the Model Building Bylaws (MBBL) and Urban Regional Development Formulation and Implementation (URDPFI) Guidelines to create provisions for creating Electric Vehicle Charging Infrastructure. The Ministry of Power revised EV Charging Guidelines and Specifications to accommodate all business models

14 Sinha, S. (2021). Case of India and the Measures Used to Promote E-mobility. NITI Aayog.

in charging infrastructure. Further regulations include the National Electric Policy 2021 and "Go Electric" campaign.

To address environmental concerns, the Ministry of Environment has drafted the Battery Waste management Rules (2020). The National Institution for Transforming India (NITI AAYOG) focuses on the national mission on transformative mobility and battery storage by creating a circular economy. India is also working on a Vehicle Scrapping Policy where manufacturers are incentivized for scrapping vehicles over 15 years old. While disincentives will be issued for vehicles registering more than 15 years from the initial registration date.

Malaysia[15]

Electric vehicle standards development has been in place in Malaysia for over a decade. The country first developed MS 2413 (2010) or the Electrical Motorcycle Standards and continues to improve and update standards related to overall efficiency while creating enabling policies for supporting local industries. Malaysia follows the ASEAN EV standards as well as EU standards, while conducting confirmation testing. The Government Standards Department (SIRIM) oversees most testing on standards. The Standards Committee involves national agencies on: Highway Enforcement, Transportation, Standards, Road Safety, Environment. It also includes members of the Academe and Industrial Partners, manufacturers and associations. The Committee is tasked to extensively discuss and debate on the proposed standards until a consensus is achieved.

EV Standards Development in Malaysia include:

2010 Electrical Motorcycle Standards
2012 Electric Bicycle Standards (2-wheeler <25 kph)
2014-2015 Updating of 2010 and 2012 Standards based on testing and feedback 2015 Electric Motorcycle standard applied to small electric cars

15 Gitano-Briggs, H. (2021). Light Duty Electric Vehicle Standards in Malaysia. Focus Applied T echnologies.

2017 E-moped class standard (mandatory battery lifetime testing)
2021 2nd Revision of Electrical Motorcycle Standards.

ASEAN[16]

60% of trips in Southeast Asian cities take less than 30 minutes, with an average trip length of 6km[17]. With supporting infrastructures, these trip activities can be converted into e-vehicle trips or active transportation trips that can easily mitigate carbon emissions in the transport sector. In support of electric 2-3 wheelers, the United Nations Environment Program (UNEP) has been supporting several Asian countries on EV standards, regulations development, and demonstration projects for personal use and urban freight.

UNEP is currently supporting the Philippines (Pasig City), Thailand, Viet Nam, as well as Indonesia and Myanmar. Policy support includes fiscal regulations, tax exceptions, tax breaks on corporate industries. In terms of regulatory frameworks, industry standards development is being pursued in addition to local measures such as designating electric 2-3-wheeler zones in cities, promoting consumer information, and fuel labeling.

5.3.2 Local

A considerable amount of work has been done in terms of electric vehicle research in the Philippines. In particular the Philippine Electric Vehicle Policy Analysis Report[18] discussed the entry point of legislation needed with regard to supporting EV demand generation, EV cost

16 Fabian, B. (2021). Managing Electric 2/3 Wheelers or LVs in Asia. Sustainable Mobility Unit. UNEP.

17 Ibid.

18 Biona, J. (2019). Philippine Electric Vehicle Policy Analysis Report (Draft). Manila: Mitsubishi Motors Corporation.

reduction, charging infrastructure and development, and industry development. The extensive report also highlighted the stakeholders involved in each sector, defining their roles and responsibilities in moving towards supporting EVs in the country (Table 2).

Table 2. EV legislation needs in the Philippines

Sector	Driver/s and Stakeholder/s
Demand Generation	DOTr, LGU
EV Cost Reduction	DTI, DOF
Charging Infrastructure Development	DOE, LGU
Industry Development	DTI, LTO, DENR, DOST, TESDA

Source: Dematera, K. (12 Nov 2021) Anchoring EV programme to address core challenges in the Philippines.

Table 3. Overview of policy instruments on e-mobility in the Philippines

Instruments	National	Local
Legislative and regulatory	Emission standards	Access restrictions, low emission zones
	Lower EV registration fees & taxes	Local air quality management
	EV standards and charging protocols	Speed restrictions
		Number coding schemes
Economic	Vehicle and fuel tax	Local parking management and restrictions
	Road user charge	Parking pricing and benefits for e-vehicles (2/3 wheelers)
	Research and Development	
Strategic Planning	Industry development	Infrastructure for light electric vehicles, walking and cycling
	Public transport planning	Public transport planning and 3 wheelers
	Power generation	Charging infrastructure planning

Instruments	National	Local
Organizational	Building codes	Signages and markings
		Local permitting processes
	ICT infrastructure	Pilot projects on new technologies
	Procurement	Leveraging city-owned properties
		Award criteria (preference for cleaner transport services/vehicles)
Technological	Clean production and technology	Driver/manager/operator training, including government and commercial fleets
Information and communication	Awareness campaigns	Demand operation (e.g., industries or LGU offices operating vehicle fleets)
	Vehicle labeling	Targeted awareness campaigns
		Public events

Source: Dematera, K. (12 Nov 2021) Example of policy instruments focused on e-mobility (Preliminary mapping of instruments for the Philippines).

Table 3 presents an overview of policy instruments related to e-mobility in the Philippines. These points can be used as entry points for local governments to initiate interest in e-mobility within their own localities. In principle, cities should have a good understanding of electric vehicle technologies, and have a reliable travel demand database, and technical capacities, before adapting these policy instruments.

5.4 E-mobility in Pasig City

Initiatives related to promoting e-mobility have been categorized as policy, plan, or program in Table 4. Executive Order 63 S.2021 created a dedicated Steering Committee for e-mobility composed of City Transport, City Environment (CENRO), City Health Department, City Planning (CPDO), City Engineering Office, Office of the General Services, Tricycle Operation and Regulatory Office (TORO), City

Council Secretariat, Barangay Affairs, and Office of the Mayor. On the planning side, the development of an e-mobility road map is being prepared in coordination with Clean Air Asia, which provides technical training to the City.

Demonstration Programs are also underway in coordination with Solutions Plus[19] of UNEP. Partnering with PHLPost, locally developed and assembled e-cargo quadricycles are deployed in parcel deliveries in Pasig City. Not only are these vehicles more appropriate for urban deliveries as opposed to conventional motorcycles, but these vehicles can also be utilized as shared vehicles for passenger use.

Table 4. Pasig City e-mobility initiatives

Policy	Plan	Program
EO No. PCG – 63 Series of 2021 An Executive Order Appointing Members to the Pasig E-mobility Steering Committee	CitieSWITCH to E-mobility Project (UPS/ Clean Air Asia)	Green Delivery "shared vehicle use" Demonstration Project (PHLPost/UNEP/ SOL+)
Comprehensive Land Use and Water Plan (Integration of e-mobility)	Development of e-mobility Roadmap (Pasig Transport)	E-trikes Project (DOE/ADB)
Tricycle Upgrading Ordinance (2016)	DOTr / UNDP Low Carbon Transport (LCT) Pilot City	

19 Solutions Plus. (2021). Factsheet Pasig Demonstration City. Accessed at http://www.solutionsplus.eu/uploads/4/8/9/5/48950199/factsheet_pasig_2.pdf

5.4.1 Demonstration projects and programs

Accelerating the adoption and scale-up of electric mobility for low-carbon city development in the Philippines (GEF/UNEP/UNIDO)[20] has the objective of reducing GHG emissions form transport in the Philippines through e-mobility development cities. Executing agencies involve DOE and DILG, CCC, DOTr, DENR, DTI, and LCP. The project timeline is from 1 June 2020 to 1 June 2025.

"E-Trike Project"[21] led by the DOE and ADB-Clean Technology Fund distributed 100,000 e-trikes in Philippine Cities from 2016-2021.

Jeepney+NAMA (GIZ/DOTr)[22] involves transport policy improvements and consolidation of the jeepney fleet towards low carbon vehicles.

Promotion of Low Carbon Urban Transport Systems in the Philippines (UNEP/GEF/DOTr) sets the enabling environment for low carbon transport systems. LCT has an extensive policy database toolbox[23] with entries from local and international examples.

Solutions Plus[24] and Integrating Electric 2&3 Wheelers into Existing Urban Transport Modes in Developing and Transitional Countries[25] (UN Environment).

---

20 GEF (2018). Accessed at https://open.unido.org/projects/PH/projects/180210

21 ADB. Not dated. Accessed at https://www.adb.org/sites/default/files/projects/163994/43207-012-phi- dpta-08.pdf

22 GIZ. (2016). The Jeepney+ NAMA. Accessed at https://changing- transport.org/publication/transforming-public-transport-in-the-philippines/

23 LCT. (2021). Policy Database. Accessed at https://lowcarbontransport.ph/policydb/ao-mc/

24 EU. (2021). Solutions Plus Project. Accessed at http://www.solutionsplus.eu/

25 IKI. (2021). Integrating electric 2 & 3-wheelers into existing urban transport systems in developing countries. Accessed at https://www.international-climate-initiative.com/en/details/project/integrating- electric-2-3wheelers-into-existing-urban-transport-systems-in-developing-countries-17_I_288-2851

6 Perceptions Survey

There are numerous studies on demand of different public transportation modes or even the aggregate public transportation market from different countries, which gives a broader perspective on the nature of public transportation demand and the factors affecting it. In a study by Polat (2012) which aggregates studies or literature looking into public transportation demand, the author specified first that in transportation studies, the first step is determining the representative data for the dependent variable which is public transport demand. The author noted that the usual metric for this is the number of passengers for a certain period of time, usually, the time frame covered by the study. This could be measured by manual calculation such as passenger or revenue counting, or by using estimates provided by the service providers. Estimates could be determined by counting the number of transport vehicles of the mode traveling in a day, the number of roundtrips it makes in that timeframe, and the estimated or actual number of passengers accommodated per trip. Certain specifications could also be used such as passenger per kilometer if the study will look into targeting certain routes or passengers for the study.

In understanding public transportation demand, the same article by Polat (2012) stated that three factors should be taken into consideration. First, the public transport environment is dynamic and interactive which means that it is possible that different modes of transport may be complement goods and not substitutes as usually assumed. Second, public transport demand is time- dependent which means that there are peak hours during a day where demand is higher usually due to the purpose of the trip or that there are peak seasons where transportation is higher than usual. Lastly, different traveler types have different expectations based on their travel time and purpose (such as work or leisure).

The factors affecting the demand for public transport can be mapped out by looking into the common factors affecting the demand as studied in economics which are the following: price or cost of the good and other related (substitute or complement) goods, and the

consumer's tastes and preferences, income, and expectations. All these variables must be considered in the context of public transport.

Cost of travel. For public transport, cost is not limited to the fare price incurred by the commuters to gain access to the public transport service since one also has to consider the travel time as it is also valued by individuals as an opportunity cost when travelling (Horn, 2004). As stated in the literature review of Polat (2012), fare price is usually the most significant variable when it comes to public transport as it is consistent with the studies of FitzRoy and Smith (1998), Bonnel and Chausse (2000), and Bresson et al. (2003). The journal article by Bresson et al. (2003) also discussed that the own price elasticity of public transport usually changes with time, as the short-run, medium-run, and long-run own price elasticities are different, showing that there is a possibility that it takes time for consumers to shift their consumption after a price change. However, as stated in a journal article by Crotte, Noland, and Graham (2009), there are certain circumstances wherein price would not be significant in explaining demand as shows in his study since it is possible that the certain public transport mode is the only accessible or affordable mode, the public transport mode is the cheapest among alternatives, road congestion makes other substitutes more costly in terms of time, or the consumer prefers the certain services provided by that public transport mode which allows the commuter to disregard a higher cost.

As previously stated, travel time is another cost incurred by travelers which influences their choice of which public transport mode to access. Additionally, as stated by Walle and Steerberghen (2006), it is possible that time is more important to an individual's demand as they are faced with a more constant constraint as there are only 24 hours a day. Moreover, individuals are usually required to attend to certain activities like work or school at a specific time, making travel time important. Travel time could be interpreted in econometric models differently based on the assumptions of the researcher as travel time is not limited to only the journey time. For example, Krygsman et al.

(2004) incorporated the time required to access the public transport and the egress time in determining the travel time, and states that improvements in accessibility would not only reduce travel cost as it would generally reduce travel time without a need for expensive infrastructure investments but also provide more convenience to commuters. Also, Walle and Steerberghen (2006) used time and space determinants to determine if it causes changes in the choice of public transport modes to be used.

Alternative transport modes. The study of Bresson et al. (2004) states that having alternative transport modes has a direct effect in explaining the demand for public transport since it is less likely to choose a certain public transport demand given more and more choices of alternatives. The study also noted that even though the direct effect of having alternatives is already established, it is still advisable to look at the cross-price elasticity of the demand for public transport especially with regards to fuel price since increasing car ownership is one of the main reasons for the lower public transport demand and fuel price is one of the daily operational costs of choosing to travel through private transportation. (Krygsman, Diist, & Arentze, 2004) (Papon, 2002) (Lythgoe & Wardman, 2002) (Matas, 2004)

Service quality. As stated in the review of Polat (2012), there are numerous studies that have incorporated various service variables in their studies and have found it to be one of the most significant variables in explaining the demand for public transport as it can reflect the consumers' tastes and preferences, as well as their expectations. The literature review cited the works of Bresson et al. (2003), Francis (2002), Lythgoe and Wardman (2002), and FitzRoy and Smith (1998) as research works who proved the first statement. The work of Bresson et al. (2003) stated that it is possible that service quality and fare price might have the same weight in terms of the decision making of individuals in choosing which public transport mode to use as price increases could be compensated with a similar improvement in service quality. Also, FitzRoy and Smith (1998) noted that service quality is a function of its quantity, as more trips would not only reduce

waiting time, but also lower the congestion levels which are both factors of service quality. This statement was further explained by the work of Francis (2002), as he stated that service frequency in terms of the number of trips per day would determine how long the commuters would have to wait and has stated that it affects demand since the availability of the service is a significant variable in explaining public transport demand.

Economic factors. Polat (2012) stated that among there are economic factors that would theoretically be explanatory variables of the demand for public transport such as income, and employment rate. The study made by Crotte, Noland, and Graham (2009) in Mexico City stated that for families whose workers are earning minimum wages or households in the low-income level would consider public transportation as a normal good, and thus would still give patronage to it given a small income increase since they are not considered to be potential car owners. Middle to high income earners on the other hand would instead tilt to car ownership given an income increase, thus treating public transportation as an inferior good. Meanwhile, Matas (2004) stated that rising employment rates in Madrid contributed to the increase in the patronage of its underground transport system which is rail-based. This could be explained by the additional mobility needed by the newly employed to access their workplace if it is far from their residences. Matas (2004) noted however that employment rates should not affect short-run demand generally as employment rates do not fluctuate significantly in the short-run.

Population density. Francis (2002) stated that population growth and population characteristics like age structure would influence the level of demand for public transport. Population growth, especially in urban areas, would generally increase the demand for public transport as mobility is almost a necessity in developed areas. Meanwhile, the age structure would affect public transportation in such a way that if there are more adolescent to middle-aged individuals in the population, there would be more demand for public transport as it is necessary for education or work-related activities.

7 Analyses of Results

The following show changes in modality of respondents before, at the height of the lockdown and with the subsequent ease in restrictions. A marked increase in private vehicle trips was noted. Due to the targeted sampling, use of electric vehicles was also significant. Modalities for mass transport such as buses and trains were mostly shunned at the height of the lockdowns. The frequency of use of more local modes such as tricycles have almost returned to pre-COVID levels. Although most respondents to the quantitative surveys made it known that they had only used albeit infrequently.

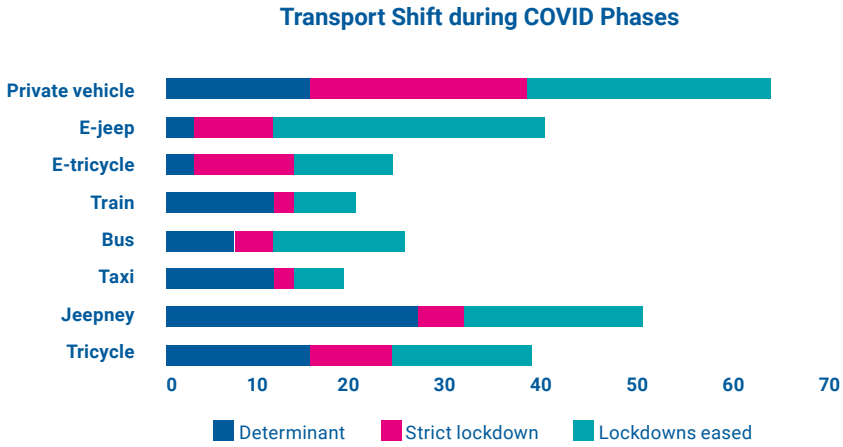

Figure 5. Transport shift of commuters during the different phases of COVID. It is divided to pre-COVID, the strict lock downs and the "new normal".

The highest determinant was use of renewable energy (E1), especially in choosing this mode of vehicle over others. The lowest was waiting time at the station (R1) since it was unreliable when the next unit would come. There was high satisfaction in the perception of safety within the vehicle due to CCTV and less possibility for pickpockets. In terms of the environment, its protection from weather outside is highly satisfactory. Accessibility for the elderly and the disabled is also one of its high points.

Table 5. Determinants with quantitative and qualitative rating

Determinant	Mean Rating	Quantitive Rating
Waiting time at the station (R1)	3.05	Neither dissatisfied nor satisfied
Availability of the vehicle (R2)	3.06	Neither dissatisfied nor satisfied
Predictability of travel time (R3)	3.97	Neither dissatisfied nor satisfied
Fear of pickpockets (S1)	4.51	Very Satisfied
CCTV camera able to monitor (S2)	4.44	Very Satisfied
Handrails attached (S3)	4.32	Satisfied
Route appropriateness (A1)	4.17	Satisfied
Designated stops, pick-up and drop off points (A2)	4.30	Satisfied
Accessible to the elderly and the disabled (A3)	4.62	Very Satisfied
Use of renewable energy (E1)	4.78	Very Satisfied
Ventilation inside the vehicle (E2)	4.51	Satisfied
Level of lighting (E3)	4.38	Satisfied
Sound level (E4)	4.62	Very Satisfied
Protected from the weather (E5)	4.44	Very Satisfied
Leg space comfortable (C1)	4.38	Satisfied
Aisle space (C2)	4.36	Satisfied

In a regression analysis of the perception of commuters based on an averaged value of the determinants. These were then clustered to the following criteria: reliability, accessibility, safety, environmental soundness, and comfort, the following conclusions were generated:

- Environmental soundness, specifically the use of renewable energy, was consistently the reason most passengers approved of e-vehicles
- This was followed by safety, comfort, accessibility and reliability, respectively
- The variability in waiting time and availability were it users were the least satisfied

8 Challenges and Limitations

The widespread effect of the omicron variant of COVID was not foreseen by the researchers. Although it had been planned that a significant portion of the study could be conducted online. The number on both sides, the research assistant and the target interviewee limited the sample size of the study. Key informant interviews, including with local government officials and elderly operators, were reluctant to have face-to face interviews, albeit justifiably.

During the formulation of the questions, it was assumed that eased restrictions were supposed to be the new normal. But lockdowns were again heightened due to the increasing number of cases in the city. This required some refining of terms to encompass different alert levels.

Similarly, policies were mostly formulated pre-COVID. only ad hoc mandates are used at present. Yet even these change under different alert level warnings

Finally, although a significant part of the transport sector caters to a younger population, school age children have been confined at home. Hence, mostly working age professionals were the respondents of this study.

9 Conclusions and ways forward

This research presented the definition of smart cities and e-mobility as characterized by technology-led innovations in transportation and e-vehicles. This paper collected resources on e-mobility in terms of EV technical research and policy analysis. An overview of key policy instruments at the national and local level has been highlighted. Linkages to existing policies, plans, and programs, on promoting low-carbon cities and e-mobility has been outlined with supporting documentation and references.

E-mobility has come a long way in the Philippines with emerging technologies and demonstration projects on innovative solutions to urban transport and mobility. Fundamentally cities are planned for people, and it is essential that pathways to achieve e-mobility are inclusive and accessible for all. There is a need to understand existing technologies, trip demand, and user behavior to create effective policies in promoting e-mobility.

The ways forward recommended are as follows:

- Understand transport demand and emissions baselines to create need-based and targeted policies;
- Localize best practices and standards with different stakeholders;
- Communicate and coordinate policies and data sharing with national and local government agencies; and
- Prioritize local engagement and bottom-up participatory planning.

REFERENCES

ADB. Not dated. e-Trike Project: Presentation: Proposed Market Transformation through Introduction of Energy Efficient Electric Tricycles Project Accessed at https://www.adb.org/sites/default/files/projects/163994/43207-012-phi-dpta-08.pdf

Bathan-Baterina, G and Dematera, K. (2020). Role of policymaking in mainstreaming electric mobility in Southeast Asia. UNEP. Clean Air Asia.

Benevolo, C., et.al. (2016). Smart Mobility in Smart City Action Taxonomy, ICT Intensity and Public Benefits. Empowering Organizations: Enabling Platforms and Artefacts, pp.13-28.

Biona, J. (2019). Philippine Electric Vehicle Policy Analysis Report (Draft). Manila: Mitsubishi Motors Corporation.

Chen, Y. and Silva, E. (2021). Smart transport: A comparative analysis using the most used indicators in the literature juxtaposed with interventions in English metropolitan areas. Transportation Research Interdisciplinary Perspectives. Vol.10 June 2021. https://doi.org/10.1016/j.trip.2021.100371.0

Dematera, K. (12 Nov 2021) Anchoring EV programme to address core challenges in the Philippines.
Dematera, K. (12 Nov 2021) Example of policy instruments focused on e-mobility (Preliminary mapping of instruments for the Philippines).

EO no. PCG-63 Series of 2021. An Executive Order Appointing Members to the Pasig E- Mobility Steering Committee

EU. (2021). Solutions Plus Project. Accessed at http://www.solutionsplus.eu/

Fabian, B. (2021). Managing Electric 2/3 Wheelers or LVs in Asia. Sustainable Mobility Unit. UNEP .

GEF (2018). Accessed at https://open.unido.org/projects/PH/projects/180210
Gitano-Briggs, H. (2019). Development of ASEAN light duty electric vehicle policy guidelines (draft unpublished).

Gitano-Briggs, H. (2021). Light Duty Electric Vehicle Standards in Malaysia. Focus Applied Technologies.

GIZ. (2016). The Jeepney+ NAMA. Accessed at https://changing- transport.org/publication/transforming-public-transport-in-the-philippines/

IKI. (2021). Integrating electric 2 & 3-wheelers into existing urban transport systems in developing countries. Accessed at https://www.international-climate- initiative.com/en/details/project/integrating-electric-2-3wheelers-into-existing-urban-transport- systems-in-developing-countries-17_I_288-285123

J

AO No.2020-1. Guidelines on the Proper Use and Promotion of Active Transport During and After the COVID-19 Pandemic

LCT. (2021). Policy Database. Accessed at https://lowcarbontransport.ph/policydb/ao-mc/

Mejia, A. (2021). Overview of E-mobility Policy Tools for Local Authorities.

Pasig City (2021). Accessed at https://www.pasigcity.gov.ph/.

Pasig Transport (2021). Accessed at https://www.facebook.com/PasigTransport.

Promotion of Low Carbon Urban Transport Systems in the Philippines (2021). Accessed at https://lowcarbontransport.ph/pasig-city/.

Sinha, S. (2021). Case of India and the Measures Used to Promote E-mobility. NITI Aayog. Siy, A. (2021). Pasig Transport.

Solutions Plus. (2021). Factsheet Pasig Demonstration City. Accessed at http://www.solutionsplus.eu/uploads/4/8/9/5/48950199/factsheet_pasig_2.pdf

SOLUTIONSplus. (9-12 Nov 2021) Pasig Specific training on E-mobility. Conducted online.

UNEP (2020). Policy Guidelines for Electric 2- & 3-wheelers for Southeast Asia.

UNFCC (2021). "Pasig City - A Smart City with a Green Heart – Philippines". Accessed at https://unfccc.int/climate-action/momentum-for-change/activity-database/pasig-city-a-smart- city-with-a-green-heart.