FINANCING AND INTEGRATING RENEWABLE ENERGY IN THE CITY OF BUTUAN

E-TRIKES PUV PILOT PROJECT FOR BUTUAN CITY

PRE-FEASIBILITY STUDY

JUNE 2025

SUPPORTED BY:

Federal Ministry for Economic Affairs and Climate Action

on the basis of a decision by the German Bundestag

IKI INTERNATIONAL CLIMATE INITIATIVE

PREPARED FOR:

WWF

CITY OF BUTUAN OFFICIAL SEAL

PREPARED BY:

PREFERRED ENERGY, INC.

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

ABBREVIATIONS

ANECO	Agusan del Norte Electric Cooperative, Inc.
BCEDP	Butuan City Energy Development Plan (2023-2050)
BIR	Bureau of Internal Revenue
BXU	Butuan City
CGB	City Government of Butuan
CapEx	Capital Expenditures
CDP	Comprehensive Development Plan
CENRD	City Environment and Natural Resources Department
CPDC	City Power Development Council
CPDC-TWG	City Power Development Council - Technical Working Group
CPDD	City Planning and Development Department
CTTMD	City Transportation and Traffic Management Department
CLUP	Butuan City Comprehensive Land Use Plan The Executive Summary 2019-2028
CO_2	Carbon Dioxide
CREVI	Comprehensive Roadmap for the Electric Vehicle Industry
CS	Charging Station
DBP	Development Bank of the Philippines
DENR	Department of Environment and Natural Resources
DOD	Depth of Discharge
DOE	Department of Energy
DOST	Department of Science and Technology
DOTr	Department of Transportation
DOT	Department of Tourism
DPP	Distribution Development Plan
DPWH	Department of Public Works and Highways
DTI	Department of Trade and Industry
DU	Distribution Utility
EPIRA	Electric Power Industry Reform Act of 2001
ERC	Energy Regulatory Commission
E-Trikes PUV Project	EV PUV Tricycle Units Project
EVIDA	Electric Vehicle Industry Development Act
EV	Electric Vehicle
EVCS	Electric Vehicle Charging Stations
EZ	Economic Zone
FinRE-BXU	Financing Integration of the Renewable Energy Projects in Butuan City
FIT	Feed-in-Tariff
GEAP	Green Energy Auction Program
GEOP	Green Energy Option Program
GHG	Greenhouse Gas Emissions
GWh	Gigawatt-hour
HUC	Highly Urbanized City
IRR	Implementing Rules and Regulation
IRR	Internal Rate of Return
ITH	Income Tax Holiday
kWh	Kilowatt-hour

LBP	Land Bank of the Philippines
LCOE	Levelized cost of electricity
$LiFePO_4$	Lithium Iron Phosphate Battery
LPTRP	Local Public Transportation Route Plan
LGC	Local Government Code of 1991
LGU	Local Government Unit
LTFRB	Land Transportation Franchising and Regulatory Board
LTO	Land Transportation Office
MPSUID	Master Plan for the Sustainable Urban Infrastructure Development in Butuan City December 2020
MW	Megawatt
NEA	National Electrification Administration
NEDA	National Economic and Development Authority
NOLCO	Net Operating Loss Carry-Over
NPC SPUG	National Power Corporation Small Power Utilities Group
NPV	Net Present Value
OpEx	Operating Expenses
PE	Protective Earthing
PEI	Preferred Energy, Inc.
PEP	Philippine Energy Plan 2020-2040
PMU	Project Management Unit
PSPP	Power Supply Procurement Plan 2024-2033
Pre-FS	Pre-Feasibility Study
PV	Photovoltaic
PUVs	Public Utility Vehicles
PUVMP	Public Utility Vehicle Modernization Program
RE	Renewable Energy
ROI	Return of Investment
RPS	Renewable Portfolio Standards
RPTTM	Roadmap for the Public Tricycle Transportation Modernization 2023-2027
SEC	Securities and Exchange Commission
SEDZs	Special Economic Development Zones
SP	Sangguniang Panlungsod
TMP	Tricycle Modernization Program
TSD	Treatment, Storage, and Disposal Facility
TWG	Technical Working Group
UPEEI-RDFI	University of the Philippines Electrical and Electronics Engineering Institute-Research and Development Foundation, Inc.
US NREL	National Renewable Energy Laboratory of the United States of America
VAT	Value-Added Tax
WESM	Wholesale Electricity Spot Market
WWF Philippines	Kabang Kalikasan ng Pilipinas Foundation, Inc.

I. INTRODUCTION

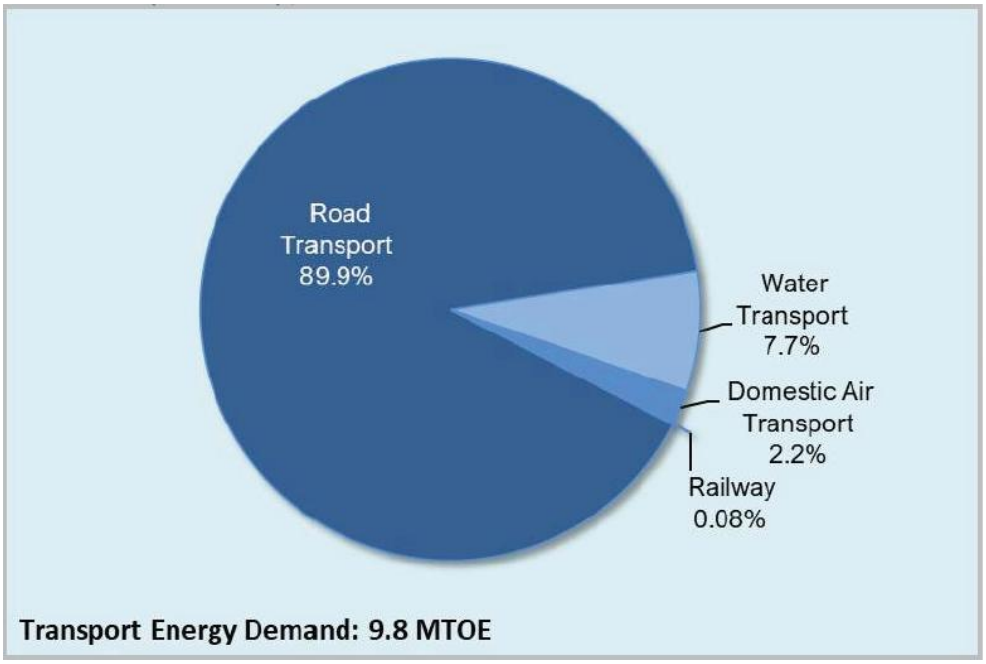
The Philippines is an archipelagic country composed of 7,641 islands[1] wherein 2,000 islands are primarily inhabited. The country is geographically located in the eastern region of Southeast Asia wherein it is surrounded by large bodies of water: Philippine Sea and Pacific Ocean in the east, South China Sea in the west and Celebes Sea in the south. Being an archipelago, the country has incorporated various and creative ways of linking its islands and its inhabitants.

Figure 1. Map of Southeast Asia[2]

The Philippine transportation sector is the top energy consumer on mobilizing and connecting people, goods and services from and within its islands. Transport sector has 7.1% increase per year for mobility and connectivity with the country's economic expansion on major infrastructure projects[3]. Being one of the top consumer of imported fossil fuels, it also contributes to the country's greenhouse gas (GHG) emissions of 30.3%[4]. Transportation sector in the country is divided into three sub-sectors: domestic air, land and water. The country's land transportation heavily relies in combined public and private transportation units. Land road transportation covers the largest fuel consumer in the country. Figure 2 shows the energy consumption per transport sub-sectors.

[1] "How Many Islands are There in the Philippines?", https://www.worldatlas.com/articles/how-many-islands-are-there-in-the-philippines.html
[2] Southeast Asia Map, https://cdn.vectorstock.com/i/1000v/56/55/southeast-asia-map-vector-2745655.jpg
[3] p. 7, II. Reference Scenario, Total Final Energy Consumption, Philippine Energy Plan 2020-2040
[4] p. 8, GHG Emission, Philippine Energy Plan 2020-2040

Figure 2. Transport Final Energy Consumption by Sub-sector in Percentage (2020)[5]



Based on the graph above, the land road transport sub-sector is considered as the country's major conduit for economic growth activities. Land road transportation directly impart numerous processes and innovations in manufacturing, business and financing, agriculture, construction, and service industries. Both privately and publicly owned and operated land transport systems play critical role on interlinking workforce population to these various industries. While privately-owned transport units provide immediate, safe, comfortable, convenient and cloistered mode of travel, they usually give way to heavier and longer vehicle traffic congestion. Large volume of operating privately-owned vehicles also increase higher road accidents particularly in urbanized areas[6]. Privately-owned vehicles also contribute to more and higher GHG emissions especially in heavily-congested urban locations. Traffic congestion poses direct threats to rapid growing urbanization in the country. Hence, efficient and well-maintained public mass transportation system provides wide and convenient access to the public that can mitigate these socio-economic and environmental issues.

The Philippines is continuously experiencing rapid population growth in its urban areas due to innumerable employment and income-generating opportunities. Public mass transport directly correlates to these social and economic growth leading to various development and urbanization. Public mass transport system is dependent on infrastructures such as terminals, road and bridges, as well as the availability of applicable transport units with their preferred conditions and accessibility. Public utility vehicles (PUVs) primarily jeepneys followed by tricycles and pedicabs, and some taxis are prominent in most urban areas. Single motorcycle units are also gaining prominence in urban areas to beat traffic congestion. But these vehicles pose direct threats to road safety and adds up to frequent road accidents[7].

[5] p. 25, II. Total Final Energy Consumption by Sector, Philippine Energy Plan 2020-2040
[6] p. 4, Urban Transport, B. The Philippine Transport System, The Philippines: Transport Sector Assessment, Strategy, and Road Map, Asian Development Bank 2012
[7] p. 4, Urban Transport, B. The Philippine Transport System, The Philippines: Transport Sector Assessment, Strategy, and Road Map, Asian Development Bank 2012

The Philippine government has started the implementation of Public Utility Vehicle Modernization Program (PUVMP) on 2017 to coincide with the ongoing improvements in public transport infrastructures as part of the former Philippine administration's "Build, Build, Build Program". The PUVMP not only focuses on the modernization of jeepneys but it also covers the transformation of other PUVs in the country. Its goal is to effectively address existing issues on safety, convenience, comfort, efficiency, energy and environmental impacts[8].

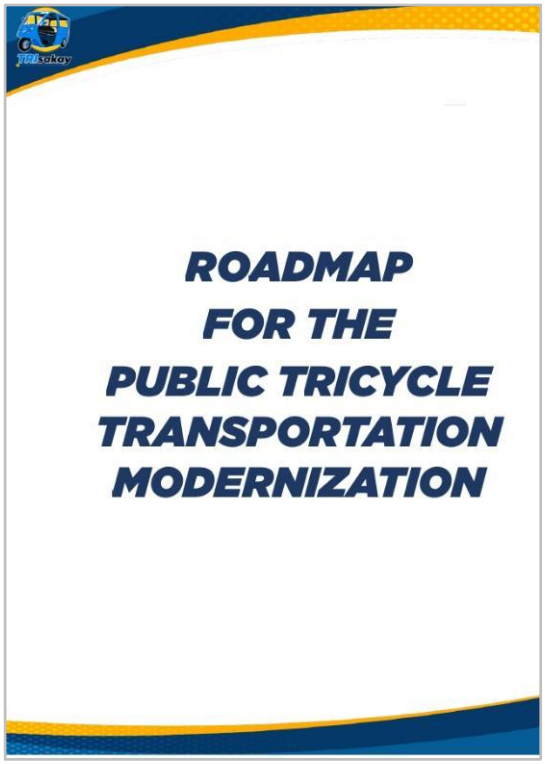


Figure 3. Roadmap for the Public Tricycle Transportation Modernization in Butuan City for 2023-2027

The City Government of Butuan (CGB) has acknowledged the rapid population growth and anticipated the increasing economic activities within its political boundaries. It has then conducted series of studies to improve its urban development. These studies are but not limited to the Master Plan for Sustainable Urban Infrastructure Development (MPSUID), the Butuan City Energy Development Plan (BCEDP), the Comprehensive Land Use Plan (CLUP), the Local Public Transportation Route Plan (LPTRP), the Roadmap for the Public Tricycle Transportation Modernization in Butuan City for 2023-2027 (RPTTM) and the Tricycle Modernization Program (TMP). As the Regional Center and Development Hub, the CGB will lead and pave the way on incorporating innovative and applicable solutions for economic development not only in the Province of Agusan del Norte but in the entire Caraga Administrative Region. One of these innovative and applicable solution for urban economic development is the TMP.

The CGB opted for the partnership offered by Kabang Kalikasan ng Pilipinas Foundation, Inc. (WWF-Philippines) for the implementation of the Financing Integration of the Renewable Energy Projects in Butuan City (FinRE-BXU). Part of the FinRE-BXU program is the inclusion of Electric Vehicle (EV) PUV tricycle units with strategically located charging stations in the city. CGB plans to be the pioneering Local Government Unit (LGU) in Region XIII on implementing energy efficiency and carbon mitigating measures in its public transport sector. This is also in accordance with the Local Government Code of 1991, the Renewable Energy Act of 2008, the Energy Efficiency and Conservation Act of 2019, the Electric Vehicle Industry Development Act of 2022, and other applicable laws and regulations in the country.

WWF-Philippines sought the expertise of Preferred Energy, Inc. (PEI) as its renewable energy (RE) consulting firm for the identification, preparation and provision of applicable financial solutions for the FinRE-BXU Projects. PEI is a non-stock, non-profit organization registered with the Securities and Exchange Commission on 19 April 1996. PEI is one of the pioneer firms engaged in RE market analysis, financial and technical feasibility studies in the country.

[8] PUVMP: Public Utility Vehicle Modernization Program Philippines, https://ltoportal.ph/puvmp-public-utility-vehicle-modernization-program/

PEI pioneered several outstanding researches and projects which led to commercial implementation of RE projects in the Philippines. Among these are the Philippine Wind Energy Atlas (2001) led by the National Renewable Energy Laboratory of the United States (US NREL), the first 1MW solar farm, the largest in the developing world in 2007, operated in conjunctive use with-hydropower in Cagayan de Oro City, and the first 1-MW ricehusk-fired biomass power plant (2005) in Isabela, Cagayan, among others.

In the MPSUID, BCEDP, LPTRP and RPTTM, the CGB identified the necessity to improve its PUV transport system, particularly its PUV tricycle units. PUV tricycle units are considered the most basic mode of transportation in the city[9]. Improvement of existing fossil fuel-powered PUV tricycle units to EV PUV tricycle units will significantly lead to a more efficient, safe, comfortable and convenient basic public transport in the city. To determine the feasibility of implementing an EV PUV tricycles project in Butuan City, this pre-feasibility study (Pre-FS) was undertaken upon the request of the CGB through WWF-Philippines.

This Pre-FS shall provide an overview on the proposed EV PUV Tricycle Units Project (E-Trikes PUV Project), as one of the proposed RE pilot projects in Butuan City. The E-Trikes PUV Project aims to establish a sustainable and environmentally friendly transport solution in Butuan City by harnessing solar energy on battery charging of E-trike units as the city's basic public transport system. This solution will contribute to the city's efficient energy management, socio-economic and environmental sustainability goals.

[9] p. 1, Background and Objectives, Roadmap for the Public Tricycle Transportation Modernization in Butuan City for 2023-2027

II. OBJECTIVES

To determine the viability of incorporating electric vehicles (EVs) in the fleets of Butuan City's Public Utility Vehicle (PUV) tricycle service providers and operators, this pre-feasibility study (Pre-FS) was conducted upon the request of the CGB through WWF Philippines. The objectives and goals of this pre-FS will:

- **Improve basic public local transport system:** The E-Trikes PUV Project aims to introduce the utilization and familiarity of modernized e-tricycles to the city residents as the basic mode of transportation in the city.
- **Provide efficient, safe and accessible transport system:** The project will provide convenient, safe, comfortable and efficient public transportation units in a newly identified tricycle route to accommodate and serve passengers to and from the identified integrated land public transport terminals within the city.
- **Reduce travel time between the city's integrated land public transport terminals:** Timely dispatch of the e-tricycle units and monitored battery-swapping operations on the assigned tricycle routes will be implemented. This will reduce the waiting time of the passengers and their baggage in terminal and/or along the route. This will also prevent overloading of passengers and goods in designated units, which will compromise public's safety and integrity.
- **Complement the existing city public transport system:** The operations of e-tricycle will complement existing city public transport system by following the designated route, avoiding direct competition on the routes of other city PUVs and minimizing traffic congestion in the city proper.
- **Environment-friendly public local transport:** Existing city tricycle units are major sources of air and noise pollution due to over-usage of fossil fuel-powered single motors. E-tricycles have zero greenhouse gas (GHG) emission making it more environment-friendly option for the city's local transport.
- **Fulfill city's mobility sector sustainable goals:** E-tricycle units are designed to accommodate six to eight passengers without compromising the motor and battery capacities. With minimum operational expenses since there are only few moving parts, the project can maintain existing PUV tricycle transport fare matrix and improve income of city public transport operators. This can lead to more economic and social activities within the city.

During the development of this Pre-FS, PEI will closely work with the project management unit (PMU) of WWF Philippines, the CGB's Technical Working Group (TWG), and to coordinate with the planning consultants from the University of the Philippines Electrical and Electronics Engineering Institute-Research and Development Foundation, Inc. (UPEEI-RDFI) on determining the applicability of the stated information in the Butuan City Energy Development Plan 2023-2050 (BCEDP), Butuan City Comprehensive Land Use Plan The Executive Summary 2019-2028 (CLUP), and the Roadmap for the Public Tricycle Transportation Modernization in Butuan City for 2023-2027 (RPTTM) of the CGB, Distribution Development Plan (DDP), Power Supply Procurement Plan 2024 (PSPP) and the Renewable Portfolio Standards (RPS) of Agusan del Norte Electric Cooperative, Inc. (ANECO) as the local power utility in Butuan City, and with the financing institutions and potential RE developers and suppliers for the development, installation and operations of E-Trikes PUV Project.

Figure 4. Introductory Meeting among WWF Philippines, CGB and PEI, 27 February 2024

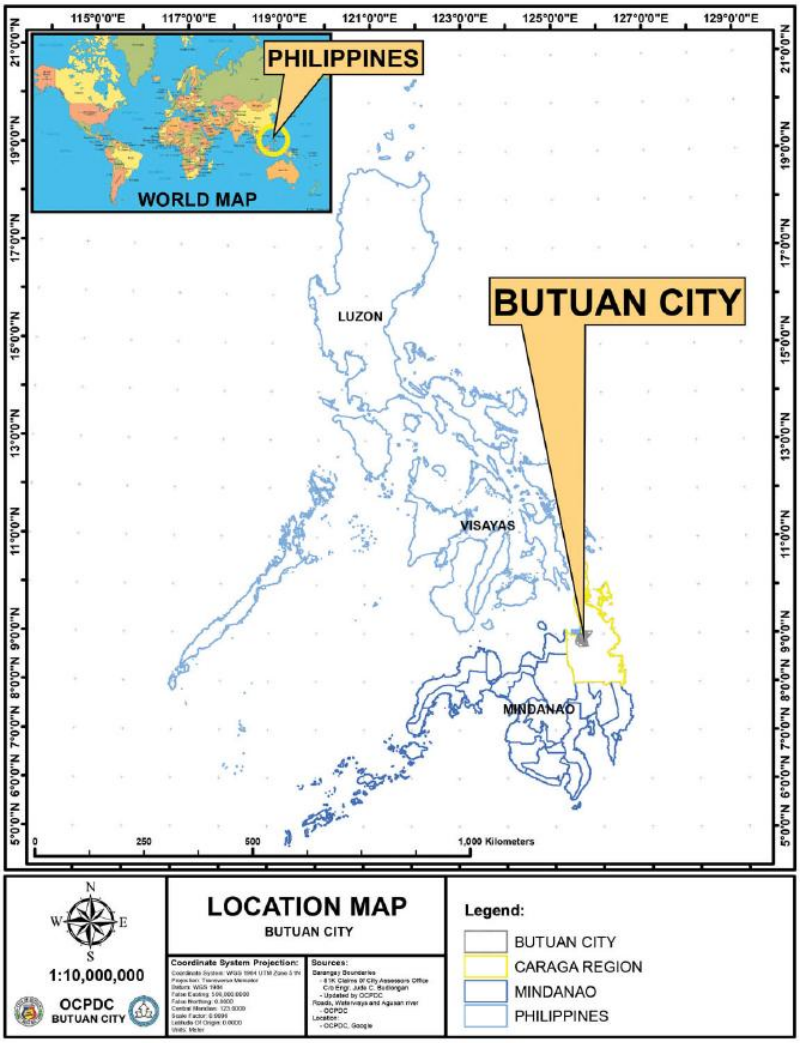
III. PROJECT BACKGROUND

1. Profile of Agusan del Norte

1.1. Geographic Profile of Agusan del Norte

Agusan del Norte is one of the five provinces in Caraga Administrative Region or Caraga Region. Caraga Region is designated as Region XIII. Caraga Region is located at the northeastern part of Mindanao island, southern part in the Philippines. The province is situated at the northwestern part of the Caraga Region. The City of Cabadbaran is its capital and the province is bordered by the province of Surigao del Norte and Lake Mainit in the northeast, Butuan Bay at the northwest, the province of Surigao del Sur in the middle east, the province of Agusan del Sur in the southeast and the province of Misamis Oriental in the southwest. Agusan River, the country's third longest river, traverses the province. The land surrounding the river is relatively flat to rolling lands while mountainous terrain is mostly located in the northeastern and western areas. Figure 5 shows the location of Butuan City and Caraga Region in the Philippines while Figure 6 presents the Map of Agusan del Norte with its geopolitical components.

Figure 5. Map showing the Location of Butuan City in the Philippines and Caraga Administrative Region[10]

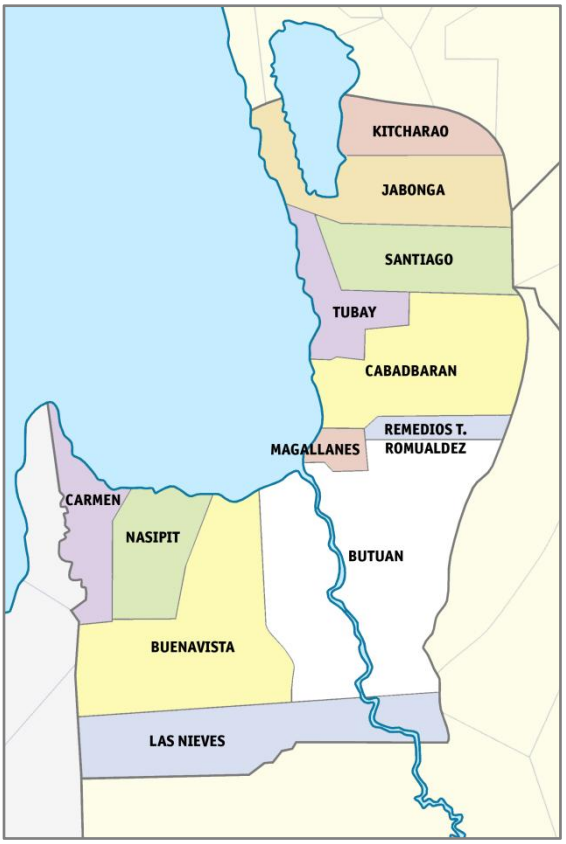


[10] p. 15, Location Map, 2016-2020 Ecological Statistics Yearbook, City Government of Butuan

1.2. Demographic Profile of Agusan del Norte

The province of Agusan del Norte has ten municipalities and one component city[11], Cabadbaran City, with a total population of 387,503 per the 2020 census and a land area of 2,611.63 square kilometers[12]. The independent highly urbanized city, Butuan City, is geographically located in the province but it is administratively independent from the province. Agusan del Norte is the second smallest province in the Caraga Administrative Region or Region XIII and it is a third class province[13].

Figure 6. The Province of Agusan del Norte with the 10 Municipalities, 1 Component City (Cabadbaran City) and 1 Highly Urbanized City (Butuan City)[14]



1.3. Social and Economic Profile

Agusan del Norte is one of the provinces in the Caraga Administrative Region of Mindanao, Philippines. The province is marked by its rich natural resources, predominantly agricultural economy, and growing industrial and service sectors.

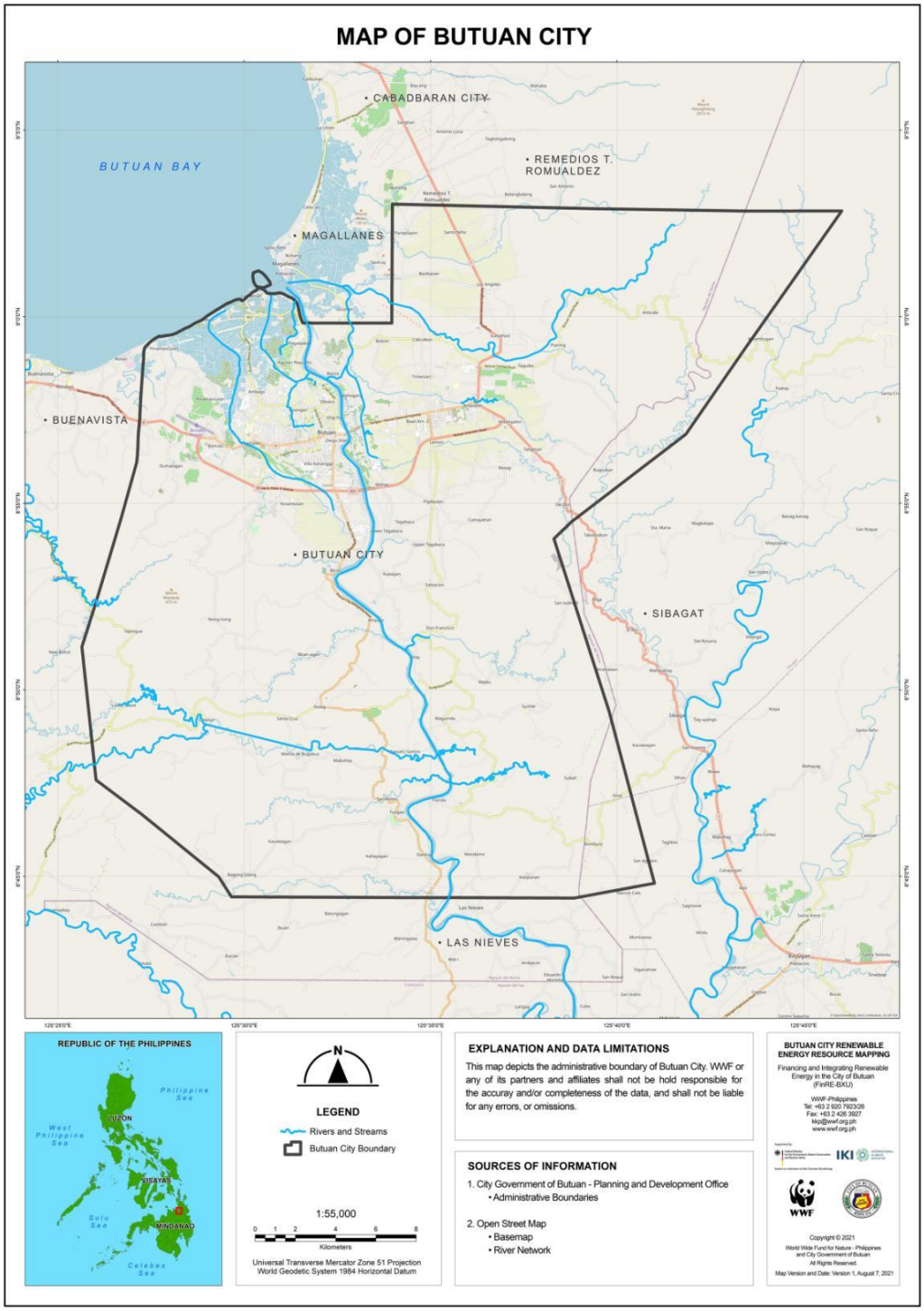
2. Profile of Butuan City

The City of Butuan is a rapidly growing urban center in the province of Agusan del Norte. It is positioned as a regional hub for economic activity in Caraga Region. As the

[11] p. 2, Philippine Standard Geographic Code 4Q 2023 National and Provincial Summary
[12] p. 5, TABLE 1.1 Population, Land Area and Density by Region and by Province: CENSUS YEARS 1995 to 2020, 2023 Philippine Statistical Yearbook
[13] Agusan del Norte website, Provincial Profile webpage, https://agusandelnorte.gov.ph/government/geophysical-resources-and-environment
[14] Map of Agusan del Norte with the Municipalities and Cities, https://upload.wikimedia.org/wikipedia/commons/3/3f/Ph_fil_agusan_del_norte.png

population and industrial base expand, the need for reliable, affordable, and sustainable energy sources for power generation and transportation becomes increasingly critical. The current energy supply, which heavily relies on fossil fuels, is both environmentally unsustainable and economically volatile due to fluctuating global oil prices. Integrating renewable energy into the city's energy and mobility sectors are therefore essential to meet both short-term needs and long-term sustainability goals. Figure 7 exhibits the map of Butuan City with its geopolitical boundaries.

Figure 7. Map of Butuan City



Source: WWF Philippines and City Government of Butuan

2.1. Geographic Profile of Butuan City[15]

The City of Butuan is is a coastal urban center located along Butuan Bay, is the regional hub of the Caraga Administrative Region in the northeastern part of Mindanao, Philippines. The city is classified as a Highly Urbanized City (HUC) located within the geographical coordinates from 125°27’23”E to 125°43’13”E and from 8°44’27”N to 9°2’53”N. The Agusan River Basin traverses in the city

[15] p.13, Geographical Location, Chapter 1, Geo-Physical Environment, Butuan City Ecological Profile (EP) 2023

flowing off to Butuan Bay. Butuan City is bordered by Butuan Bay, the Municipalities of Magallanes and Remedios T. Romualdez in the north, the Municipality of Sibagat, Agusan del Sur in the east, the Municipality of Las Nieves in the south, and the Municipality of Buenavista in the west.

2.2. Demographic Profile of Butuan City

The city's official name, City of Butuan, is known as the Timber City of the South and considered the regional center of Region XIII or the Caraga Administrative Region in the northeastern section of Mindanao island. The city was reclassified from a chartered city of Agusan del Norte to HUC on 7 February 1985. Butuan City has a population of 372,910 per the 2020 census and a land area of 816.62 square kilometers[16].

2.3. Social and Economic Profile of Butuan City

Butuan City plays a crucial role as the gateway to the mineral-rich and agricultural heartland of the region. The city's strategic location has long made it a center for trade and economic activity, dating back to ancient times. The city is rapidly undergoing transformation as it strives to balance its historical roots in agriculture and timber with emerging opportunities in industrial and service sectors.

Industries and Sources of Income: Butuan City's economy is diversified and driven by agriculture, forestry, fishing, trade and services complemented by commercial activities and industrial enterprises, particularly in wood processing and mining. The city's fertile land supports the cultivation of rice, coconuts, bananas and other high-value crops. Local business development and investments in infrastructure have contributed to economic diversification in recent years. To stimulate further growth, the city has identified several Special Economic Development Zones (SEDZs) focusing on agro-industrial, wood-processing sectors and potential international trading hubs [17]. These SEDZs comprises 1,746.85 has. for the city's industrial and commercial investments and activities in the city[18].

Livelihood and Workforce: The city has various livelihood programs aimed at supporting low-income households, especially in rural barangays. Programs focus on agricultural productivity, micro-enterprise development, and vocational training to enhance skills and increase employment opportunities. Workforce in the city mainly consists of individuals aged 15 to 64, with a significant proportion engaged in the agricultural sector, followed by services and small-scale industries.

Employment Rate and Gender Distribution: Employment rates are stable, but underemployment remains a significant challenge, especially in rural barangays. Many workers engage in seasonal agricultural work or informal trading, which does not provide a stable income throughout the year[19]. The population in the city is nearly evenly split between men and women, with a slight majority of women of fifty-one percent. Women's participation in the workforce has

[16] p. 4, TABLE 1.1 Population, Land Area and Density by Region and by Province: CENSUS YEARS 1995 to 2020, https://psa.gov.ph/system/files/psy/2023-Philippine-Statistical-Yearbook.pdf
[17] p. 103, Special Economic Development Zones, Butuan City Energy Development Plan (2023-2050)
[18] p. 15, Geographical Location, Chapter 1, Geo-Physical Environment, Butuan City Ecological Profile (EP) 2023
[19] p. III-17, Master Plan for Sustainable Urban Infrastructure Development in Butuan City December 2020

increased, particularly in education, healthcare, and administrative roles, although men still dominate the construction and mining sectors.

Poverty Incidence: Approximately 20-25% of the population lives below the poverty line, higher than the national average, particularly in rural areas in the city[20]. Livelihood programs and social services aim to reduce poverty by improving agricultural productivity and providing skills training for non-farm work.

Electricity Supply: Butuan City is connected to the Mindanao power grid wherein it is within the franchise area of Agusan del Norte Electric Cooperative, Inc. (ANECO). ANECO sources its electricity from hydroelectric and coal-fired power plants. Although power instability and interruptions are common, especially in remote areas, efforts are underway to enhance energy resilience by incorporating more renewable energy sources, such as solar and hydroelectric power.

Water Supply: Water supply in the city is being provided and operated by Butuan City Water District (BCWD). The supply of BCWD comes mainly from surface water sources, such as rivers. Despite this, remote barangays face distribution challenges, prompting efforts to expand the water network and improve water quality. Projects are underway to increase the capacity of existing facilities and establish new water distribution lines[21].

Transportation: Butuan City has a well-developed road network for mobility of goods and people in the city and in the nearby towns. Bancasi Airport is the city's domestic airport, while Masao Port and Butuan Ferry Port are the city's two ports, serving as the main trading hubs across the province of Agusan del Norte and the entire Caraga Region. The city also has its own integrated land transport terminals for provincial and regional public utility vehicles (PUVs) fossil fueled buses and vans. Local public transportation mainly relies on conventional tricycles and jeepneys, leading to congestion and air pollution in urban areas. Plans to upgrade the road network aim to improve traffic flow and reduce travel time[22].

Literacy Rate and Education: The City of Butuan has a high literacy rate with over 99.4% of its population able to read and write as of 2015[23]. The city houses several public and private educational institutions in the Caraga Region including Caraga State University and Father Saturnino Urios University, providing higher education and preparing the locals for employment opportunities[24].

Healthcare: The city is home to multiple hospitals and health centers. Butuan Medical Center and Agusan del Norte Provincial Hospitals are the main and public hospitals located within the city offering healthcare services and programs to the city and provincial residents. The ratio of medical personnel to the population is below the national average, with initiatives underway to improve healthcare facilities and increase the number of healthcare workers[25].

[20] p. III-17, Master Plan for Sustainable Urban Infrastructure Development in Butuan City December 2020
[21] pp. X-13 to X-19, Master Plan for Sustainable Urban Infrastructure Development in Butuan City December 2020
[22] pp. V-9 to V-12, Master Plan for Sustainable Urban Infrastructure Development in Butuan City December 2020
[23] p. IX-2, Master Plan for Sustainable Urban Infrastructure Development in Butuan City December 2020
[24] pp. IX-2 to IX-4, Master Plan for Sustainable Urban Infrastructure Development in Butuan City December 2020
[25] pp. IX-4 to IX-7, Master Plan for Sustainable Urban Infrastructure Development in Butuan City December 2020

City Settlements: Butuan City has a mix of formal housing developments and informal settlements. While housing construction has increased, many residents still live in substandard conditions, particularly in flood-prone areas. With the rapid urbanization, the city has included in its development program such as but not limited to socialized housing projects and relocation programs to address these issues[26].

[26] pp. IX-7 to IX-9, Master Plan for Sustainable Urban Infrastructure Development in Butuan City December 2020

IV. MARKET AND RESOURCE ASSESSMENT

1. Market Assessment

Daily land transportation traffic in Butuan City comprises of 51% private vehicles, 46% PUVs (combination of public utility jeepneys, vans for hire, buses, and tricycles for hire), and 3% cargo vehicles[27]. Private vehicles occupy most of the road space (65%) compared to PUVs (27%) and cargo vehicles (8%). The average road passenger of PUVs (combined public utility jeepneys, vans for hire, buses, and tricycles for hire) is 30.4 per vehicle compared to private vehicles and single motorized vehicle of 3.1 per vehicle. Hence, the city government is promoting the improvement and modernization of PUVs since PUVs carry more passengers per vehicle and occupies less road space compared to private vehicles[28].

1.1. Butuan City PUV Tricycle Transportation Sector

The City Government of Butuan have registered 1,835 motorized tricycle operators in the city and 3,030 are registered franchises for motorized tricycle-for-hire[29]. The city's existing tricycles-for-hire are either obsolete or about to reach superannuation. PUV tricycles are the primary transport unit in the city servicing all the urban and rural barangays.

The CGB implemented Sangguniang Panlungsod (SP) Ordinance No. 3616-2010 for the regularization of its PUV tricycles and other local transport services, and SP Ordinance No. 6559-2022 for the modernization of the city's PUVs. The primary goals under the SP Ordinance No. 6559-2022 are the improvement of PUVs operational standards, and the inclusion of electric-powered PUVs aligning with the national government's modernization program.

1.2. Butuan City PUV Tricycle Transportation Growth

Butuan City was identified as one of the center growth centers in the country and in Caraga Region per the National Spatial Strategy (NSS) for 2015-2045[30]. As the center for socio-economic growth in the region, it is expected that there will be continuous increase in population growth in the city relying on city public transportation. Figure 8 shows the average population growth rate of Butuan City while Figure 9 presents the city's consolidated PUV tricycle route map.

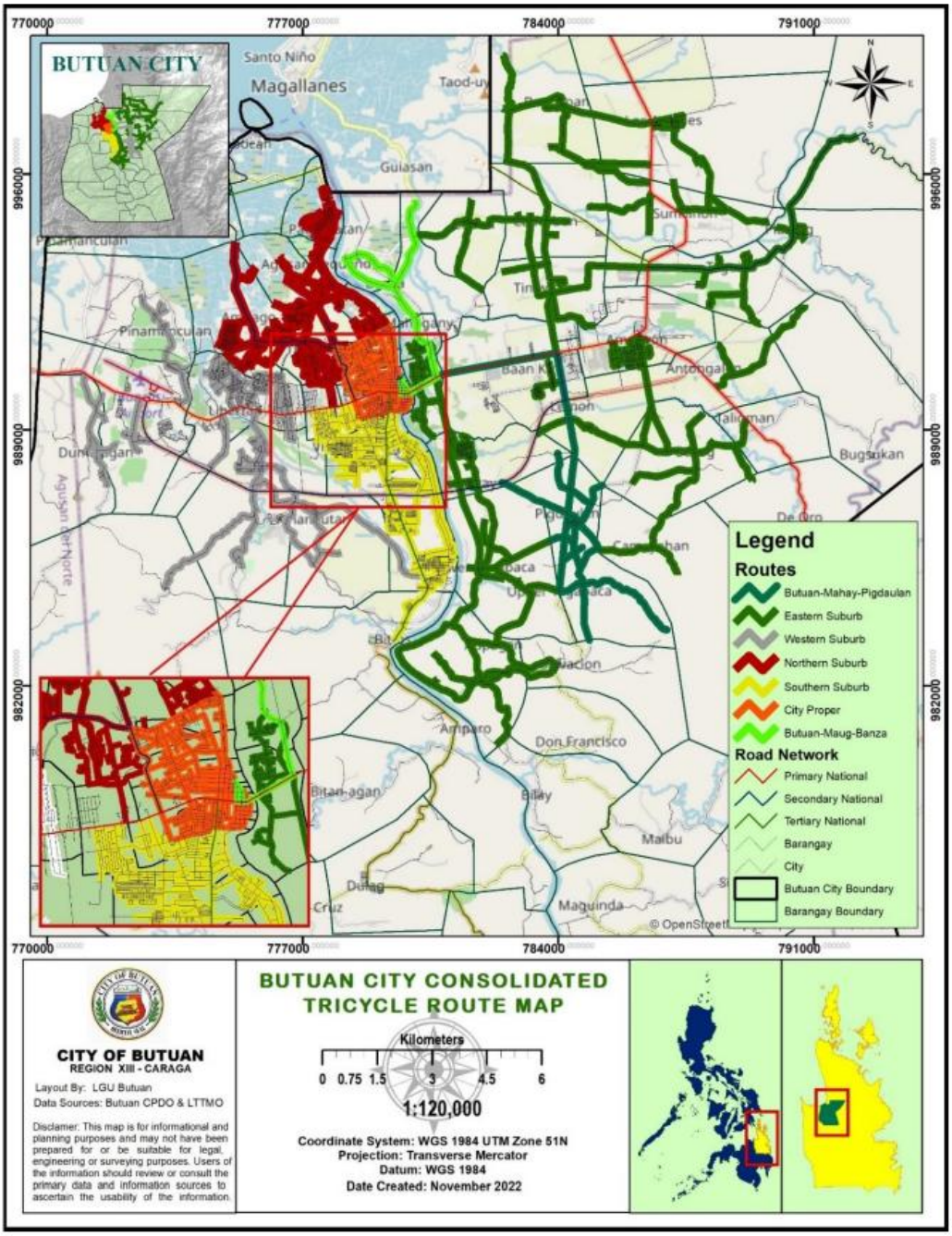
Figure 8. Butuan City Population and its Growth Rate

	ITEM	BUTUAN CITY	CARAGA REGION	PHILIPPINES	COMPARATIVE PERFORMANCE	
					VS CARAGA	VS PH
AREA	Hectares	81,662	1,884,697	30,000,000	4.33%	0.27%
POPULATION	Total	372,910	2,804,788	109,035,343	13.30%	0.34%
	Ave growth rate (2010-2020)	1.87%	1.45%	1.67%	128.97%	111.89%

Data source: Roadmap for the Public Tricycle Transportation Modernization, CTTMD

[27] p. 61, Route Map of City Tricycle Services, Roadmap for the Public Tricycle Transportation Modernization
[28] pp. 54-55, Roadmap for the Public Tricycle Transportation Modernization
[29] p. 48, Route Map of City Tricycle Services, Roadmap for the Public Tricycle Transportation Modernization
[30] p. 2, Roadmap for the Public Tricycle Transportation Modernization

Figure 9. Consolidated Tricycle Route Map[31]



2. Identification of a Tricycle Route

Determining the ideal tricycle routes, terminals and charging stations are crucial on the implementation of the E-Trikes PUV Project in the city. This method highlights the fundamental process of identifying potential tricycle route, terminal, area for charging station of the e-tricycle units and infrastructure proximity such as interconnection or distribution lines and substations.

[31] p. 47, Figure 22. Route Map of City Tricycle Services, Roadmap for the Public Tricycle Transportation Modernization

PEI, through WWF Philippines, were able to meet City Transportation and Traffic Management Department (CTTMD) in their office at Butuan City Sports Complex Office Compound on 29 July 2024. PEI was able to gather fieldwork information and data from CTTMD. CTTMD, through WWF Philippines, accommodated PEI and conducted ocular site visits on the identified PUV tricycle terminals and routes in the city.

Figures 10.1 to 10.3. PEI and WWF Philippines Meeting with the City Transportation and Traffic Management Department, 29 July 2024

Photos sourced from WWF Philippines

Upon the initial meeting with CTTMD and evaluation of their data, PEI was able to identify two PUV tricycle routes with the following primary criteria:

- Longest and steepest existing public tricycle routes servicing rural barangays without direct access to other PUVs;
- Complementing existing PUVs routes in urban barangays from rural barangays and vice versa;
- Paved roads and bridges with existing and ongoing social and economic activities;
- Existing public tricycle terminals and public social buildings along the identified routes as potential charging stations; and,
- Readily-available electric meters in the tricycle terminals.

These two initially identified tricycle routes are highlighted in Table 1.

Table 1. Initially Identified Tricycle Routes for E-Trikes PUV Project

Route B4	Route G9
Longest identified PUV tricycle route	Long and steepest PUV tricycle route
Located in the central portion of the city servicing five urban barangays and eleven rural barangays[32]	Located in the northeastern part of the city servicing one urban barangay and two rural barangays[33]
Comprises of 26.46km for its north bound route and 25.43km for its south bound route	Has a total route length of 13.04km

The successful conduct of the Capacity Development Workshop on the Feasibility Study for Renewable Energy Projects last 17 and 18 October 2024 has led CTTMD to modify and update their data of the suitable tricycle route. CTTMD then provided their updated data to PEI. Upon the evaluation of PEI, the following are the refined standards for the practical implementation of the E-Trike PUV Project:

- **Location:** Public tricycle route servicing city, provincial and regional passengers to and from the existing city integrated land transportation terminals; existing public land transportation terminals catering the large volume of passengers to and from the city; route and terminals preferably outside or has minimum geohazards.
- **Infrastructures:** Paved accessible routes with existing and ongoing social and economic activities; Existing public tricycle terminals with electrical meters as charging stations.
- **Power interconnection points:** ANECO; readily-available distribution power lines and substation.
- **Security:** Community or socially-acceptable e-tricycle route; relatively peaceful without any threats to the e-tricycle route, terminals and potential charging stations; safety of project personnel, e-tricycle riders, passengers and charging stations operators.

2.1. PUV Tricycle Route Y9

Based on the provided information and upon consultation with the CTTMD, the identified PUV tricycle route is Route Y9. This is a newly-identified tricycle route located within the central portion of the city servicing nine urban barangays[34]. This route comprises of 4.45km for its east to north bound route and 4.12km for its south to west bound route. This tricycle route is rendered in Figure 11.

Considering that Route Y9 is within the city's commercial district, the road traffic condition in this area is mostly congested throughout the day. The route is also frequently traversed by all types of land vehicles, typically PUV tricycle units and private vehicles. These traffic congested areas lead to increase in fuel consumption and contributes to the city's air and noise pollution[35].

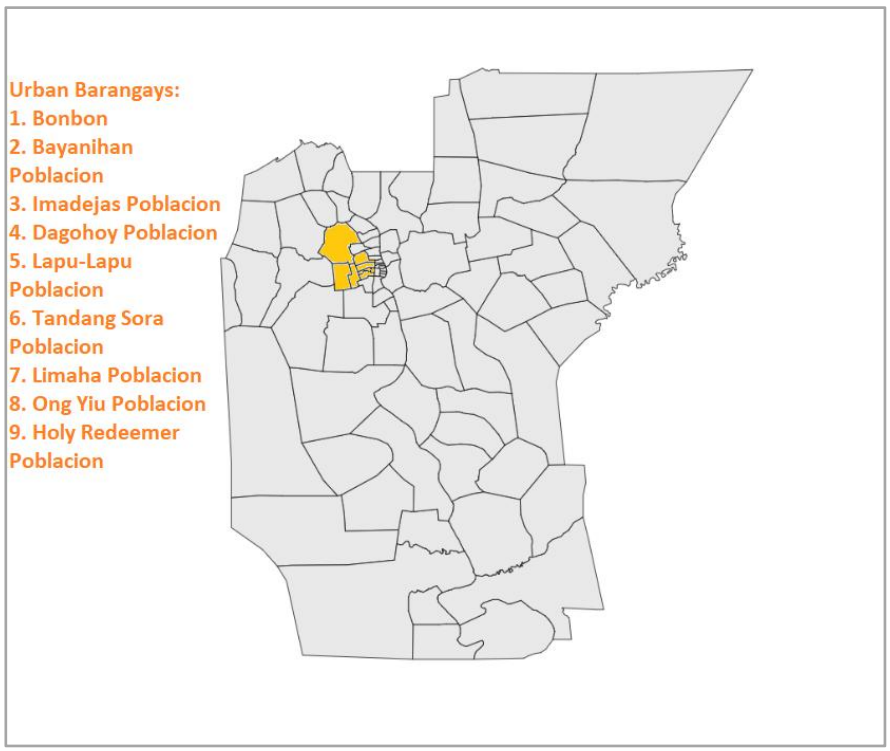
[32] Barangays in the City of Butuan, Philippine Standard Geographical Code, Philippine Statistics Authority, https://www.psa.gov.ph/classification/psgc/barangays/1630400000
[33] Barangays in the City of Butuan, Philippine Standard Geographical Code, Philippine Statistics Authority, https://www.psa.gov.ph/classification/psgc/barangays/1630400000
[34] Barangays in the City of Butuan, Philippine Standard Geographical Code, Philippine Statistics Authority, https://www.psa.gov.ph/classification/psgc/barangays/1630400000
[35] p. 53, Traffic Congestion, Roadmap for the Public Tricycle Transportation Modernization

Figure 11. PUV Tricycle Route Y9

2.2. Geographical Profile of Route Y9

This PUV tricycle route and terminals have fully paved roads and are situated at the city proper comprising of nine urban barangays. These barangays have an elevation within 20 to 100m above sea level,[36] relatively flat area with zero to 3% of sloping[37]. Being at the heart of the city, barangays in this route are mostly developed with an exception on the south and southwestern portions of Barangay Bonbon. Soil types in these barangays are mostly Butuan loam with a few San Manuel clay loam and San Manuel loam in Barangay Bonbon[38]. Two of the barangays, namely Barangays Bonbon and Holy Redeemer Poblacion, have natural waterways[39]. Type IV is the climate type in these barangays[40] wherein rainfall is more or less evenly distributed throughout the year. This Route Y9 and the PUV tricycle terminals are more than 9km away from an active fault line[41] and beyond any identified landslide prone areas within the city[42]. However, the route and the terminals are within flood, ground shaking, liquefaction, and sea level rise prone areas[43] in the city. Figure 12 below shows the barangays in Butuan City within Route Y9.

Figure 12. Butuan City Map with the Barangays in Route Y9[44]



[36] p. 20, Topographic Map, 2016-2020 Ecological Statistics Yearbook, City Government of Butuan
[37] p. 21, Slope Map, 2016-2020 Ecological Statistics Yearbook, City Government of Butuan
[38] p. 22, Soil Map, 2016-2020 Ecological Statistics Yearbook, City Government of Butuan
[39] p. 23, Waterways Map, 2016-2020 Ecological Statistics Yearbook, City Government of Butuan
[40] p. 53, Climate Map, 2016-2020 Ecological Statistics Yearbook, City Government of Butuan
[41] p. 56, Active Faultline Map, 2016-2020 Ecological Statistics Yearbook, City Government of Butuan
[42] p. 58, Earthquake Induced Landslide Hazard Map; p. 62, Landslide Hazard Map; p. 64, Rain Induced Landslide Hazard Map, 2016-2020 Ecological Statistics Yearbook, City Government of Butuan
[43] p. 60, Flood Hazard Map; p. 61, Ground Shaking Hazard Map; p. 63, Liquefaction Hazard Map; p. 66, Sea Level Rise (3m) Hazard Map, 2016-2020 Ecological Statistics Yearbook, City Government of Butuan
[44] Blank Butuan City Map, https://www.citypopulation.de/en/philippines/butuan/

2.3. Demographic Profile of Route Y9

This route traverses within nine urban barangays in the city. These urban barangays have the highest population density in the city[45] with a population totaling to 40,375 or an average of 4,486 residents[46]. The total household population in these barangays is 40,173[47]. The city's land transportation integrated terminals are situated within this route[48]. Being at the heart of the growing commercial activities in the city, this PUV tricycle route is expected to service 4,000 to 5,000 local residents and visiting passengers daily.

2.4. Social and Economic Profiles in Route Y9

The city's integrated land transportation terminals for inter-provincial buses and PUV vans servicing passengers and goods going to the northern, eastern and southern parts of Agusan del Norte and Caraga Administrative Region, and to the southern regions of Mindanao are in the Langihan Public Terminal Area. Passengers and goods going to and from the western parts of the province and the region are being serviced in another city integrated land transportation terminal at the Butuan Bus Transport Terminal within Robinsons Place Butuan compound. Residential areas (subdivisions, apartment rental complexes, hotels and lodging accommodations), health institutions (hospitals, clinics, health centers), educational institutions (primary to tertiary schools, training centers), commercial establishments (public market, shopping malls and trade districts) and government offices (city government hall, police stations) are mostly located in these barangays promoting active social, political and economic growth in the city[49]. Development and modernization of settlements and commercialized areas herein are expected to increase in the succeeding years. Settlers in these barangays are mostly immigrants from neighboring rural barangays, municipalities and provinces in the Caraga Administrative Region.

3. PUV Tricycle Operator for Route Y9

Upon the conduct of Capacity Development Workshop on the Feasibility Study for Renewable Energy Projects last 17 and 18 October 2024, CTTMD provided PEI initial information on the the tricycle operator for Route Y9. The Butuan South Bound Transport Cooperative was the identified tricycle franchise operator for this route. The operator intends to have seven units of its fleet size as the route is still developmental. Table 2 below shows a summarized information on the tricycle operator for this route.

Table 2. Route Y9 Tricycle Operator

Name of Tricycle Route Operator	Butuan South Bound Transport Cooperative
Cooperative Office Address	Bingkilan, Barangay San Vicente, Butuan City
Date Established	31 January 2024

[45] p. 52, Population Density Map, 2016-2020 Ecological Statistics Yearbook, City Government of Butuan

[46] Barangays in the City of Butuan, Philippine Standard Geographical Code, Philippine Statistics Authority, https://www.psa.gov.ph/classification/psgc/barangays/1630400000

[47] pp. 93-94, Table 9.0 Total Population, Household Population, Number of Households by Barangay Actual Censuses, 2016-2020 Ecological Statistics Yearbook, City Government of Butuan

[48] p. 49, Transportation Service Facility Map, 2016-2020 Ecological Statistics Yearbook, City Government of Butuan

[49] p. 34, Commercial Establishment Map; p. 39, Housing and Resettlement Map, 2016-2020 Ecological Statistics Yearbook, City Government of Butuan

	Established in compliance with CGB Sangguniang Panlungsod (SP) Ordinance Nos. 3616-2010 and 6559-2022
President	Nathaniel Enrile Cocon
General Manager	Elmer Jugan Calo
Cooperative Members (as of 5 December 2024)	Thirty-one (31)
Target Membership for 2025	One hundred sixty-nine (169)
Capital (as of 5 December 2024)	PhP31,000.00
Target Capitalization for 2025	PhP169,000.00
PUV Tricycle Routes Operated	Two namely: Route Y9 - Robinsons Tricycle Terminal to Langihan Tricycle Terminal and vice versa Route Y18 - Barangay San Vicente to G. Flores Tricycle Terminal via Maon Road
No. of Existing Owned Terminal	None
No. of Existing Leased Terminal	One
Location of Leased Terminal	R. Calo Street Tricycle Terminal
No. of Existing Tricycle Units	New (3-5 years): 1 Old (5-10 years): 16 Obsolete (10 years and up): None
No. of Existing Units for 6 Passengers	17
No. of Existing Units for 8 Passengers	None
Estimated No. of Passengers Served Daily for all the Operated Routes	2,800
Expected No. of Passengers Served Daily for Route Y9	150

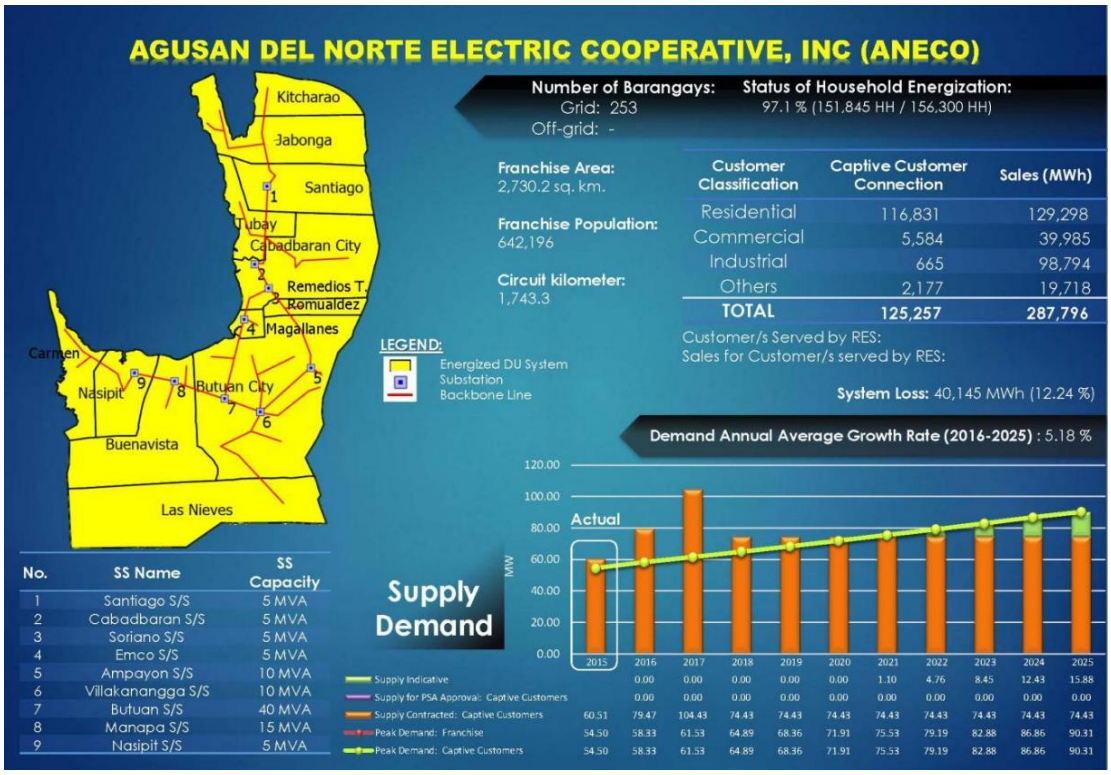
Data source: CTTMD

4. Profile of the Local Electric Utility in Butuan City

The city is within the electric franchise area of Agusan del Norte Electric Cooperative, Inc. (ANECO). The local utility was registered under the National Electrification Administration (NEA) in accordance with the Presidential Decree No. 269. ANECO was incorporated on February 12, 1977[50] to distribute electricity in the entire province of Agusan del Norte and in the City of Butuan. It is one of the seven local power utilities in Caraga Region. Figure 13 in the following page is a summarized profile of ANECO derived from the Department of Energy (DOE).

[50] ANECO Corporate Profile, https://www.aneco.ph/corpprofile#corp_profile

Figure 13. ANECO Profile[51]



ANECO distributes power to the two (2) cities of Butuan and Cabadbaran and ten municipalities that comprise the rest of Agusan del Norte namely, Las Nieves, Remedios T. Romualdez, Santiago, Tubay, Magallanes, Jabonga, Kitcharao, Nasipit, Buenavista and Carmen. It is serving almost 137,000 member-consumers in the entire Butuan City and the Province of Agusan del Norte.

ANECO has a well-established energy supply infrastructure with several substations serving its distribution network namely Santiago, Cabadbaran, Soriano, Emco, Ampayon, Villa Kananga, Butuan, Manapa, and Nasipit, have capacities ranging from 5 MVA to 40 MVA. These substations play a crucial role in ensuring a reliable supply of electricity to the consumers.

4.1. Current Market of ANECO

ANECO's operation for 2023 registered over 438,435 MWhs of electricity, delivering 99.6% of this to its various consumers. Of these, 69.08% were consumed by Butuan City and 8.80% by Cabadbaran City[52]. The rest were delivered to the other 10 municipalities within its franchise area. Table 3 presents the utility's energy mix in its franchise area while Table 4 shows the energy consumption per customer type.

[51] ANECO Distribution Utility Profile, https://doe.gov.ph/ducsp/profile/aneco
[52] Year 2023 kWh Sales of Agusan del Norte Electric Cooperative, Inc.

Table 3. ANECO Energy Sales, 2023[53]

Cities and Municipalities	Energy Sales (MWh)	Service Percentage (%)
Butuan City	301,698.93	69.08%
Cabadbaran City	38,436.91	8.80%
Buenavista	23,455.40	5.37%
Carmen	6,090.01	1.39%
Jabonga	4,520.34	1.04%
Kitcharao	6,243.81	1.43%
Las Nieves	4,722.22	1.08%
Magallanes	16,788.55	3.84%
Nasipit	18,481.08	4.23%
Remedios T. Romualdez	5,031.47	1.15%
Santiago	4,523.52	1.04%
Tubay	6,716.81	1.54%
TOTAL	**436,709.05**	**100.00%**

Data source: ANECO

Table 4. ANECO Energy Consumption Per Customer Type, 2023

Customer Type	MWh	Percentage
Commercial	74,044.33	16.93
Industrial	109,704.54	25.08
Residential	219,334.25	50.14
Public Building	30,453.13	6.96
Street Light	3,172.81	0.73
Own-Use	753	0.17
TOTAL	**437,462.05**	**100.00**

Data source: ANECO

As shown in Table 3, residential customers account for the bulk of energy sales at 50.14% on the average due to being the highest in number of connections. While

[53] Year 2023 kWh Sales, Agusan del Norte Electric Cooperative, Inc.

industrial customers accounted for the lowest in terms of number of customers, it is second highest in terms of consumption because this sector is highly energy intensive in their utilization of electricity. The commercial sector consumed 16.93% and others, composed of low and higher voltage public buildings and streetlight customers accounted for only 7.69% of energy sales due to its relatively low energy consumption.

4.2. Existing Power Supply Situation

ANECO sources its power from multiple generation companies, including those utilizing fossil fuels and renewable energy. According to its Power Supply Procurement Plan 2024 (PSPP), ANECO currently faces increasing energy demand across all sectors, with a notable increase in peak demand from 63.15MW in 2019 to 68.41MW in 2020, marking an 8% growth due to new loads in the region. Despite this, ANECO remains reliant on non-renewable sources, primarily coal, which subjects it to fluctuating fuel prices and supply instability. Table 5 shows the Energy Mix Supply of ANECO.

Table 5. ANECO Energy Supply Mix[54]

GENERATION COMPANIES	ERC CASE NUMBER	LOCATION	FUEL TYPE	STATUS OF ERC APP'N	CONTRACT		MINIMUM	
					CAP. (MW)	PERIOD (YRS)	MWh/yr	MW
1. National Power Corp. Power Sector Assets and Liabilities Management Corporation (NPC – PSALM)	2016-186RC	Mindanao	Mix of Hydro, Geothermal & Coal	Approved	36	4 (until Dec 2025)	170,030	19.75
2. Sarangani Energy Corporation (SEC)	2013-010RC	Maasim, Sarangani Province	Coal	Approved	10	25 (until 2041)	35,040	4.00
3. Therma South, Inc. (TSI)	2014-164RC	Davao City	Coal	Approved	1	25 (until 2040)	4,380	0.50
4. FDCUI - MISAMIS POWER COR.	2015-069RC	Villanueva, Mis. Oriental	Coal	Approved	12	25 (until 2041)	42,048	4.80
5. GN Power Kauswagan Ltd. Co. (GNPK)	2014-011RC	Kauswagan, Lanao Del Norte	Coal	Provisional Authority	24.96	25 (until 2042)	109,325	12.48
6. Asiga Green Energy Corporation (AGEC)	2014-063 RC	Santiago, Agusan Del Norte	Hydro	Approved	8	25 (until 2044)	35,040	4.00
7. Agusan Power Corporation	2012-112RC	Jabonga, Agusan Del Norte	Hydro	Provisional Authority	24.9	25 (Dec 2048)	87,250	9.96
8. ANECO Modular Generator Sets	2019-072RC	Aneco Warehouse, Brgy. Bit-Os, Butuan City	Diesel	For Approval	10	N/A	0.00	0.00
TOTAL					**126.86**		**483,113.00**	**55.49**

Data source: ANECO Power Supply Procurement Plan, 2024

Currently, ANECO faces increasing energy demand across all sectors, with a notable increase in peak demand from 68.41MW in 2020 to 84.72MW in 2023, marking an 80.74% growth due to new loads in the region. Population grown, rapid urbanization and planned infrastructure particularly in Butuan City is expected further increase demand in the next 10 years. A reduction in low-cost power supply from NPC SPUG and increase in non-renewable energy sources in

[54] p. 6, List of Power Suppliers as of December 2023, Agusan del Norte Electric Cooperative, Inc. Power Supply and Procurement Plan 2024

the supply mix will result in increased generation rate and dependence on coal and diesel will subject ANECO to price instability as imported fuel prices are vulnerable to fluctuations in the international markets and geopolitical events. Hence there is an urgent need to develop more renewable energy projects to meet both short-term and long-term energy demands.

4.3. ANECO Existing Energy Mix and Consumption

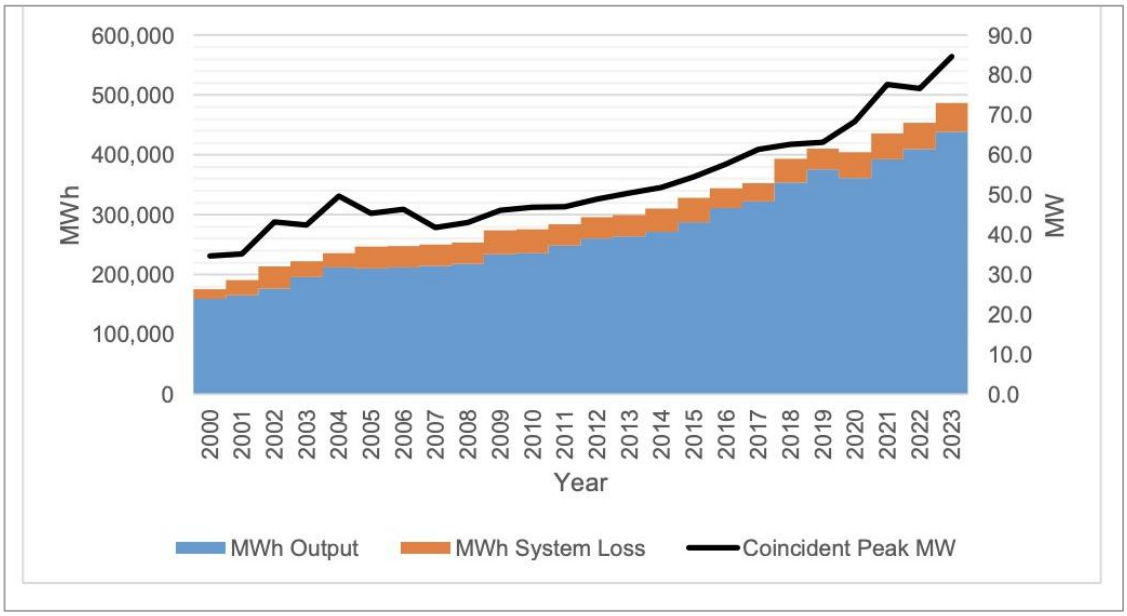
ANECO has experienced significant growth in energy demand over the past decade. Peak demand increased from 34.66MW in 2000 to 84.72MW in 2023, reflecting a growing population, increasing industrial activity, and expanded commercial development within the region. The MWh output in 2023 reached 438,435 MWh, a figure that is expected to rise as urban areas such as Butuan City continue its urbanization and infrastructure development initiatives. Table 6 and Figure 14 show ANECO's historical consumption data from 2000 to 2023. Comparing the past 2 years of operation, ANECO's coincident peak load increased from 76.71 MW in 2022 to 84.72 MW in 2023 a jump of 10.44%. ANECO attributes this to the increased consumption of the public buildings, large load, and commercial consumers. The MWh offtake also increased by 5.48% from 461,794 MWh in 2022 to 487,080 MWh in 2023.

Table 6. ANECO Historical Coincident Peak and Offtake, 2000-2023

Year	Coincident Peak, MW	MWh Offtake
2000	34.66	175,214
2001	35.14	190,802
2002	43.13	213,875
2003	42.38	222,018
2004	49.71	235,598
2005	45.33	246,512
2006	46.41	247,636
2007	41.79	250,492
2008	43.12	253,768
2009	46.11	273,824
2010	46.93	275,420
2011	47.06	284,353
2012	48.89	295,621
2013	50.48	299,286
2014	51.83	311,420
2015	54.50	332,398
2016	57.75	350,201
2017	61.44	359,490
2018	62.61	398,387
2019	63.15	418,284
2020	68.41	412,327
2021	77.67	442,636
2022	76.71	461,794
2023	84.72	487,080

Data source: ANECO Power Supply Procurement Plan, 2024

Figure 14. ANECO Graph of Historical Consumption, 2000-2023

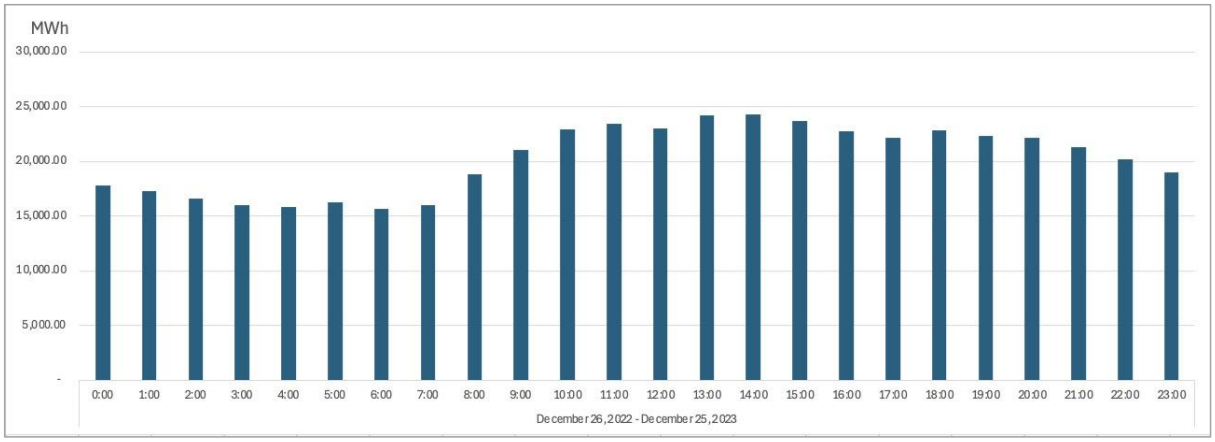


Data source: ANECO Power Supply Procurement Plan, 2024

4.4. ANECO Hourly Load Profile Analysis

ANECO's hourly load profile from 2023, as presented in Figure 15, shows that it has a significant drop of power consumption during nighttime from 12:00 AM (0:00) to 4:00 AM (4:00).

Figure 15. ANECO Hourly Load Profile,
Average from December 26, 2022 to December 25, 2023



Data source: ANECO

The hourly load profile shows:

- **Daytime Load ocurrs from 9:00 AM – 5:00 PM.** This can be attributed to the high demand due to commercial and industrial activities;
- **Evening Peak** which is driven by residential consumption occurs from **6:00 PM – 9:00 PM**; and,
- **Nighttime Load occurs from 11:00 PM – 6:00 AM** when there is minimal activity, resulting in reduced demand.

As per consultation with ANECO, selling of their excess contracted power to the Wholesale Electricity Spot Market (WESM) is performed during the off-peak hours from 12:00 AM to 4:00 AM. These off-peak hours are the the desired hours for the charging of the proposed EV tricycle units.

Upon analyzing the publicly-available anecdotal data from ANECO on its monthly breakdown of generation charge from July to August 2024, it is notable that the utility has over-contracted energy from its existing power supply agreements. Due to this, ANECO sells its excessive contracted power to the WESM in a much higher price compare to its purchased power from WESM. This actual scenario is presented in Figure 16 highlighting the selling price of ANECO's surplus contracted power to WESM at PhP5.3583.

Figure 16. ANECO Breakdown of Generation Charge for September 2024[55]

AGUSAN DEL NORTE ELECTRIC COOPERATIVE, INC.
Km. 2 JC Aquino Avenue, Butuan City

BREAKDOWN OF GENERATION CHARGE
From Power Suppliers Generation Period July 26, 2024 to August 25, 2024
To be Applied for ANECO's Customers Billing for the Month of September 2024
ERC Resolution No. 5, Series of 2007

SOURCE	% TO TOTAL kWh PURCHASED	kWh PURCHASED	BASIC GENERATION COST (Php)		OTHER COST ADJUSTMENTS (DAA,NSS, & OTHER BILLING ADJUSTMENTS)	TOTAL GENERATION COST FOR THE MONTH (Php)	AVERAGE GENERATION COST (Php / kWh)
			Demand Charge	Energy Charge			
		(A)	(B)	(C)	(D)	(E = B + C + D)	(E / A)
NPC-PSALM	42.31%	19,857,470.60		57,419,198.69	-	57,419,198.69	2.8916
Bilateral Contracts with Independent Power Producers (IPPs)							
1. Therma South Inc. (TSI)	1.23%	576,000.00	1,996,105.80	1,999,882.32		3,995,988.12	6.9375
2. Sarangani Energy Corporation (SEC)	6.72%	3,155,745.72	24,702,656.71	11,246,544.27		35,949,200.98	11.3917
3. FDC Misamis Power Corp. (Coal)	13.44%	6,308,271.80	29,042,688.29	19,435,547.00		48,478,235.29	7.6849
4. Asiga Green Energy Corporation	7.16%	3,358,022.94		19,812,335.36		19,812,335.36	5.9000
5. GNPower Kauswagan Ltd. Co.	21.77%	10,217,110.00		80,866,319.46		80,866,319.46	7.9148
6. Agusan Power Corporation	13.62%	6,390,976.43		40,582,061.23		40,582,061.23	6.3499
Wholesale Electricity Spot Market (WESM)							
Purchases	1.41%	661,054.78		4,276,341.85	(1,920,278.46)	2,356,063.39	3.5641
Sales	-7.68%	* (3,605,765.18)		** (19,320,814.77)		(19,320,814.77)	5.3583
Net Metering	0.03%	12,662.00		73,292.72		73,293	5.7884
Self-Generation					-	-	-
Sale for Resale					-	-	-
Others:							
PPD & Other Adjustments					-	(2,324,949.80)	-
Total	100.00%	46,931,549.10	55,741,450.80	216,390,708.13	(1,920,278.46)	267,886,930.67	5.7080
Other Generation Rate Adjustment Approved by ERC							
Effective Rate							5.7080

* kWh Sold for the month
** Amount Collected for the month

Prepared by:
JUN PAUL B. JUMALON
Utility Economics Analyst

Checked by:
VINCENT E. LUMALIS
Utility Economics Officer

Reviewed by:
MELQUISEDEC M. BOMPAT
Corplan Department Manager

Noted by:
DARWIN T. DAYMIEL
General Manager

Utilization of these excessive contracted energy from ANECO can be transmuted by providing reliable connection and power to the proposed installation of charging stations in the terminals of the identified tricycle routes. In this manner, ANECO will no longer sell at a loss to the WESM its surplus contracted energy but turn it into additional profit by selling to the charging stations of the E-Trikes PUV Project.

[55] Month of August 2024, Download Breakdown of Generation Charge, https://www.aneco.ph/files/rates/Breakdown%20of%20Generation%20Charge%20Aug%202024.pdf

V. E-TRICYCLE UNITS AND CHARGING STATIONS ASSESSMENT

1. Existing PUV Tricycle Unit Models in Butuan City

Butuan City is one of the fastest growing urban and regional centers in the country. Being the regional center of Caraga Region, its primary mode of public transportation are the tricycles catering from 6 to 8 passengers. Table 7 presents the tricycle types and their number of units as of 2023.

Table 7. Butuan City PUV Tricycle Units as of 2023

Tricycle Type	With Valid Franchise	With Valid Motorized Tricycle Operators Permit	Old but Road-Worthy Units
6-Seater	2,883	1,894	1,894
8-Seater	161	147	147
TOTAL	**3,044**	**2,041**	**2,041**

Data source: CTTMD

1.1. Tricycle Units for Six Passengers

Tricycle units in Butuan City that caters most of the passengers in the urban barangays are 6-seater units. Figures 17.1 to 17.4 exhibit the 6-seater tricycle unit.

Figures 17.1 to 17.4. Butuan City Tricycle Units for Six Passengers


Photos source: CTTMD

1.2. Tricycle Units for Eight Passengers

The 8-seater tricycle units are being utilized and operated to and from urban and rural barangays. This tricycle model was derived from the PUV tricycle model unit in Cagayan de Oro City, Misamis Oriental, which is called motorela. Motorela is a four-wheeled PUV tricycle as shown in Figures 18.1 to 18.4.

Figures 18.1 to 18.4. Butuan City Tricycle Units for Eight Passengers

Photos souce: CTTMD

2. Existing Motor Capacity for PUV Tricycles in Butuan City

PUV tricycle units in Butuan City for 6-seater and 8-seater with their design, specifications, motor capacity, operational life and costs are summarized in Table 8 below.

Table 8. Butuan City PUV Tricycle Model Units Specifications and Costs as of 2024

Tricycle Type	6-Seater	8-Seater
Model	Steel Plate	Steel Plate
Design	3-wheeled side car	4-wheeled center car
Dimensions	4 ft. by 5 ft.	7.5 ft. by 5 ft. by 4 ft.
Motorcycle Unit Brand	Honda TMX Yamaha STX	Suzuki Barako 175 Yamaha STX
Motorcycle Unit Operational Life	10 Years	10 Years
Motorcycle Unit Tank Capacity	11L to 12L	11L to 12L
Motorcyle Unit Price Range	PhP50,000.00 to PhP80,000.00	PhP50,000.00 to PhP90,000.00
Motorcycle Unit Cost	PhP75,000.00	PhP89,000.00
Steel Frame Cost	PhP60,000.00	PhP70,000.00
Third-Party Liability Insurance Cost per Annum	PhP700.00	PhP700.00
Fuel Cost per Annum	PhP109,500.00	PhP127,750.00
Maintenance Cost per Annum	PhP15,000.00	PhP15,000.00

Data source: CTTMD

3. PUV Tricycle Terminals in Butuan City

The city has two existing integrated tricycle terminals within its urban barangays. These two integrated tricycle terminals are the Langihan Tricycle Terminal, and the G. Flores Tricycle Terminal, also known as the Leon Kilat Livelihood Center. Relevant information on these two integrated tricycle terminals are summarized in Table 9. Figures 19.1 and 19.2 show the tricycle units at G. Flores Tricycle Terminal while Figures 20.1 to 20.4 are the photos taken at the Langihan Tricycle Terminal.

Table 9. Butuan City Integrated Tricycle Terminals

Triycle Terminals	Langihan Tricycle Terminal	G. Flores Tricycle Terminal
Location	Barangay Holy Redeemer Poblacion, Butuan City	G. Flores Avenue, Brgy. Leon Kilat Poblacion, Butuan City
Notable Landmarks	Along Butuan City PUV Van Terminal Complex 200m from Langihan Public Market 300m from Butuan City Integrated Bus Terminal	Within the center of the city proper 110m from Philippine Postal Office Butuan City 200m from Philippine Ports Authority Butuan City Office
Routes Served	Northbound, eastbound, southbound	Westbound and other zones
Structure	Solid concrete flooring, concrete and steel frame columns/posts, steel roofing	Solid concrete flooring, wooden columns/posts, steel roofing
Passenger Waiting Area	None	None
Passenger Restrooms	Yes, but poorly maintained	Yes, but poorly maintained

Data source: CTTMD

Figures 19.1 and 19.2. PUV Tricycle Units at G. Flores PUV Tricycle Terminal in Brgy. Leon Kilat Poblacion

Figures 20.1 to 20.4. Langihan PUV Tricycle Terminal in Brgy. Holy Redeemer Poblacion

4. Suppliers for E-Tricycle Units

The public transportation sector of Butuan City is modernizing in compliance with the existing local and national applicable laws and regulations. These applicable laws and regulations are stated in **Annex A**. To affirm the modernization of its tricycle public transport units in the city, PEI in coordination with CTTMD, identified several potential suppliers with the following significant criteria:

- **Legality**: Philippine company registered either with the Securities and Exchange Commission (SEC) or the Department of Trade and Industry (DTI) operating as an electric vehicle supplier, importer, trader, manufacturer or assembler of EV and its ancillary and spare parts. DOE-accredited and registered in compliance with the EVIDA Rules for supplying, importing, trading and manufacturing EV in the country.
- **Financial Capacity**: EV company operating in the country for more than 5 years that have successful implemented partnerships and operations of EV PUV units and

charging stations in the country. EV company that can provide business models for the financing partnerships on PUV E-Tricycle units in Butuan City.

- **Technical Capability**: Existing Philippine EV company with more than 5 years of technical experience on trading, importing, developing and maintaining EV PUV units and charging stations.

Identified suppliers for the E-Tricycle units based on these criteria are listed in **Annex B**.

5. E-Tricycle Unit Technical Design and Specifications

Technical designs and passenger capacity for the PUV E-tricycle Units in Butuan City are opted to cater six to eight passengers upon consultation with the tricycle operator and CTTMD. This design of the proposed E-Tricycle Units is being considered based on the actual road conditions and existing PUV tricycle units operating within the city roads and boundaries. Technical specifications for the PUV E-Tricycle Units are provided in **Annex C**. Renderings of these E-Tricycle Units are shown from Figures 21.1 to 21.3.

Figures 21.1 to 21.3. Renderings of the Proposed PUV E-tricycle Unit

Photo Sources: E-Volution Transport Solutions, Inc. (top), Elaia Green Vehicles Corporation (left), and GerWeiss Motors Corporation (right)

6. E-Tricycle Units Battery Specifications

A robust and heavy-duty battery capacity is essential for the continuous operations and charging of the proposed E-Tricycle Units in the city. Battery capacity will depend on the preferred model and operational hours of the E-tricycle Units that will be dispatched in the aforementioned PUV tricycle route upon the agreement with the tricycle operator and their preferred supplier.

Lithium iron phosphate ($LiFePO_4$) battery type is regarded for this project. This type of battery is lighter and has higher energy efficiency compared to the heavier and shorter operational life-cycle of a traditional lead-acid battery. Battery capacity for the preferred 8-passenger unit is mentioned in Annex C while Table 10 below shows its specifications.

Table 10. $LiFePO_4$ Battery Specifications[56]

Items	Parameters
Rated Voltage	72V
Rated Capacity	100Ah
Energy	8.06kWh
Internal Resistance	≤10mΩ
Discharge Cut-off Voltage	60V
Maximum Continuous Charge Current	100A
Maximum Continuous Discharge Current	100A
Peak Discharge Current	315A (30S)
Depth of Discharge (DOD)	100% (adjustable)
Cycle Life	5,000 cycles at 0.5C 80% DOD
Dimension	74cm by 32cm by 25cm
Weight	72kg
Charge Temperature Range	0 to 60°C
Discharge Temperature Range	-20 to 65°C
Recommended Operating Temperature	-20 to 60°C
Self-Discharge Capacity (Residual Capacity)	3.00% per month
Battery Life	10 Years

Data Source: $LiFePO_4$ Battery Factory

7. Charging Stations for E-Tricycles and EVs

The geographic location of Butuan City makes it suitable for the development of solar power charging stations for e-trikes and EVs. The city has Direct Normal Irradiation of 3.70 kWh/sq.m as an average daily rate and a Global Horizontal Irradiation (GHI) of 4.68kWh/sq.m. as an average daily total rate per the Global Solar Atlas[57].

Butuan City also boast a total rooftop surface area of 753 hectares that can be utilized for solar rooftop PV installations[58]. At about twenty-five percent of these total rooftop surface area can be developed for solar PV rooftop projects, which amounts to 188 hectares of potential installations with an annual energy production of 256GWh and an

[56] 72V 100Ah Golf Cart Lithium Battery, $LiFePO_4$ Battery Factory, https://www.lifepo4-battery-factory.com/product/72v-100ah-lifepo4-golf-cart-battery/
[57] p. 50, Solar Energy Resources, Butuan City Energy Development Plan 2023-2050 September 2023 Draft
[58] p. 70, Butuan City Energy Development Plan 2023-2050 September 2023 Draft

additional 188MW of solar PV capacity in the city[59]. However, this projected rooftop energy generation capacity is yet to be verified upon the conduct of an in-depth feasibility study on structural and technical assessment of public, industrial and commercial buildings in Butuan City.

7.1. Technical Assessment for Charging Stations (CS)

The assessment of potential locations of charging stations in Butuan City were conducted by CTTMD upon series of coordination with ANECO. From the initial assessment of CTTMD and ANECO, existing communal transformers and distribution lines within the city predominantly operate on a single-phase 230V system. Technical requirements for a CS are as follows: an AC input of 380V, 3-phase, neutral with Protective Earthing (PE)[60].

Based on the technical assessment of CTTMD and ANECO, below are the criteria for potential CS in the city:

- **Existing Power Supply Infrastructures**: Determine infrastructures or establishments in the city with an actual 3-phase power supply.
- **High Foot Traffic and Commercial Activity**: Accessibility on continuous commuter and commercial activities in central business districts for EV tricycle and CS operators, residents and passengers.
- **Security and Maintenance of Establishments**: Safety of passengers, customers and employers on these commercial centers and residents along adjacent communities. Oversight on operations, access and maintenance of CS.

Taking consideration on the criteria above, Robinsons Place Butuan and SM City Butuan are the only establishments in the city that have an access and existing 3-phase power supply. Establishing CS in these commercial centers eliminates the costly electrical upgrades or installations. These establishments are also located within the central commercial district along one of the major highways in the city. Furthermore, both of these malls have an established management teams ensuring the safety of the passengers and CS edifice.

For the purpose of this Pre-FS, the Charging Station for the implementation of the E-Tricycle Units will be situated at the Robinsons Place Butuan in J. C. Aquino Avenue, Barangay Bonbon, Butuan City. This coincides with the identified tricycle Route Y9 as discussed in section 2.1.

[59] p. 70, Butuan City Energy Development Plan 2023-2050 September 2023 Draft
[60] Narrative Report on ANECO Specifications on Charging Stations, CTTMD, March 2025

Figure 22. Robinsons Place Butuan with GoHotels Butuan[61]

Photo Source: Four Square City Guide

[61] Photo Source: https://fastly.4sqi.net/img/general/600x600/5890389_I8TKcrRGKbKvf3MEeg5Jx-lADuT0HzKBMTIRTOsUH_k.jpg

VI. FINANCIAL AND ECONOMIC ASSESSMENT

A thorough financial assessment is crucial for the stakeholders to evaluate the viability of implementing E-Trikes PUV Project in Butuan City's public transport sector as a sustainable transport alternative ensuring that investments are reasoned and beneficial. This section of the Pre-FS presents *c*omprehensive analyses on the financial aspects between gasoline-powered and electric-powered tricycle units.

1. Capitalization Costs for a Conventional Tricycle Unit

As mentioned in Table 8, Butuan City has two modes of PUV tricycle units operating within the city. For this proposed project, the capital costs for an 8-passenger model will be compared to the cost of an electric tricycle unit. The **Total Capitalization Cost** for a 8-seater tricycle unit is **PhP249,000.00** broken down as follows:

- **Motorcycle Unit Cost:** PhP89,000.00
- **Motorcycle Unit Price Range:** PhP50,000.00 to 90,000.00
- **Steel Frame Cost:** PhP70,000.00

2. Annual Operational Cost of a Gasoline-Powered Tricycle Unit

Per Table 8 in section V.2, the **Total Annual Operational Cost** for a 8-seater tricycle unit is **PhP143,450.00** with the following details:

- **Annual Fuel Costs:** PhP127,750.00
- **Annual Maintenance Cost:** PhP15,000.00
- **Annual Third-party Insurance:** PhP700.00

The national average cost of gasoline per liter is PhP62.00[62] was utilized for this Pre-FS. Using the Annual Fuel Cost mentioned above, the estimated annual gasoline consumed per the conventional 8-seater tricycle unit is 2,060.48L[63].

3. Capitalization for a E-Tricycle Unit

Table 11 presents the capitalization estimates for a 8 passenger E-Tricycle Unit upon the consultation of PEI with existing EV suppliers and verification of publicly gathered data.

Table 11. Breakdown of Capitalization Estimates for E-Tricycle Unit

Items	Estimated Cost in PhP
E-tricycle Unit for 8 Passengers	135,000.00 to 150,000.00
72V 100Ah $LiFePO_4$ Battery	40,000.00 to 77,000.00
Shipping and Importation (minimum 25 units per shipping)	28,000.00 to 30,000.00 (1,200.00.00 per unit)
Miscellaneous	20,000.00 to 25,000.00
Total Estimated Cost	**253,200.00**

4. Charging Cost Estimates for LiFePO4 Battery

For a 72V 100Ah $LiFePO_4$ battery, the energy capacity is determined by using the following formula:

Voltage (V) x Capacity (Ah)/1000 = Energy (kWh)

72V x 100Ah/1000 = 7.2kWh

[62] 2024 Average Gasoline Price per Liter, Republic of the Philippines Department of Energy

[63] PhP127,750 per year ÷ PhP62 per Liter = 2,060.48Liter per year

The estimated electricity rate ranges from PhP9.00 to 15.00 per kWh. Since there is no established standard rule yet nor a determined power rate for charging stations, the average electricity rate of PhP12.00 per kWH is used for this study. To determine the cost to charge one unit of 72V 100Ah $LiFePO_4$ battery, the formula below was used:

Energy (kWh) x Electricity Rate (PhP/kWh) = Cost to Charge
7.2kWh x PhP12.00/kWh = PhP86.40

Assuming that the charging frequency is twice per week from the start of the E-Tricycle Unit operational phase, the following formula was utilized to calculate the estimated annual charging cost:

Cost to Charge (PhP) x Number of Charging Cycles per Year = Annual Charging Cost
PhP86.40 x 104 = PhP8,985.60

From the aforementioned computations, the estimated annual cost for charging a 72V 100Ah $LiFePO_4$ battery is **PhP8,985.60**.

5. Comparative Cost Analysis on the Conventional PUV Tricycle and E-Tricycle Units

A comparative analysis on the cost estimates between the conventional PUV tricycle and the proposed e-tricycle unit for 8 passengers is presented in Table 12 below.

Table 12. Comparative Analysis on CapEx and OpEx between Conventional and E-Tricycle Units for 8 Passengers

Tricycle Type	8-Seater Conventional Unit	8-Seater E-Tricycle Unit
Design	4-wheeled center car	3-wheeled unit
Operational Life	10 Years	12 to 15 Years
Total Capital Expenditures (CapEx) per Unit	**PhP249,000.00 (inclusive of metal/steel frame)**	**PhP253,200.00 (inclusive of battery, shipping and miscellaneous costs)**
Annual Third-Party Liability Insurance Cost	PhP700.00	PhP700.00
Annual Fuel Cost	PhP127,750.00	Not applicable
Estimated Annual Battery Charging Cost	Not applicable	PhP8,985.60
Annual Estimated Maintenance Cost	PhP15,000.00 (tires, brakes, change oil, tune up, spare parts)	PhP5,000.00 (tires, brakes, tune up and contingencies)
Annual Estimated Other Operational Costs[64]	PhP3,000.00	PhP3,000.00
Annual Average Salary of Tricycle Driver[65]	PhP127,320.00	PhP127,320.00

[64] These are permits, licenses, taxes and other fees.

[65] p. 7 Table 1. Average Monthly Wage Rates of Time-Related Workers on Full-Time Basis in Selected Industries and Occupations, Philippines: August 2022, Highlights of the 2022 Occupational Wages Survey (OWS), September 22, 2023.
Average Monthly Wage Rate of Motorcycle Drivers: PhP10,610 x 12 months = PhP127,320.00

Annual Estimated Boundary Fee[66]	PhP47,450.00	PhP47,450.00
Estimated Annual Operating Expenses (OpEx)	**PhP321,220.00**	**PhP192,455.60**

The essential parameters to be considered in the OpEx are the estimates on fuel costs per km and charging fee per kWh. The chunk of annual OpEx for the conventional 8-seater tricycle unit is the fuel cost of PhP127,750.00 while it was the annual average salary of tricycle driver for the e-tricycle unit amounting to PhP127,320.00. Weighing these computed assumptions, the OpEx for e-tricycle units are relatively low compared to the deployed traditional PUV tricycle units.

6. Financial Metrics for the E-Trikes in Butuan City

To understand the financial viability of the E-Trikes PUV Project in Butuan City, certain financial metrics were indicated and discussed in this section. These are the Internal Rate of Return (IRR), Net Present Value (NPV) and estimated Payback Period.

6.1. Internal Rate of Return (IRR)

Internal Rate of Return (IRR) is one of the important metric to determine the profitability of the E-Trikes PUV Project. An IRR analysis for this study requires consideration of various factors to attract its potential investors. Such factors that can influence the IRR are as follows:

- **Financing Costs:** Interest rates on any loans used to finance the E-Trike PUV unit will directly affect the IRR.
- **Purchase Price:** Lower purchase price significantly leads to a higher IRR.
- **Operating Costs:** Lower operating costs increases the IRR.
- **Revenue:** Higher revenue directly increases the IRR.
- **Useful Life:** A longer operational life leads to a higher IRR.
- **Salvage Life:** A higher salvage value improves the IRR.
- **Market Conditions:** Competition from other modes of transport, local demand for public transportation services, inflation rate and prevailing socio-economic climate influence the IRR.

6.2. Net Present Value (NPV)

NPV represents the difference between the present value of cash inflows and the present value of cash outflows over a period of time. A positive NPV suggests a profitable investment. To calculate the NPV, an estimate of cash flow associated with the investment on E-Trike PUV unit includes the initial investment, annual revenue, annual operating costs, salvage value and discount rate. The following are factors affecting the NPV:

- **Cash Flow Amount and Timing:** Accurate estimation of future cash flows is essential for a reliable NPV calculation.
- **Discount Rate:** A higher discount rate reduces the present value of future cash flows. Lower discount rate increases NPV. Prevailing market interest rates influences the discount rate.
- **Inflation:** Inflation rates erode the purchasing power of future cash flows. Expected inflation rate with annual adjustments should be considered.

[66] p. 2, Summary Poverty Reduction and Social Strategy, 2020. Tricycle drivers who are renting a tricycle unit pay daily boundary fee of PhP130.00.
Daily boundary fee PhP130.00 x 365 days = PhP47,450.00

- **Risk Factors:** Higher risk leads to a higher discount rate lowering the NPV.
- **Market Conditions:** Market demand and competition can affect cash flows and NPV.
- **Tax Implications:** Taxes can impact the cash flows.
- **Qualitative Factors:** Changes in policies, technological innovations and ethical considerations can influence the cash flows and NPV.

6.3. Payback Period

The payback period is the is the length of time for an investment to generate enough cash flow to cover its initial cost. This is the cumulative net cash flow to equal in the initial investment. A simple way to assess the financial viability of the E-Trikes PUV Project is how long it would take to "pay back" the initial investment. A shorter payback period is generally considered more favorable. Factors affecting the payback period are:

- **Size and Complexity of a Project:** Large and complex projects influences the required time to generate cash flows and recover costs.
- **Initial Investment:** A higher initial investment results to a longer payback period.
- **Cash Flow Timing:** Immediate generation of cash flow will have a shorter payback period compared to those with delayed returns.
- **Revenue Generation Rate:** A higher revenue generation leads to a faster recovery of the initial investment.
- **Operating Costs:** Higher operating costs reduce the net cash flows extending the payback period. An efficient cost management can shorten the payback period.
- **Market Conditions:** Demand for the transport service, competition, market trends, passengers behavior, road traffic conditions potentially affect payback period.
- **Financing Costs:** Interest payments through loans can affect E-Trikes PUV Project viability and cash flows lengthening the payback period.
- **Regulatory Environment:** Policies or regulations can impact E-Trikes PUV Project feasibility and cash flows affecting payback period.

6.4. Financial Assumptions

- **Initial Investments:** Purchase price of the E-Trike PUV unit, any necessary modifications or upgrades, license and registration fees are considered in this portion. Prices of the E-Trike PUV unit vary depending on its brand, model, accessories and features. As mentioned in Section VI.3, the estimated capitalization cost for E-Trike PUV unit is PhP253,200.00.
- **Useful Life:** Usable operational life of the E-Trike PUV unit. As stated in Table 12, the operational life of E-Trike PUV unit is 12 to 15 years. A 10-year useful life was utilized in this case for the sample computation.
- **Salvage Value:** This is the estimated value of the E-Trike PUV unit at the end of its operational or useful life. The salvage value can be significant if the battery and other parts have a resale value. An assumption of PhP25,000.00 is the salvage value per E-Trike PUV unit after 10 years.
- **Annual Operating Costs:** Daily operational expenses includes boundary fee, electrical charging costs, maintenance expenses (tires, battery, repair costs), and drivers' salaries. Electricity cost for charging the batteries will deviate on the local tariff and actual consumption patterns while maintenance costs will depend on the condition of the E-Trike PUV unit, driving habits and

frequency of repairs. Indicated in Table 12, the estimated annual operating cost per E-Trike PUV unit is PhP189,455.60.

- **Annual Revenue**: Generated income from the fares collected during the operations of the E-Trike PUV unit. Projections will depend on the number of trips and boundaries reached per day, average fare prices, and passenger occupancy rates. These are influenced by the determined tricycle route, operating hours and demand or flow of passengers. Route Y9 is a newly identified tricycle route in the city therefore no actual data is available yet on the frequency of trips, passenger occupancy and fare matrix rates. An assumption of PhP200,000.00 as the average annual revenue for the E-Trike PUV unit with 15% yearly increase is used for this study.
- **Annual Cash Flow:** This is the difference from the annual revenue and annual operation costs. In this case, a positive net cash flow for an E-Trike PUV unit starts with PhP35,346.15 from year 1 of its operation as shown in Table 13.

6.5. Computations

The following formulas were used for sample computations in this study:

Annual Revenue = Σ of Revenue Assumption with 15% Increase and Revenue Assumption with 15% Increase x Adjusted Inflation Rate
i.e. Year 1: PhP230,978.00 = PhP230,000.00 + (PhP230,000.00 x 0.0326)

Annual Operating Cost = Σ of Estimated Operating Cost and Estimated Operating Cost with Adjusted Inflation Rate
i.e. Year 1: PhP195,631.85 = PhP189,455.60 + (PhP189,455.60 x 0.0326)

Annual Cash Flow = Annual Revenue - Annual Operating Cost
i.e. Year 1: PhP35,346.15 = PhP230,978.00 - PhP195,631.85

Table 13 below presents the sample cash flow computation for E-Trike PUV unit with a useful life of 10 years. The average annual inflation rate used in this computation is 4.26%[67] with a reduction of 1.00% as an adjustment[68]. A tabulated data on Philippine inflation rate is summarized in Annex D. This inflation adjustment is reflected in both annual revenue and annual operational cost.

Table 13. Sample Computation for E-Trike PUV Unit for 10 Years in Philippine Pesos

Year	Initial Investment	Annual Revenue	Annual Operating Cost	Annual Cash Flow
0	-253,200.00	0.00	0.00	-253,200.00
1	0.00	230,978.00	195,631.85	35,346.15
2	0.00	266,754.18	202,009.45	64,744.73
3	0.00	308,071.74	208,594.96	99,476.78
4	0.00	355,788.97	215,395.15	140,393.81
5	0.00	410,897.12	222,417.04	188,480.09

[67] Average inflation rate from 2020 to 2024. Source: https://www.rateinflation.com/inflation-rate/philippines-historical-inflation-rate/
[68] Philippine Historical Inflation Rate decrease from 2023 to 2024. Source: https://www.rateinflation.com/inflation-rate/philippines-historical-inflation-rate/

Year	Initial Investment	Annual Revenue	Annual Operating Cost	Annual Cash Flow
6	0.00	474,540.98	229,667.83	244,873.15
7	0.00	548,042.63	237,155.00	310,887.63
8	0.00	632,928.95	244,886.26	388,042.70
9	0.00	730,963.32	252,869.55	478,093.77
10	0.00	844,182.23	261,113.10	608,069.13

The Annual Cash Flow for year 10 includes the Salvage Value of the E-Trike PUV unit. This computation is shown through the formula below.

Year 10 Revenue - Year 10 Operational Cost + Salvage Value
= Year 10 Annual Cash Flow
PhP844,182.33 - 261,113.10 + 25,000.00 = PhP608,069.13

6.6. Sensitivity Analysis

Sensitivity analysis is necessary to ascertain the robustness of the investment under different scenarios. This involves the changing key inputs (such as revenue, operating costs, useful life, discount rate) to assess the impact on the calculated IRR, NPV and payback period. This will evaluate investment's resiliency to uncertainty.

6.7. Incentives

The Philippine government promotes initiatives on the adoption of electric vehicles through various incentives programs. The intention for these incentives is to encourage the transition to a safe and sustainable transportation, reducing carbon emissions, mitigate climate change and to improve air quality particularly in urbanized areas. Table 14 shows common incentives for E-Trikes PUV Project.

Table 14. Incentives for PUV E-Trikes Project

Fiscal Incentives	Non-Fiscal Incentives
Purchase Subsidies Financial assistance to buyers of E-Trike PUV reducing the initial purchase cost. Subsidies can be varied based on factors such as the model and type of the E-Trike PUV unit and buyer's eligibility.	**Streamlined Registration Process** Simplified procedures on registration of E-Trike PUV units including licensing for its franchise operations reducing bureaucratic hurdles and delays.
Tax Breaks Exemptions or reductions from various taxes such as Value-Added Tax (VAT), excise taxes and import taxes can significantly lower the overall cost of ownership.	**Training and Capacity Building** These are training and support programs to E-Trikes PUV drivers and operators such as safe driving practices, vehicle maintenance, battery-swapping and charging operations and business management.
Low-Interest Loans Government-backed loans with favorable interest rates makes the financing of the E-trikes PUV easier for individuals or tricycle operators.	**Charging Infrastructure Development** Government initiatives to expand network of charging stations for E-Trikes PUV and other electric vehicles, ensuring convenient, safe and accessible charging options.

Fiscal Incentives	Non-Fiscal Incentives
Grants Financial grants may be availed to support the purchase of E-Trikes PUV units including the installation and operations of charging infrastructures.	**Marketing and Promotion** Advertisements, publications and public awareness campaigns to highlight the benefits of E-Trikes PUV and to encourage their adoption by the drivers and the passengers.

Furthermore, several conducted studies on the deployment of EV PUV tricycle units have a Return of Investment (ROI) of up to 242.38%[69]. This figure alone attracts both the suppliers and operators for this investment. A positive Net Present Value (NPV) of 877,748.16[70] is also noticed on the deployment of EV PUV tricycle units compared to the conventional tricycle units. These data strongly indicate long-term benefits outweighing the CapEx.

[69] Comparative Study between Conventional and Converted Electric Tricycle, Philippine Journal of Science, 12 January 2023, https://philjournalsci.dost.gov.ph/images/pdf/pjs_pdf/vol152no3/comparative_study_between_conventional_and_coverted_electric_tricycle_.pdf

[70] Comparative Study between Conventional and Converted Electric Tricycle, Philippine Journal of Science, 12 January 2023, https://philjournalsci.dost.gov.ph/images/pdf/pjs_pdf/vol152no3/comparative_study_between_conventional_and_coverted_electric_tricycle_.pdf

VII. PROJECT BENEFITS

The EV-Trikes PUV Project in Butuan City will provide various benefits addressing the plans and targets of the LGUs, the national government and global environment. Benefits from this proposed project cover the economic, social, environmental and geopolitical aspects making commendable impacts on development goals of the CGB.

1. Benefits to the LGU

This EV-Trikes PUV Project presents an opportunity for increased revenue and socio-economic growth in the city and in Caraga Region. Provision of an efficient, practical, safe, reliable and robust mode of transportation will boost the movement of people and goods within and from Butuan City. It will reduce the travel and waiting time of the passengers and goods leading to increase in economic activities within the area. Businesses nearby and along the tricycle route will flourish with the continuous influx of people to and from the city and neighboring municipalities and provinces.

The project generates significant income through taxes from real-estate, businesses, franchise, and associated fees, which can be reinvested on the improvement of public facilities, services and community development programs. This financial boost helps fund essential infrastructure projects, healthcare, and education, directly improving the quality of life for residents in Butuan City.

2. Benefits to the Economy

Integration of E-Tricycle Units imparts economic benefits in the country as discussed in Table 15.

Table 15. Economic Benefits of Integrating E-Tricycle Units in PUV Sector

Decreased Fuel Cost	E-Tricycle Units no longer rely on imported gasoline for mobility resulting to savings on fuel expenditures. Imported fossil fuel price is always volatile.
Reduced Maintenance Cost	E-Tricycle Units has fewer moving parts compared to the conventional gasoline-powered engines. This can add to savings to the operators and riders or drivers.
Increased Income for Tricycle Operators or Drivers	Significant savings from fuel and maintenance costs leading to increase net incomes of tricycle drivers and operators. This contributes to improvement of their quality of life.
Investment Opportunities	Integrating E-Tricycle Units in the public transport sector creates opportunities on enhancing renewable energy projects. This enhances the economic viability of these EV PUV units.
Job Creation	Investments on renewable energy projects for powering these EV PUVs also gives job opportunities in the infrastructure, manufacturing, and operations and maintenance of assembly plants and charging stations. This will boost and improve local economies.
National and Local Government Incentives	Incentives were provided and granted to those importers, suppliers and consumers/operators of EV PUV units and charging stations. This includes tax holidays and subsidies.
Mileage Efficiency	Road traffic conditions play a big role on fuel efficiency of PUV units. Traffic congestions are inevitable in urbanized areas. E-Tricycle Units fare more better than the gasoline-powered tricycle units since they are not consuming fuel while idling in road traffic. This significantly increases the income of drivers and operators.

3. Benefits to the Environment

Listed in Table 16 are the environmental benefits of deploying E-Tricycle Units in Butuan City.

Table 16. Environmental Benefits of E-Tricycle Units

Fossil Fuel Displacement	An average of 24.41km/L is being consumed by one tricycle unit[71]. Deployment of E-Tricycle Units will help achieve by at least 30% decrease in carbon emissions by 2030 or an annual reduction of approximately 561,000 barrels per year[72].
Lower Greenhouse Gas Emissions	The estimated annual CO_2 of the 8-seater conventional tricycle unit is 4,780.31kg[73] while it is 456.77kg[74] for the e-tricycle unit. Implementation of e-tricycle units will significantly reduce CO_2 emissions. Reducing greenhouse gas emission is substantial to climate change mitigation.
No Exhaust Emission	Zero tailpipe emission promotes no air pollution particularly in growing urban areas.
Noise Pollution Reduction	Electric-powered motors are quieter than gasoline-powered engine motors. Quieter urban environment enhances quality of life in urban residents.
Sustainable Energy Utilization	E-Tricycle Units can be powered by renewable energy sources eliminating dependence on imported fossil fuels for public mobility.
Improved Public Health	Diminution of air and noise pollution specially in urban areas will lead to improved and better health of residents. Decrease in respiratory and other health issues associated with air and noise pollution will significantly contribute to healthier population.

On the other hand, the utilization of $LiFePO_4$ battery compared to the conventional lead-acid battery promotes eco-friendly approach on the operational life of the E-Tricycle Units. Table 17 summarizes the environmental benefits of integrating $LiFePO_4$ batteries in the PUV units.

[71] Energy use and emissions of two stroke-powered tricycles in Metro Manila, Elsevier Ltd., Transportation Research, An International Journal, 2007, https://www.sciencedirect.com/science/article/abs/pii/S1361920907000624

[72] Estimation of Energy Demand and Emissions from the Tricycle Section in Quezon City, Philippines, Elsevier Ltd., Transportation Research Procedia, 2024, https://www.sciencedirect.com/science/article/pii/S2352146524004964?via%3Dihub

[73] 2,060.48L per year x 2.32kg per L of gasoline = 4,780.31kg/yr of CO_2
Environmental Saving, Comparative Study between Conventional and Converted Electric Tricycle, Philippine Journal of Science, 12 January 2023, https://philjournalsci.dost.gov.ph/images/pdf/pjs_pdf/vol152no3/comparative_study_between_conventional_and_coverted_electric_tricycle_.pdf

[74] 7.2kWh x 0.61kg per kWh x 104 charging cycles in a year = 456.77kg/yr of CO_2
Change in carbon intensity of electricity generation, 2000 to 2023, https://ourworldindata.org/grapher/carbon-intensity-electricity?tab=chart&stackMode=relative&country=~PHL

Table 17. $LiFePO_4$ Battery Benefits[75]

Durability and Reliability	Stable release and uptake of lithium ions during charge and discharge cycles Minimal degradation over repeated charge-discharge cycles
Safety	Inherent properties reducing risks of thermal runaway conditions leading to battery fires or explosions High thermal stability unlike with cobalt oxide materials in traditional lithium-ion batteries Less prone to overheating and fire hazards
Eco-friendly Components	Electrolyte are composed of non-flammable organic solvent or polymer No heavy metals such as cobalt or nickel mostly found in conventional lithium-ion batteries Less carbon footprint and toxic waste generation on sustainable energy storage
Cost Effective	Affordable compared to the typical lithium-ion battery and conventional lead-acid battery

[75] LiFePO4 vs. Li-Ion vs. Li-Po Battery Complete Guide, https://www.lithiumbatterytech.com/lifepo4-vs-li-ion-vs-li-po-battery-complete-guide/

VIII. BUSINESS MODEL OPTIONS

1. E-Tricycle Project Business Model Options

Butuan City's public transportation sector plays a big role on its economic growth. Residents, tourists and daily commuters are all relying on the city's road network and public transportation units. Having an efficient, reliable and eco-friendly public transportation system is an essential component towards a sustainable smart city.

For the deployment of the proposed E-Trikes PUV Project in Butuan City, the following business models options can be be considered:

- **Public-Private Partnerships (PPP):** Collaboration with among the selected EV supplier, LGU, and the tricycle operator for the deployment of E-Trikes as part of the city's PUV modernization program. LGU can provide incentives to both EV supplier and tricycle operator. Revenue streams for this option can be from the government subsidies through state banks, fare collection schemes approved by the LGU, and advertising in the e-trikes.
- **Community-Based Transport Program:** Local tricycle cooperative wherein members can invest in e-trike units, sharing profits from transport rentals or delivery services. Grants for sustainable transport initiatives, community fund-raising and profit-sharing from operations are revenue streams for this model.
- **Battery-Swapping Stations:** This model is already being implemented in the city of Mandaluyong and Boracay island[76]. E-trike operators can establish battery swapping stations to quickly exchange depleted batteries for charged ones within 10 minutes. This option increases tricycle operators' income by having readily-available charged batteries to replenish depleted batteries. Sales and maintenance including training for users and troubleshooting can also be included in this business model. Charging fees, maintenance contracts, training fees, partnerships with local commercial establishments and advertising spaces at the charging stations are some of the potential revenue streams.
- **Lease to Own:** The city governments of Navotas and Parañaque are implementing this selection[77]. E-trike units are being offered on a lease basis, which allows the tricycle operator a monthly fee instead of a full purchase. This is appropriate for those tricycle drivers and operators who cannot afford the upfront cost of e-trike units. This model provide a steady cash flow to the business.

These options can be tailored to fit specific needs and dynamics in Butuan City's local transport sector. These options also promote adoption of e-trikes in the city, which will greatly contribute on reducing CO_2 emissions and enhance urban mobility.

[76] A. Introducing battery swapping, 3.4.3. Operating arrangements of existing pilot e-trike programs, Electric Two- and Three-Wheeler Development in the Philippines, October 2022, Clean Air Asia, https://cleanairasia.org/sites/default/files/2023-03/2%20and%203-Wheeler%20Development%20PH%20Report.pdf

[77] B. Third-party operator leasing service, 3.4.3. Operating arrangements of existing pilot e-trike programs, Electric Two- and Three-Wheeler Development in the Philippines, October 2022, Clean Air Asia, https://cleanairasia.org/sites/default/files/2023-03/2%20and%203-Wheeler%20Development%20PH%20Report.pdf

IX. RECOMMENDATIONS

Implementing the E-Trikes PUV Project will aid on reducing carbon emissions, fuel dependency and noise pollution in the city of Butuan. This project can also provide additional local revenue streams by having a more efficient and environment-friendly transport system. In summary, enumerated below are our recommendations for this endeavor.

- A comprehensive feasibility study ensures the successful outcome of the implementation and deployment of the E-Tricycle Units and Charging Station/s. Determining a qualified supplier for importation and after-sales of E-Tricycle Units with an appropriate payment scheme will enhance the viability of the project.
- A thorough technical study for the installation of Charging Station/s allows investors and suppliers to maximize potential growth in preferred locations and equipment for optimum operations of these infrastructures. This study will also impart on the city's sustainable goals on e-mobility by having accessible Charging Station/s.
- A focused study on determining reasonable fare matrix in Route Y9 is crucial for implementing applicable regulations for the continuous operations of E-Trike PUV units. A constant price fare matrix can be achieved regardless of the price dynamics on the importation and distribution of fossil fuels for public transport sector since the units are utilizing electricity for charging. Consistent price matrix provides economic assurance to passengers as well as to drivers and operators by having a constant source of income.
- Monitoring and evaluation programs on the implementation of the project offer innovations on road safety, passenger comfort and environmental impacts during the operations of the E-Trikes PUV units. These programs can also be replicated to improve public land transportation networks in Butuan city and its adjacent municipalities.
- Provision of both financial and non-financial incentives for local business ventures on establishing manufacturing and assembly plants within the city will entice EV suppliers, local business establishments and operators to embark in the city's e-mobility initiative. Having these on-site facilities ensure smooth operations and maintenance of deployed fleet for the E-Trikes PUV Project. These facilities will contribute to Butuan City's economic growth with less impact on the environment.

In conclusion, the proliferation of E-Trikes PUV units in Butuan City presents multiple possibilities on social and economic opportunity, technological advancement and environmental sustainability. With the existing challenges on battery technology, transportation regulations and infrastructure development, the potential of E-Trikes PUV Project in Butuan City will revolutionize its urban transport and will impart economic increment. Additional research should focus on addressing existing gaps on the adoption of E-Trikes PUV Project with an assurance on long-term viability and social benefits as an innovative and convenient mode of transport in Butuan City and in its neighboring municipalities.

X. ANNEXES

Annex A. List of Relevant Philippine Laws and Regulations

Energy and transport regulatory frameworks includes laws approved by the legislative and executive branches of the Philippine government as well as regulations, orders and circulars issued and published by the DOE, the Department of Environment and Natural Resources (DENR), Department of Public Works and Highways (DPWH), the Department of Trade and Industry (DTI), the Department of Transportation (DOTr), the Energy Regulatory Commission (ERC), and applicable ordinances enforced by the local government units (LGUs).

Laws and Regulations	Relevance to the EV-Trikes PUV Project
Republic Act No. 7160 or the Local Government Code of 1991	Emphasizes effective and efficient transportation facilities for the public mobility as reflected in the LGUs Comprehensive Land Use Plans (CLUPs)[78]. Allows LGUs to generate and apply its local resources for revenues, improve public welfare for development of self-reliant communities in accordance with this Code and in alignment with national goals[79]. Granted corporate powers to LGUs to acquire or convey real or personal property, to enter into contracts, to manage economic enterprises subject to the limitations provided in this Code[80]. Highlights the development and utilization of energy sources shall be applied to lower the electricity cost in the LGU where the source of energy is located[81]. Underlines the provisions and improvement of effective basic services and facilities to the public such as public transportation.
Republic Act No. 8749 or the Philippine Clean Air Act of 1999	Protecting of the rights of every citizen for clean air to breathe, utilize and enjoy all natural resources in accordance with the principles of sustainable development. Monitoring air quality, to control and provide control measures on air pollution sources, mitigating emissions of hazardous and toxic air substances, and imposing applicable penalties in events of violation of this law. Identifying and implementing plans and policies consistent with the United Nations Framework Convention on Climate Change (UN FCC) and other agreements, conventions and protocols on the reduction of greenhouse emissions in the country.
Republic Act No. 9136 or the Electric Power Industry Reform Act of 2001 (EPIRA)	Reformed the Philippine power industry under the regulations strictly implemented by the ERC. Promoting the exploration and utilization of indigenous and RE resources to reduce dependency on imported fossil fuels for the country's power generation and transportation sector. Encouraging the use of RE and its importance on ensuring energy security. Provided the foundation of the Renewable Energy Act of 2008.

[78] Section 17. Basic Services and Facilities, Book I General Provisions, The Local Government Code of the Philippines

[79] Section 18. Power to Generate and Apply Resource. Book I General Provisions, The Local Government Code of the Philippines 1991

[80] Section 22. Corporate Powers, Book I General Provisions, The Local Government Code of the Philippines 1991

[81] Section 294. Development and Livelihood Projects, Book II Local Taxation and Fiscal Matters, The Local Government Code of the Philippines 1991

Laws and Regulations	Relevance to the EV-Trikes PUV Project
Republic Act No. 9513 or the Renewable Energy Act of 2008	Highlights the development and utilization of indigenous and RE resources in the country. Established the cornerstones of Renewable Portfolio Standards (RPS), Feed-in-Tariff (FIT) System, Renewable Energy Market (REM), Green Energy Option Program (GEOP) and Green Energy Auction Program (GEAP). Created of net-metering policies for distribution utilities and incentives for the exploration, development and implementation of RE projects and facilities in the country. Provides incentives for RE projects in the country such as but not limited to income tax holiday (ITH), duty-free importation on machinery, equipment and materials, and tax exemption on carbon credits.
Republic Act No. 9729 or the Climate Change Act of 2009	Highlights the energy transition of the country by exploring, developing and utilizing renewable energy resources to reduce greenhouse emissions, protect the environment and support sustainable development. Promotes the development of clean and renewable energy resources as part of climate change mitigation efforts. Encourages LGUs, private businesses, non-government organizations, local communities and the public to reduce and prevent adverse impacts of climate change. Advocates involvement of LGUs and private sector to integrate renewable energy and other energy efficiency practices into the country's energy mix for environmental and economic benefits.
Republic Act No. 11285 or the Energy Efficiency and Conservation Act	Utilizing RE resources and the role of RE power generating facilities in providing energy efficient projects and practices in the energy and transportation industries. Implementation by the LGUs of energy efficiency and conservation practices, and other feasible targets and strategies aligned with the National Energy Efficiency and Conservation Plan (NEECP). Provides incentives for energy efficient projects.
Republic Act No. 11697 or the Electric Vehicle Industry Development Act (EVIDA)	Underlines the importance of reducing reliance on imported fossil fuels for the country's transportation sector. Encourages the development, regulation, operation, and utilization of electric vehicles (EVs) including identification, installation and maintenance of charging stations throughout the country. Created the Comprehensive Roadmap for the Electric Vehicle Industry (CREVI) for the rapid development, commercialization and utilization of EVs. Highlighted the implementation of policies, standards and regulations for the importation, accreditation and operation of EV units and charging stations. Mandating the ERC to regulate Distribution Utilities (DUs) charging rates in the utilization of charging stations within their franchise areas. Provided of fiscal and non-fiscal incentives on the acquisition, utilization and operations of EVs and charging stations.
Department of Energy (DOE) Department Circular No. 2017-12-0012	Provides the Implementing Rules and Regulations of the EVIDA. Highlighted the roles, powers and functions of the DOE, ERC, DENR, DPWH, DOTr, DTI, the Department of Science and Technology (DOST), the National Economic and Development Authority (NEDA) and the LGUs for: compliant manufacturing, importation, operations and transition from conventional vehicles to EVs; and, regulated identification, registrations, accreditation and operations of charging stations in the country.

Laws and Regulations	Relevance to the EV-Trikes PUV Project
DOE Department Circular No. DC2021-07-0023	Presented the policy framework for development, establishment and operation of electric vehicle charging station (EVCS) in the country. Identified classification and safe operations of EVCS such as charging fees, modes, battery swapping, handling and storage.
DOE Department Circular No. DC2021-12-0042	Provides amended provisions on the RE Law for: the 10% corporate tax rate after the availment of ITH and, the availment of incentives and duty-free importations of machinery, equipment and materials for RE developers, manufacturers, fabricators and suppliers of locally-produced RE equipment.
Department of Finance-Bureau of Internal Revenue (BIR) Revenue Regulations No. 7-2022	Provides guidelines for the availment of tax incentives under the RE Law such as ITH, Net Operating Loss Carry-Over (NOLCO), 10% corporate tax rate, accelerated depreciation, 0% Value-Added Tax (VAT) rate, VAT-free importation on components, parts and materials, and 0% VAT transaction on locally-produced RE equipment.
DOE Department Circular No. DC2023-05-0010	Renders the procedures on unbundling of EVCS fees and the duties of EVCS operators in accordance with the EVIDA. It also underlines the obligations of DUs as EVCS operators.
DOE Department Circular No. DC2023-05-0011	Provides the guidelines and requirements on registering, accrediting, classifying and monitoring EVCS operators aligning with the terms and conditions in EVIDA.
DOE Department Circular No. DC2023-05-0012	Furnishes guidelines on EV recognition for road transport and for availment of incentive pursuant with the EVIDA, in coordination with the DOTr and in consultation with LGUs.
Department of Interior and Local Government (DILG) and Department of Transportation (DOTr) Joint Memorandum Circular No. 001 Series of 2017	Established the guidelines for: the Local Public Transport Route Plan; PUV franchises; and, review and amendment of applicable local ordinances, rules, orders and regulations for the enforcement of Public Transport Route Plans in every LGUs in the country. Initiated the training of relevant LGUs and their personnel for implementation of the Public Transport Route Plan.
DOTr Department Order No. 2017-011	Omnibus Guidelines on the Planning and Identification of Public Road Transportation Services and Franchise Issuance Emphasized the identification of PUV units, transport routes and facilities and to formulate applicable modernized and improvement plans for public mobility and connectivity to pursue social and economic activities within LGUs designated jurisdictions. Mandating the LGUs to formulate their Local Public Transport Route Plans (LPTRPs) consistent with their Comprehensive Development Plans (CDPs), Comprehensive Land Use Plan (CLUPs), Zoning Ordinances and Zoning Maps.
DOTr Department Order No. 2018-016	Mandating eligible franchise and consolidated PUV operators under the PUVMP to avail equity subsidy under the PUVMP through financial programs set up by the Development Bank of the Philippines (DBP) and Land Bank of the Philippines (LBP).
DOTr Department Order No. 2020-006	Increased the equity subsidy rate under the PUVMP from PhP80,000.00 per unit to PhP160,000.00 per unit.
DOTr Department Order No. 2019-010	Provides the qualifications and requirements of e-tricycle PUV operators as a tourist transport service franchise.

Laws and Regulations	Relevance to the EV-Trikes PUV Project
DOTr Department Order No. 2020-021	Guidelines for the Scrapping of Old Public Utility Vehicle Units (PUVs) Methodology on identification, disposal and scrapping procedures of old PUVs, accreditation and monitoring of scrapping facilities, and funding for the scrapping of old PUVs. Mandating the Land Transportation Franchising and Regulatory Board (LTFRB) and the Land Transportation Office (LTO) as part of the Scrapping Program's Authorization Committee. Spotlights the equity subsidy that can be availed by PUV cooperatives or corporations who participated in the initial implementation of the PUVMP subject to the complied requirements and availability of authorized scrapping and Treatment, Storage, and Disposal (TSD) Facility.
City Government of Butuan (CGB) Sangguniang Panlungsod (SP) Ordinance No. 3616-2010	Emphasized the regularization of the city's PUV tricycles and other local transport services.
CGB Executive Order (EO) No. 003, Series of 2019	Creation of City Power Development Council (CPDC) and the City Power Development Plan-Technical Working Group (CPDP-TWG)
CGB SP Ordinance No. 6559-2022	Initiated the modernization of the city's PUVs. Aimed at the improvement of PUVs operational standards, and the inclusion of electric-powered PUVs aligning with the national government's modernization program.
CGB Butuan City Development Council Resolution No. 03 Series of 2023	Approval of the Butuan Energy Development Plan (BEDP) 2023-2050 by the Butuan City Development Council and recommending the BEDP to the Sangguniang Panlungsod for adoption, approval and other purposes.
CGB SP Ordinance No. 7026-2023	Local regulation for the establishment of Transportation and Traffic Management Code of Butuan City
CGB Sangguniang Panlungsod (SP) Resolution No. 332-2024	Approval of the BEDP by the SP as a pathway to Butuan City's energy transition to attain Net Zero Emissions by 2050 through the development and supply of RE to meet the growing energy demands of the city.
CGB EO No. 024-2024	Local regulation for the integration of existing operational tricycle and motorela units into the Tricycle-for-Hire Useful Life Program (TULP)
CGB EO No. 046-2024	Approved city ordinance establishing the rules and regulations under Section 127 of CGB SP Ordinance No. 7026-2023 for the construction, operation and maintenance of land transportation terminals in Butuan City
CGB EO No. 7021-2024	Approved city ordinance for the creation of Comprehensive Franchise Code of Butuan City for tricycles, motorelas and pedicabs-for-hire in Butuan City
CGB EO No. 7121-2024	Implementation of rules and regulations in accordance with Chapter II of CGB EO No. 7021-2024 on tricycles, motorelas, pedicabs-for-hire

Annex B. List of PUV E-Tricycle Unit Suppliers

Company Supplier Name	E-Volution Transport Solutions, Inc.	KOR ETrike Motors Corp.	Elaia Green Vehicles Corporation	GerWeiss Motors Corporation
Supplier Company Address	1602 Corporate Plaza Tower 2, 26th Street, Bonifacio Global City, Taguig City 1635	4361 C.F. Cuadra Ugong Valenzuela City 1440	134 Sumulong Highway Brgy. Mayamot, Antipolo City Rizal 1870	Unit 6B, Isabelle Garden Commercial Building, Rodriguez Avenue, Brgy. Moonwalk Parañaque City 1709
Contact Person	Mr. Jay Carandang	Mr. Val Casimero	Mr. Miko Yamsuan	Mr. Sean Gabriel Villoria
Designation	Sales Director	Manager	Sales Manager	CEO
Contact Number	+63 927 748 4100 +63 932 189 3006	+63 999 888 7775	+63 2 980 1865	+63 949 632 9717
Email Address	jay@etsi-ev.com	valcasimero@gmail.com	myamsuan@egv.ph admin@egv.ph	gabby@gerweissmotors.com

Annex C. PUV E-Tricycle Unit Technical Speficifications

Model Type	Rickshaw
Dimensions (W x L x H)	1.25 to 1.62m x 2.90m to 3.23m x 1.7 to 1.9m
Curb Weight	330 to 365kg (without battery)
Front and Rear Tires	400-12
Front and Rear Brake Types	Front: disc brake Rear: oil drum brake
Shock Absorption Type	Front: Hydraulic shock absorber Rear: Semi-independent suspension or leaf spring
Motor	3 to 5kW
Controller	150 amps 30 tube
Rated Speed (RPM)	±2,300
Max Speed (RPM)	±4,200
Driving Range	45 to 60km
Battery Capacity	60V to 72V, 60Ah to 100Ah $LiFePO_4$
Battery Cycle Life	≥3,500 Cycles at 0.2 to 0.5C ≥6,000 Cycles at 1C 100% DOD (adjustable)
Battery Life	10 to 12 Years
Angle of Climb	>15°
Seating Capacity	9 including driver
Loading Capacity	400 to 550kg

Annex D. Philippine Historical Inflation Rates 2020-2025

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Increase	Decrease
2025	2.90%	2.10%	1.80%	1.40%	-	-	-	-	-	-	-	-	-	-	-
2024	2.80%	3.40%	3.70%	3.80%	3.90%	3.70%	4.40%	3.30%	1.90%	2.30%	2.50%	2.90%	3.20%	-	-2.80%
2023	8.70%	8.60%	7.60%	6.60%	6.10%	5.40%	4.70%	5.30%	6.10%	4.90%	4.10%	3.90%	6.00%	0.20%	-
2022	3.00%	3.00%	4.00%	4.90%	5.40%	6.10%	6.40%	6.30%	6.90%	7.70%	8.00%	8.10%	5.80%	1.90%	-
2021	3.70%	4.20%	4.10%	4.10%	4.10%	3.70%	3.70%	4.40%	4.20%	4.00%	3.70%	3.10%	3.90%	1.50%	-
2020	3.00%	2.50%	2.20%	1.80%	1.60%	2.30%	2.40%	2.20%	2.20%	2.30%	3.00%	3.30%	2.40%	-	-

Data source: RateInflation

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