National Electric Mobility Roadmap for São Tomé and Príncipe

Development of a Standard and Compliance Framework for Low-Emission Transport and Electric Mobility Roadmap for São Tomé and Príncipe

DGRNE
Direcção Geral dos Recursos Naturais e Energia

Contact
Ministry of Infrastructures and Natural Resources (MIRN)
Directorate General for Natural Resources and Energy (DGRNE)
Tel. +239 222 2669
https://dgrne.org/
https://www.facebook.com/dgrne/about/?ref=page_internaldgrne.stp.2020@gmail.com

UNIDO UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

CEREEA

GREEN CLIMATE FUND

With technical assistance from the United Nations Industrial Development Organization (UNIDO) and the Central African Centre for Renewable Energy and Energy Efficiency (CEREEAC) under the Green Climte Fund (GCF) funded project "Building institutional capacity for a renewable energy and energy efficiency investment programme for São Tomé and Príncipe"

UNIDO project team:
Mr. Martin Lugmayr, Project Manager, Ms. Andrea Eras Almeida, Project Administrator, Mr. Gabriel Lima Makengo, National Energy Programme Coordinator, Mr. Izaiah Mulenga, Technical Expert, CEREEAC

With consultancy support from:

PMANIFOLD
Advancing Net Zero Markets

The Brew-Hammond Energy Centre

KNUST
KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Mr. Rahul Ramesh Bagdia — Ms. Sayali Agade — Godwin Kafui Ayetor (Ph.D.) — David Ato Quansah (Ph.D.) – Angel de Boa Esperança

Contents

Abbreviations

AFAP	Agência Fiduciária de Administração de Projectos (Autonomous body)
AFOLU	Agriculture, Forestry, and Other Land Use
ANP	Agência Nacional de Petróleo (National Oil Agency)
B2B	Business-to-business
B2C	Business-to-consumer
BAU	Business As Usual
BEV	Battery Electric Vehicle
BUR	Biennial Update Report
CAGR	Compound Annual Growth Rate
CAREERS	Central African Centre for Renewable Energy and Energy Efficiency
CIEM	Centro Industrial Electromecânico (Mechanical Center)
CNG	Compressed Natural Gas
COE	Centre of Excellence
COVID	Corona Virus Disease of 2019
DGAAC	General Directorate of Environment and Climate Action
DGRNE	General Directorate for Natural Resources and Energy
DISCOM	Distribution Companies
DNP	National Planning Directorate
EE	Energy Efficiency
EMAE	Empresa de Agua e Electricidade
ENCO	National Oil and Fuel Company
EOL	End Of Life
ERPSSP	Economic Reform and Power Sector Support Program
ETISP	Energy Transition and Institutional Support Program
EU	European Union
EV	Electric Vehicle
GCF	Green Climate Fund
GEF	Global Environment Facility
GFDRR	Global Facility for Disaster Reduction and Recovery
GHG	Green House Gases
GOP	Great Options Plan
GST	Goods and Services Tax
GW	Giga Watt
HEV	Hybrid Electric Vehicle
HH	Households
ICEV	Internal Combustion Engine Vehicle
ICT	Information and Communication Technology
IEA	International Energy Agency

INPEIG	Gender Equality Institute
INTT	Land Transport Directorate
IRENA	International Renewable Energy Agency
KW	Kilo Watt
LDC	Least Developed Country
LEAP	Long-range Energy Alternatives Planning model
LED	Light Emitting Diode
LPG	Liquified Petroleum Gas
MHP	Mini Hydropower Plants
MIRN	Ministry of Infrastructure and Natural Resources
MPFEA	Ministry of Planning, Finance, and Blue Economy
MRV	Measurement, Reporting, and Verification
MW	Mega Watt
NDA	National Designated Authority
NDC	Nationally Determined Contributions
NDP	National Development Plan
NEEAP	National Energy Efficiency Action Plan
NREAP	National Renewable Energy Action Plan
OEM	Original Equipment Manufacturer
PHEV	Plug-in Hybrid Electric Vehicle
RAP	Autonomous Region of Príncipe
RDSTP	Democratic Republic of São Tomé and Príncipe
RE	Renewable Energy
SDG	Sustainable Development Goals
SEFA	Sustainable Energy Fund for Africa
SIDS	Small Island Developing Countries
SRIOOT	Secretária Regional de Infraestruturas (Regional Infrastructure Secretary)
STP	São Tomé and Príncipe
TCO	Total Cost of Ownership
TNC	Third National Communication
TOU	Time-Of-Use
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention for Climate Change
UNIDO	United Nations Industrial Development Organisation
USD	United States Dollar
VAT	Value Added Tax
VNR	Voluntary National Review
WB	World Bank

1 Introduction

This document presents a electric mobility (e-Mobility) Roadmap report of land transport in Sao Tomé and Príncipe (STP) under the contract – *Consultancy Services for the Development of a standard and compliance framework for low-emission transport and an electric mobility roadmap for São Tomé and Príncipe*- established between the United Nations Industrial Development Organization (UNIDO) in partnership with the General Directorate for Natural Resources and Energy (DGRNE) of the Ministry of Infrastructure and Natural Resources (MIRN, former MOPIRNA) and the National Designated Authority (NDA) at the Ministry of Planning, Finance and Blue Economy (MPFEA) being implemented under the GCF readiness project "Building institutional capacity for a renewable energy (RE) and energy efficiency (EE) investment program for São Tomé and Principe".

With this assignment, UNIDO and the Central African Centre for Renewable Energy and Energy Efficiency (CEREEAC) are supporting the Government of STP to improve the policy, regulatory, and practical framework for low-emission vehicle uptake, including electric and hybrid vehicles. For this, e-Mobility Roadmap to be formulated with a focus on the pathways to achieve wide-scale EV deployment. This covers action plan including targets and policy measures, along with their implementation timelines, institutional responsibilities, and resource requirements.

1.1 Context

The Democratic Republic of STP is a small island developing state (SIDS) off the coast of central Africa with a population of 225,00 people[1]. It is made up of two islands, located in the Gulf of Guinea at 0º 25'N latitude and 6º 20'E longitude, about 380 km west of the coast of the African Continent. The islands occupy an area of 1,001 km² and consist of the larger island Sao Tomé the smaller island Príncipe, and several tiny islets. Sao Tomé (area of 859 km^2) is about 6 times larger and four times more densely populated than Príncipe (142 km^2). Both Island share a national government, which is elected every four years. Due to the special status of the Príncipe as an Autonomous Region, there is also a regional government and regional president in Príncipe.

Generally, STP is known to be highly vulnerable to the impacts of climate change and faces development challenges stemming from structural vulnerabilities such as its geographic isolation, the small size of the national market, and dependence on imports, which affect its capacity to manage environmental and economic shocks.

STP signed the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, ratified on October 27, 1999, and became a full member of the Convention. In its first biennial update report to the UNFCCC in 2022, STP reaffirmed its commitment to reducing greenhouse

[1] UNIDO and GEF Report, "National Energy Efficiency Action Plan (NEEAP) of São Tomé and Príncipe, Period 2021-2030/2050," 2021

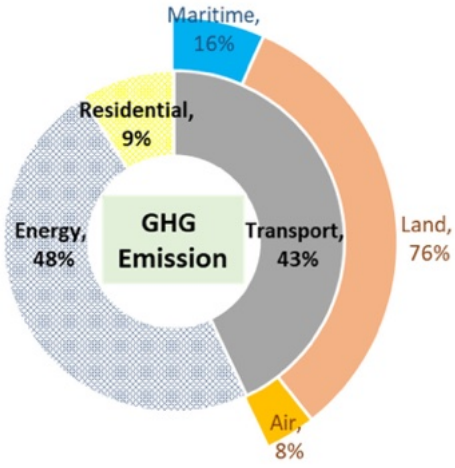
gas (GHG) emissions by 109 kT-CO_{2eq}, which corresponds to an emission reduction of 27% by 2030[2]. The prioritized mitigation measures include:

- Increase in the share of renewable energy (RE)
- Reduction of losses in the network and improvement of energy efficiency (EE)
- Reduction of carbon intensity in mobility

The transport sector is the second largest contributor to emissions after the energy sector. In terms of carbon dioxide emissions, the energy industry sectors are the biggest emitters accounting for 48% followed by transport with 43% and residential with 9%[3]. In 2018, the energy consumption of the road sector was estimated to be 11,188.26 TEP (Equivalent ton of oil). The results of GHG calculation for the road sector in 2018 was 34.3kT-CO_{2eq} which far exceeds aviation (3.83 kT-CO_{2eq}) and maritime (7.02kT-CO_{2eq}) transport *(Figure 1)*[4].

The land transport sub-sector is considered the second largest consumer of fossil fuels and contributes 33% of overall GHG emissions resulting from its massive energy use of fossil fuels. Land transport consumes gasoline, in addition to diesel (gasoil) and lubricants. According to the National Energy Efficiency Action Plan, the transport sector, particularly the land transport subcategory, is considered the second largest consumer, with 80% of gasoline and 17% of gasoil, as percentages of overall consumption, and has a major role to achieving decarbonization in STP.

Figure 1 GHG Emissions in STP with focus on Transport Sector (2018)



As of today, the country has imports of used vehicles. The absence of an age limit on imported vehicles, complete reliance on imported fuel, and the lack of fuel and vehicle standards are some of the challenges in the transport sector in STP, as in many other African countries. Recognizing this, Ministry of Infrastructure and Natural Resources (MIRN) is committed to reducing fossil fuel

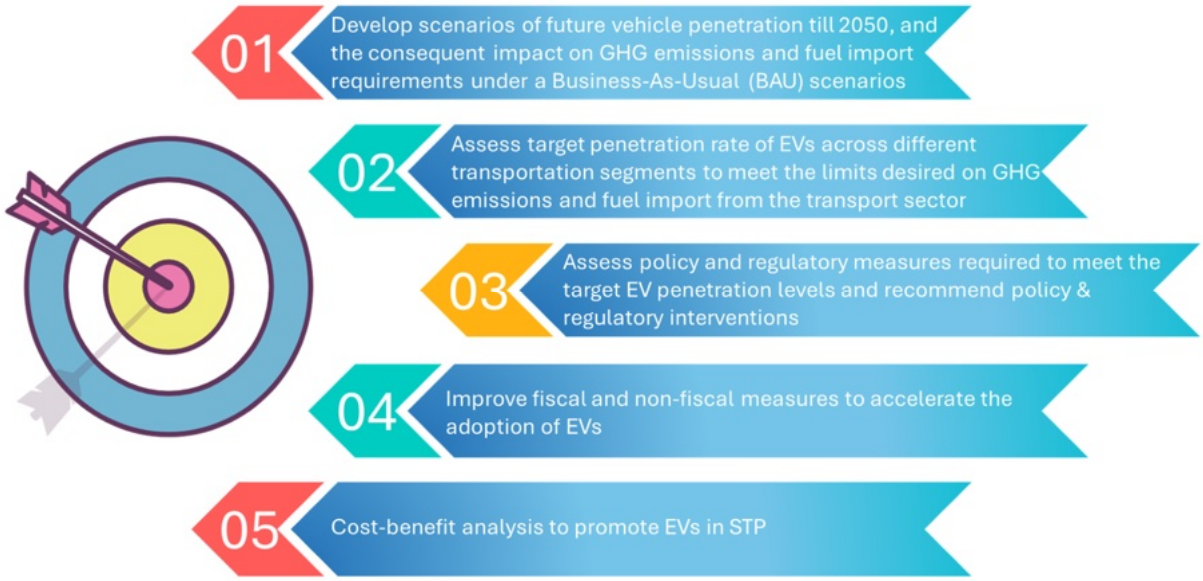
[2] M. o. I. a. N. R. (MIRN), " First Biennial Update of São Tomé and Príncipe," January 2022
[3] U. N. D. P. (UNDP), "Updated Nationally Determined Contributions (NDC-STP), NDC Partnership," 2021
[4] M. o. I. a. N. R. (MIRN), " First Biennial Update of São Tomé and Príncipe," January 2022

dependency in the transport sector and shift to alternate and indigenous resources. In addition to expanding its vehicle fleet for mass transit and improving the service delivery, it also aspires to capture the opportunity to make a technology leap and pilot Low Emission Vehicles - electric vehicles (EVs) in the country.

An established clear milestone e-Mobility roadmap could present opportunities toward a resource-efficient, resilient, equitable, and greener economy in STP. The immediate impact of reduced vehicle emissions in STP will be cleaner air and a more pristine environment. More importantly, the long-term impact will be better health, well-being, and gross national happiness of the people.

1.2 Objectives

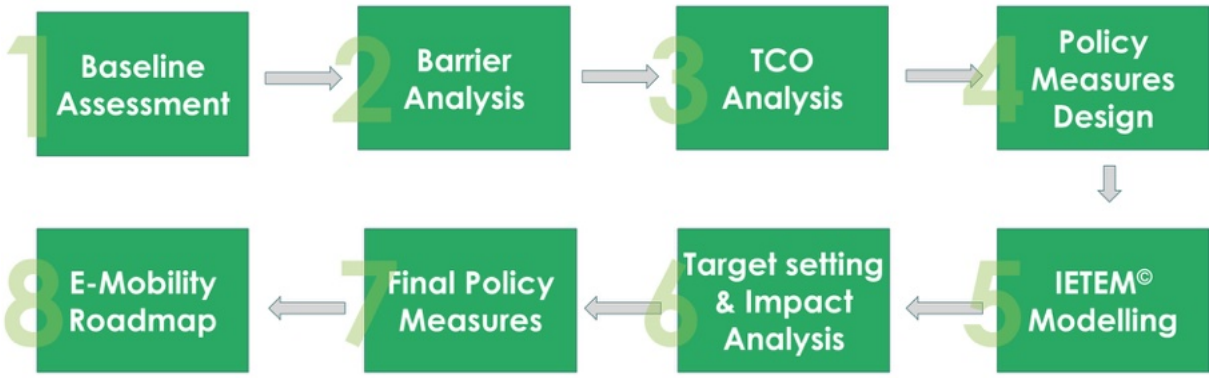
The main objective of this consultancy assignment is to recommend mid-term and long-term targets for National EV and Charging Program. The study is also aimed to develop a roadmap to promote EV penetration in conjunction with existing relevant national priorities and policies. The broader objective of this study is highlighted below,



1.3 Methodology

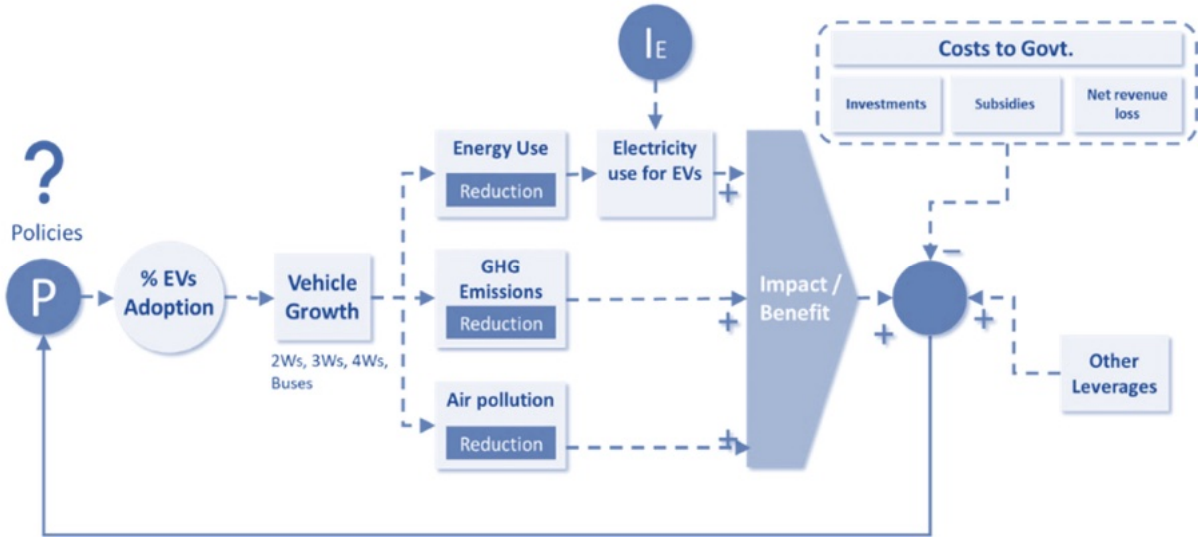
National e-Mobility Roadmap framework is developed based on the Country baseline assessment, barrier analysis across the EV value chain, and identifying appropriate policy measures to resolve the barriers to meet country's EV targets. A schematic illustration to explain the overall process is shown in *Figure 2*:

Figure 2 Approach Followed to Develop National e-Mobility Roadmap for STP



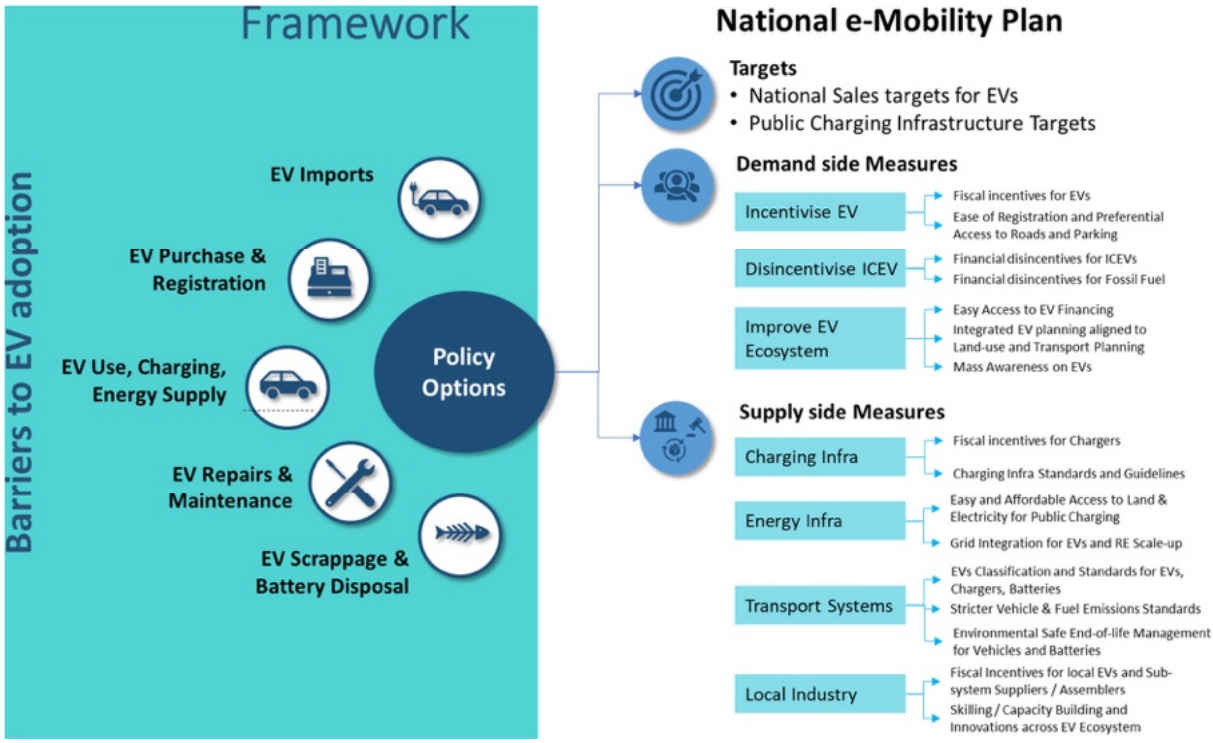
For the same, pManifold has developed Integrated Energy and Transport e-Mobility Model (IETEM©) which supports EV Roadmap planning. This is a full fledge modelling and simulation tool to analyse different EV adoption scenarios across all vehicle segments and its impact on grid, environment, economics, and close-loop design policy options as shown in *Figure 3*.

Figure 3 pManifold IETEM© Architecture to Model and Close-loop Design EV Policies for STP



The identified Policy options went through a screening process and were evaluated against the relevance and the needs of STP and consulted and validated with stakeholders. National e-Mobility Policy Framework for STP in shown in *Figure 4.* Details are explained in ***Chapter 4*** *e-Mobility Policy Measures* .

Figure 4 National e-Mobility Policy Framework for STP



2 Country Landscape and Baseline

2.1 Transport Landscape

STP transportation system is largely dominated by 2W and light vehicles including 4W-Personal and 4W-Commercial. These together account for 95% of the market share followed by heavy vehicles which account for approx. 5% of the total vehicles on the road. The market share of the buses is very small (< 4%). This statistic shows that STP's vehicle ownership is primarily individual and there is a good scope to strengthen the public transportation adoption. A summary of STP transportation mix and avg. travelling distance is shown in *Table 1*. The table also highlights the EV charging needs of each vehicle segment.

Table 1 STP Transportation Different Segment Characteristics

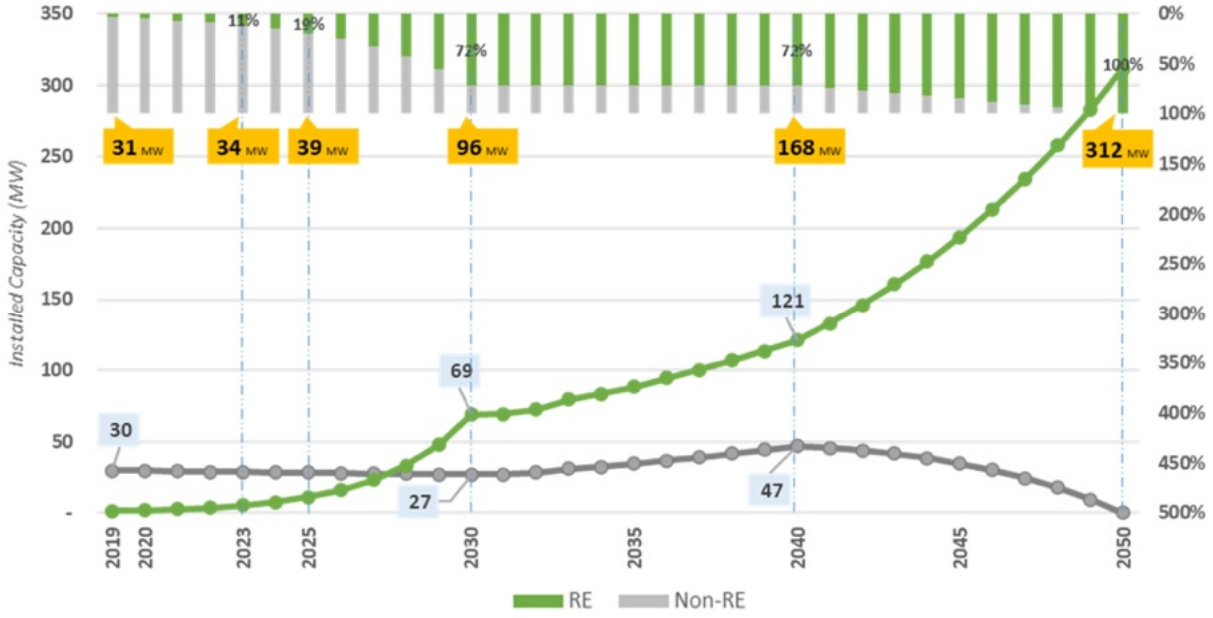
Vehicle Categories							
	2W - Personal	**2W - Commercial**	**3W**	**4W - Personal**	**4W - Commercial**	**Buses**	**Trucks**
Use	Personal	Commercial Fleet	Commercial Fleet	Personal	Commercial Fleet	Commercial Fleet	Commercial Fleet
Ownership	Individual	Individual / Group	Individual / Group	Individual	Individual / Group	Public / Private	Private
% Market Share	20%	18%	2%	35%	20%	4%	< 1%
Travelling Distance	Low (Avg. 20 km)	Average (35 km)	Average (35 km)	Low (Avg. 25 km)	Medium (Avg. 60 km)	Medium (Avg. 80 km)	High Avg. 200 km
Charging Needs	Home/ office can support most needs. May not require daily charging.	Home/ office can support most needs. May not require daily charging.	**Fleet:** May need one or more charging in a day. It can be at home/ public/ dedicated fleet stations.	May not need daily charging. Home/ office charging can support most needs.	**Fleet:** May need one or more charging in a day. It can be at home/ public/ dedicated fleet stations.	**Big battery size:** Charging can happen at terminal at end of day **Small battery size:** Interim opportunity charging along the route or at terminal during waiting time	**Big battery size:** Charging can happen at warehouse at end of day **Small battery size:** Interim opportunity charging along the route or at warehouse during waiting time
# of EV Models in STP	Limited	Limited	Limited	Limited	Limited	None	None
TCO of EVs compared to ICE vehicle	Higher 1.31 x	Lower 0.65 x	Lower 0.79 x	Higher 1.22 x	Higher 1.17 x	Higher 1.31 x	Higher

2.2 Energy Landscape

As of 2021, the total power installed in the interconnected network was 39 MW, corresponding to 2.0 MW from one hydroelectric plant (Contador) and the remaining 37 MW from diesel-based thermoelectric plants (São Tomé, Santo Amaro 1, Santo Amaro 2, Santo Amaro 3, and Bobô-Forro 1) operated by EMAE.

The renewable action plan outlines a target to achieve a minimum of 72% RE participation in STP's electricity matrix by 2030[5], maintaining this level until 2040 in terms of installed capacity, as illustrated in *Figure 5*. It indicates the projected year-wise installed capacity from thermal diesel plants and RE sources. Out of the 72% RE, it is proposed that 18% will be obtained from hydropower plants, 49% from solar plants, and the remaining 5% from biomass power plants. If the proposed projects stay on track, the installed capacity is projected to be 69 MW from RE sources and the remaining 27 MW from thermal diesel plants in 2030. The share of RE sources in installed capacity is expected to increase exponentially to 312 MW by 2050, with the CAGR of 8%.

Figure 5 Electricity Generation and RE Mix in STP (by Installed Capacity)



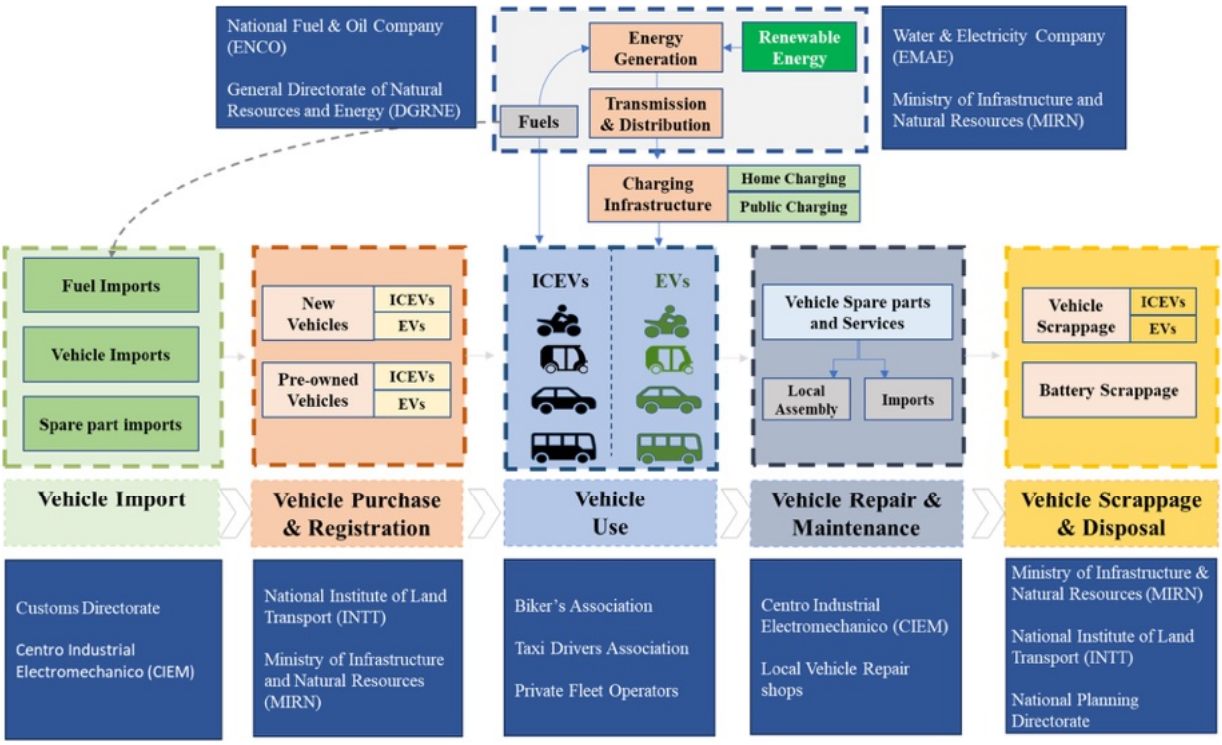
2.3 e-Mobility Landscape

STP Transport ecosystem comprises of an expansive network of intertwined roles and responsibilities between national government agencies (NGAs), local government units (LGUs), planning and development entities, operators, civil society, and users. This section presents the

[5] UNIDO and GEF Report, "National Renewable Energy Action Plan (NREAP), 2022 of São Tomé and Príncipe

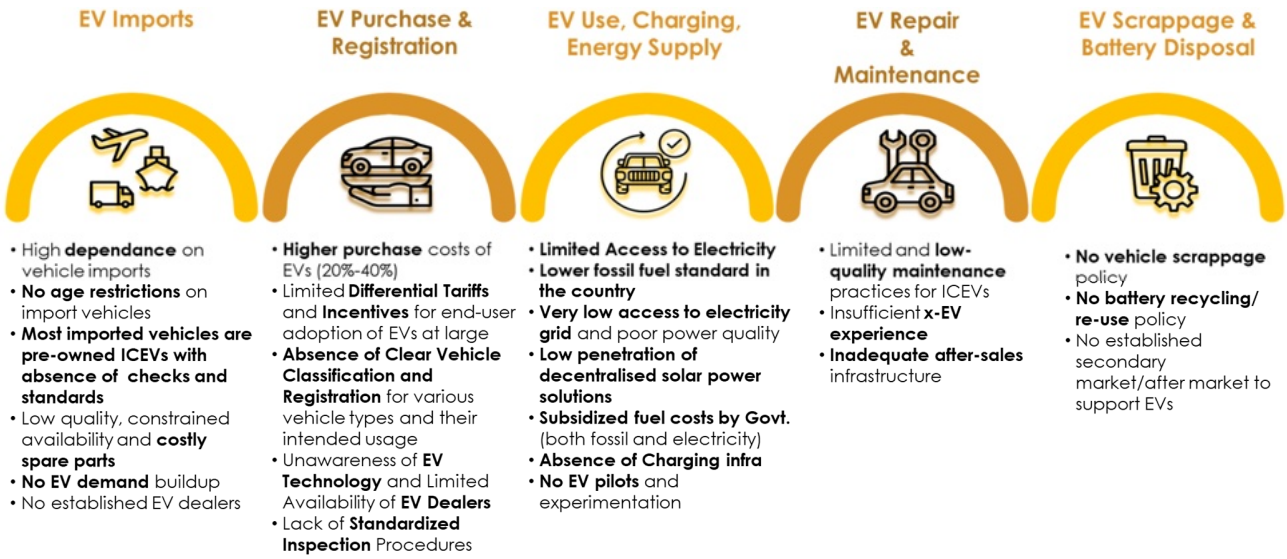
stakeholders and their respective roles/influence in the e-Mobility ecosystem. An overall stakeholder map is provided in *Figure 6.*

Figure 6 Authorities regulating fuel and vehicles across different life cycle stages



For this analysis, the value chain has been generalized and Barrier Assessment has been conducted to identify the primary challenges faced by EVs as shown in *Figure 7.* Details of Barrier Analysis is mentioned in e-Mobility Baseline Assessment Report submitted to UNIDO, Feb 2024.

Figure 7 Barrier Assessment for EVs Adoption in STP across Vehicle Life Stages



3 e-Mobility Targets

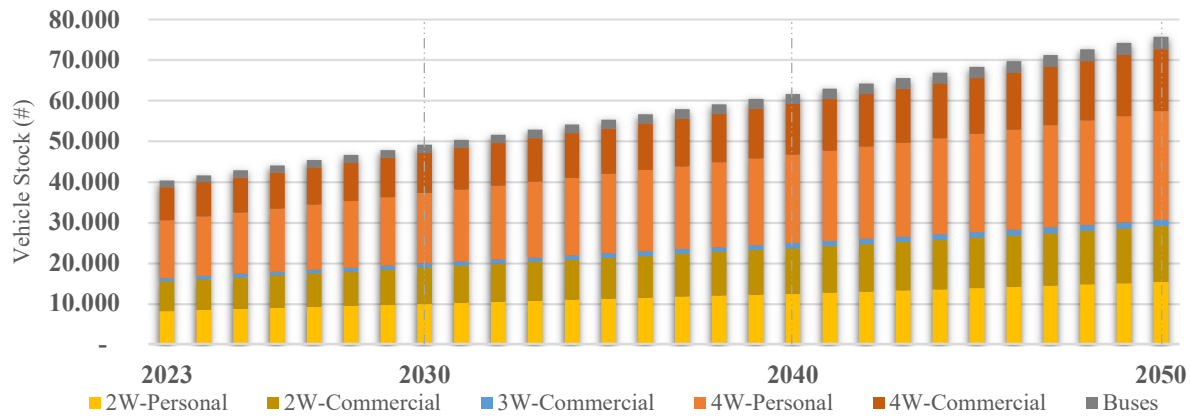
With reference to the e-Mobility Roadmap Framework as elaborated in *Section 1.3 Methodology*, National EVs and Charger Targets has to be set, followed by Demand & Supply side policy measures and their Impact Assessment. This chapter explains the importance of Target setting, specific EV targets, and the rationale for the proposed EV targets.

3.1 Vehicle Growth Forecast

The data on vehicles imported from 2017 to 2023 was obtained from the National Institute of Land Transport. About 1,314 and 1,281 units of vehicles were registered in 2017 and 2018 respectively. In 2019, the number of vehicles imported peaked at 1,754 units representing a 37% increase over 2018. However, in 2020 there was a sharp decrease in vehicles registered. Registered vehicles decreased by 41% in 2020 at the peak of the Covid 19 pandemic. The decline could be attributed to the Covid 19 pandemic which caused a major decline in vehicles worldwide in 2020. The International Energy Agency reported that global car sales contracted by 14% in 2020[6]. In 2021, registered vehicles increased but 2022 and 2023 indicate major declines. Vehicle registration in 2023 reduced by 27% compared to 2022.

According to the historical data from 2017, every year an average of 1,300 vehicles are registered. Motorcycles made up about 40% of all vehicles registered between 2017 and 2023, compared to 60% of all other vehicles. Approximately 55.5% of registered vehicles are powered by gasoline, while 44.5% are powered by diesel engines. At these growth rates, the expected no. of total vehicles on the road across different vehicle categories are forecasted to become 76,515 by 2050, representing 2.5% CAGR. The trend for the same is shown in *Figure 8,*

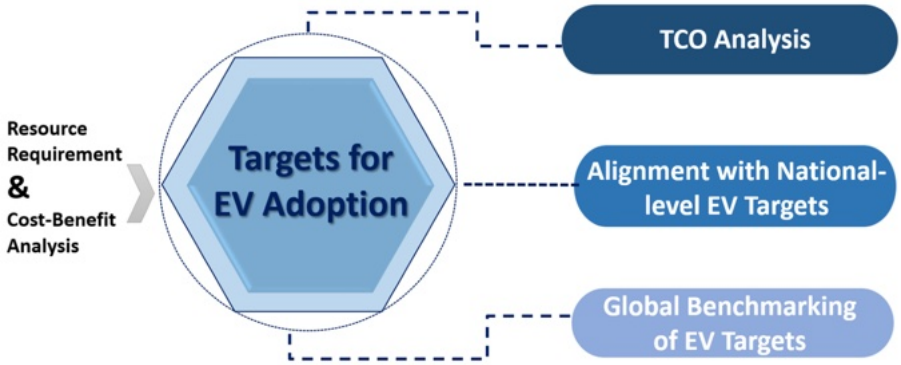
Figure 8 Total on-road vehicles stock in STP (2023-2050)



[6] IEA. *How global electric car sales defied Covid-19 in 2020*. 2021 [cited 2023 13th December]; Available from: https://www.iea.org/commentaries/how-global-electric-car-sales-defied-covid-19-in-2020.

3.2 EV Targets

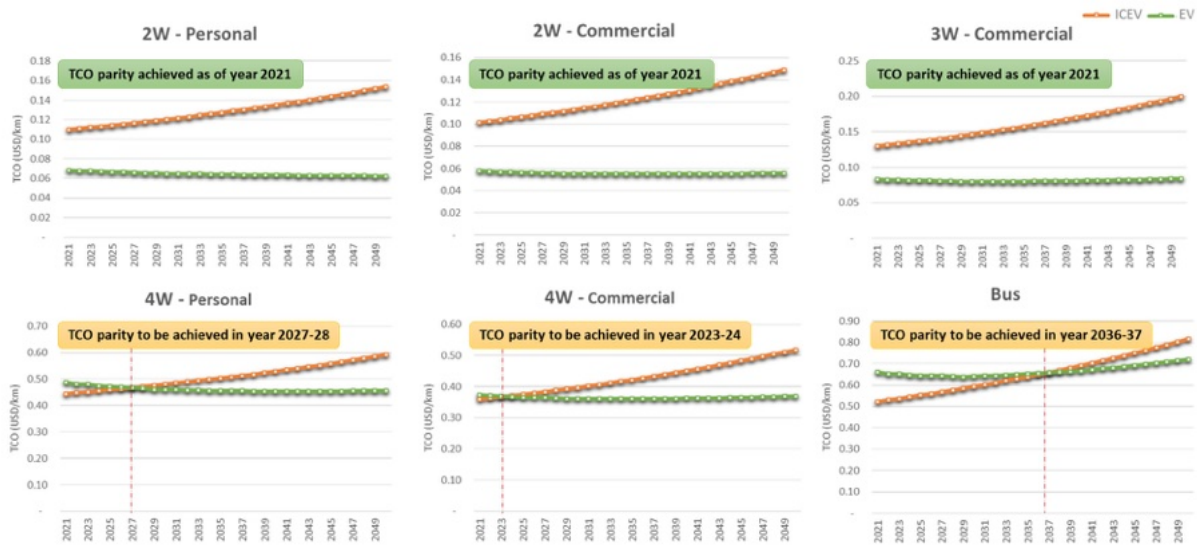
The annual EV sales target (%) is defined as number of EVs sold yearly in the country out of total vehicles (including ICE vehicles) sold in a given year. To define EV sales targets for the STP by 2050, the following aspects are taken into the consideration,



TCO Analysis

After conducting the TCO Analysis, it was observed that as of 2024, TCO parity is already being achieved in certain vehicle segments such as 2W-Personal, 2W-Commercial, and 3W-Commercial. Similarly, other segments like 4W-Personal, 4W-Commercial, and Buses are anticipated to achieve TCO parity within a few years, by 2027-28, 2023-24, and 2036-37 respectively. Buses are projected to require the longest duration to reach TCO parity. The TCO comparison has been shown below in *Figure 9.* Considering this, segments which are achieving early TCO parity have been projected to experience higher EV growth and earlier penetration in the fleet, and vice versa.

Figure 9 TCO Comparison between ICEVs and EVs among different vehicle classes



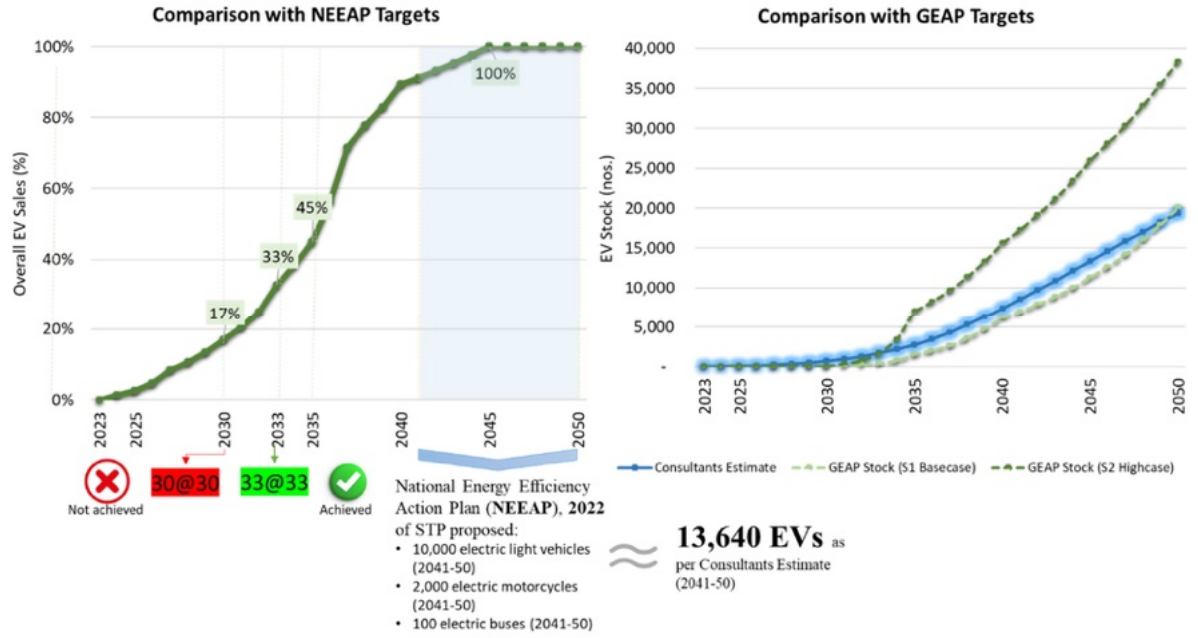
Alignment with National EV Targets

According to the National Energy Efficiency Action Plan (NEEAP) of STP, 2022, specific targets have been delineated for accomplishment by the year 2050. It is imperative for successful EV adoption, targets outlined in national level policies are attained. As per the NEEAP, 2022, STP should achieve the following targets by 2050:

- **10,000** electric light vehicles (2041-50)
- **2,000** electric motorcycles (2041-50)
- **100** electric buses (2041-50)

This gives a total EV fleet of **12,100** EVs. As per the targets set through this e-Mobility roadmap, STP is expected to have an EV Fleet of ~**13,640 (2041-50),** close to NEEAP set targets**.** Details of National EV targets and Consultants targets is shown in *Figure 10*. In addition, our targets are also situated between the base case and high case scenarios proposed by the Green Energy Acceleration Plan (GEAP).

Figure 10 EV Proposed EV Targets for STP and Comparison with other National Targets



Global Benchmarking of EV Targets

Globally, many countries have announced their EV sales target by 2030. The common EV sales target range is 30% to 60% of their total yearly vehicle sales.

Kenya	5%
South Africa	20%
China	40%

India	30%
Japan	30%
Netherland	100%

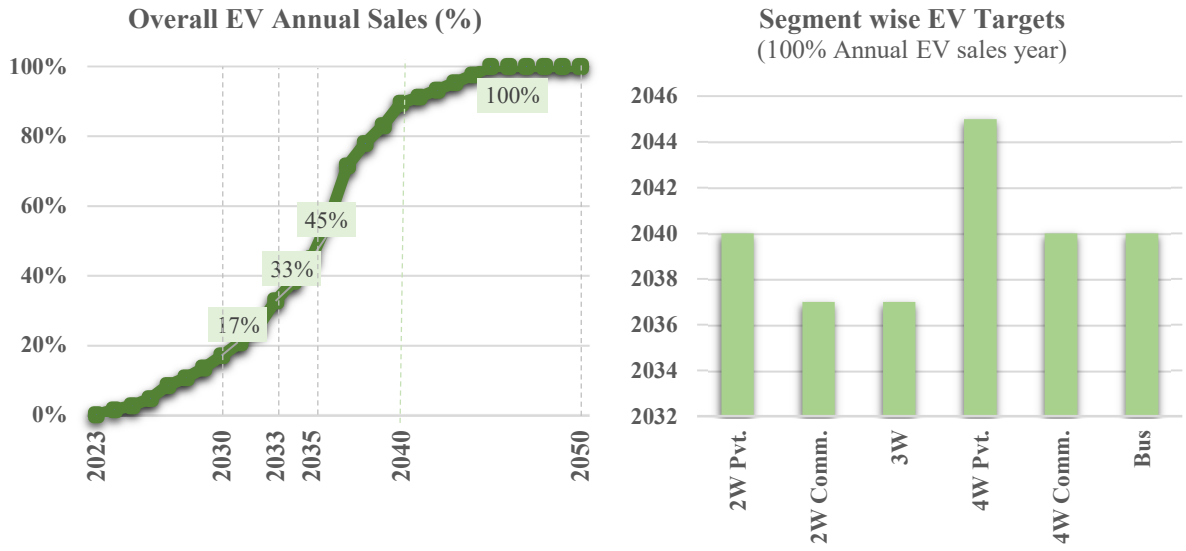
These targets reflect the global commitment to transitioning towards cleaner and more sustainable transportation options. Figure 11 demonstrates segment-level targets for select SIDS and African countries.

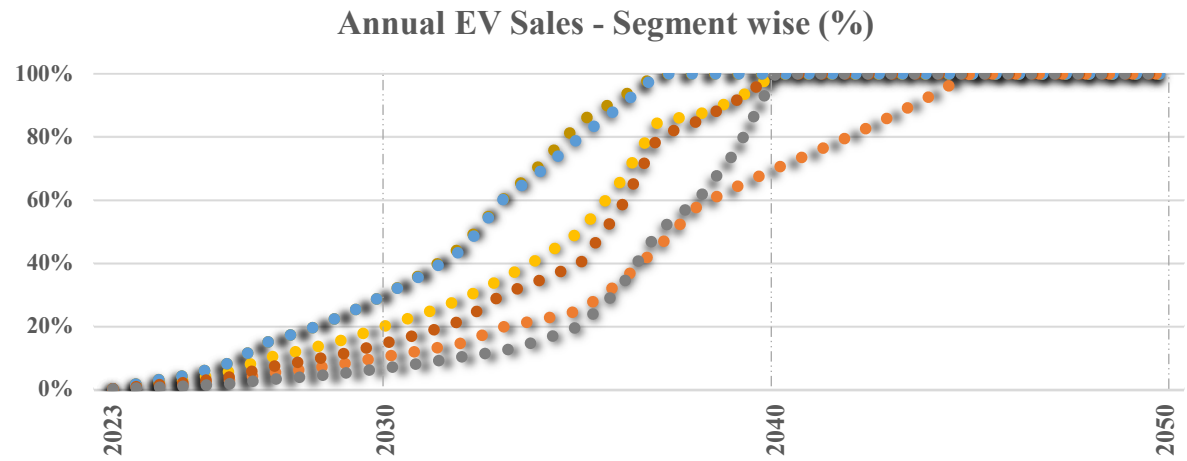
Figure 11 Global Benchmarking for EV Targets across Segments

		SIDS				African Countries		STP	
Annual Sales Target (%)	Vehicle Segments	Soloman Island		Maldives		Zimbabwe			
		2025	2035	2025	2035	2025	2035	2025	2035
	2W	20%	100%	10%	60%	20%	100%	5%	50%
	3W	100%	100%	NA	NA	30%	100%	5%	80%
	4W Pvt.	20%	40%	5%	50%	5%	60%	2%	25%
	4W Comm.	20%	60%	10%	70%	10%	65%	2%	40%
	Mini-Bus	20%	100%	20%	100%	5%	30%	NA	NA
	Standard Bus	20%	70%	20%	100%	15%	50%	1%	20%
	Overall Sales Target	15.7%	35.6%	9.7%	60.0%	6.0%	60.0%	3%	45%
	Overall EV Mix (%)	1.2%	12.3%	2.5%	31.0%	1.1%	17.1%	1%	5%

Combining above rationale, proposed targets for EV adoption as a percentage of total sales of vehicles in overall sales for each vehicle segments are indicated in Figure 12 and Figure 13 respectively.

Figure 12 Proposed EV Annual Sales Targets for STP (2023-2050)





	2023	2025	2030	2035	2040	2045	2050
2W-Personal	0%	3%	20%	50%	100%	100%	100%
2W-Commercial	0%	5%	30%	85%	100%	100%	100%
3W-Commercial	0%	5%	30%	80%	100%	100%	100%
4W-Personal	0%	2%	10%	25%	70%	100%	100%
4W-Commercial	0%	2%	15%	40%	100%	100%	100%
Buses	0%	1%	7%	20%	100%	100%	100%
Overall Annual Sales	**0%**	**3%**	**17%**	**45%**	**89%**	**100%**	**100%**
Overall EV Mix	**0%**	**1%**	**7%**	**5%**	**12%**	**20%**	**26%**

This scenario will result in on-road EV stock of ~ 5% by 2035 and 26% by 2050. Hence, it is proposed that the Govt. can consider above nos. as Targets for EVs in medium to long term. The annual EV sales projection and its sales (%) of total vehicle sales for the period 2023 to 2050 is shown in the Figure 13 and Figure 14.

Figure 13 Projected Annual EV Sales by Vehicle Segments (2023-2050)

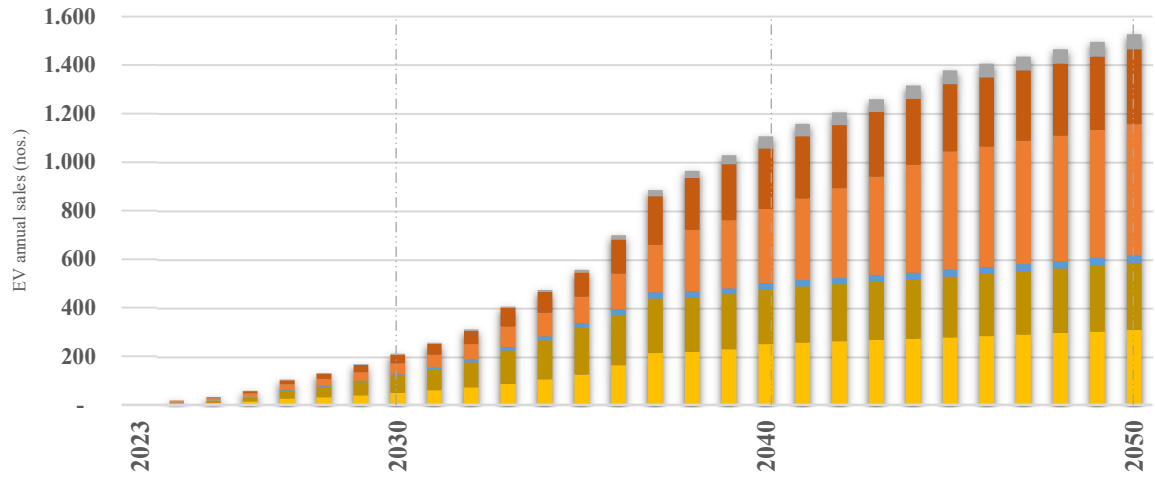
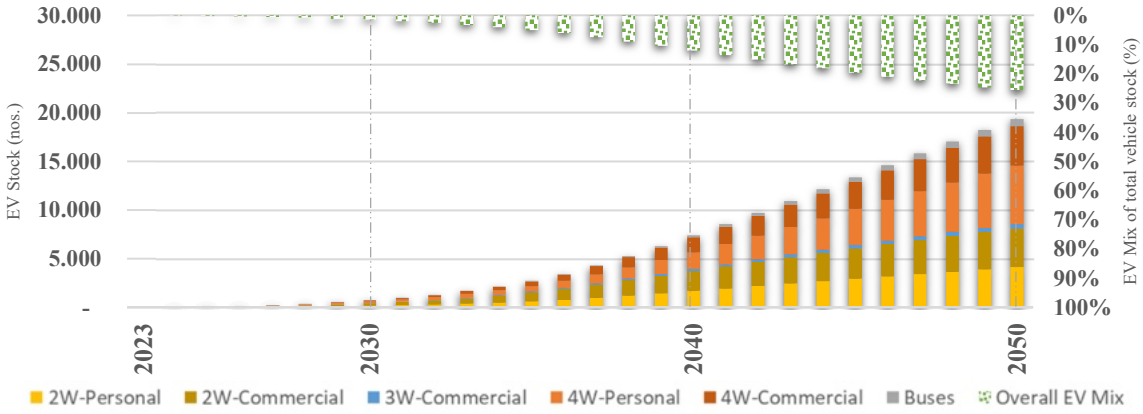


Figure 14 Projected EVs On-road Stock by Vehicle Segments and EV Stock Mix (%)



3.3 EV Charging Targets

The existing EV deployments in the STP use plug-in (fixed battery) charging. Future charging strategies will depend on vehicle segments, with charging provided through 1) public charging 2) dedicated/ captive fleet charging and 3) others (including home and office charging). These different EV charging models will also vary across vehicle segments and will evolve over time with improving battery chemistries and reducing battery costs (that will enable faster charging and higher owning/leasing of fixed batteries). STP assumed Charging Models adoption across EV segments is shown in *Table 2*:

Table 2 Assumed EV Charging Behaviours (%) across Segments and Charging Locations

	Public charging	Dedicated/ Captive charging	Others (Including Home)
2W-Personal	0%	0%	100%
2W-Commercial	30%	0%	70%
3W-Commercial	40%	30%	30%
4W-Personal	20%	0%	80%
4W-Commercial	40%	30%	30%
Buses	0%	100%	0%

Charger type will depend on each segment's battery size (kWh) and chemistries, which defines the need for different charger types, categorized as Level 1, Level 2, and Level 3. Level 1 are AC chargers with power rating ranging from 1–3 kW, level 2 are AC chargers typically from 3–20 kW and level 3 can be AC or DC chargers greater than 20 kW. The level 3 AC chargers can support max 45kW, and DC chargers can go even beyond 500kW. Different vehicle segments (characterized by their battery sizes [kWh]) and charging times requirement will require different charger types depending on the charging location and models as shown in *Table 3*.

Table 3 Charging Types (by Power Levels) across Vehicle Segments

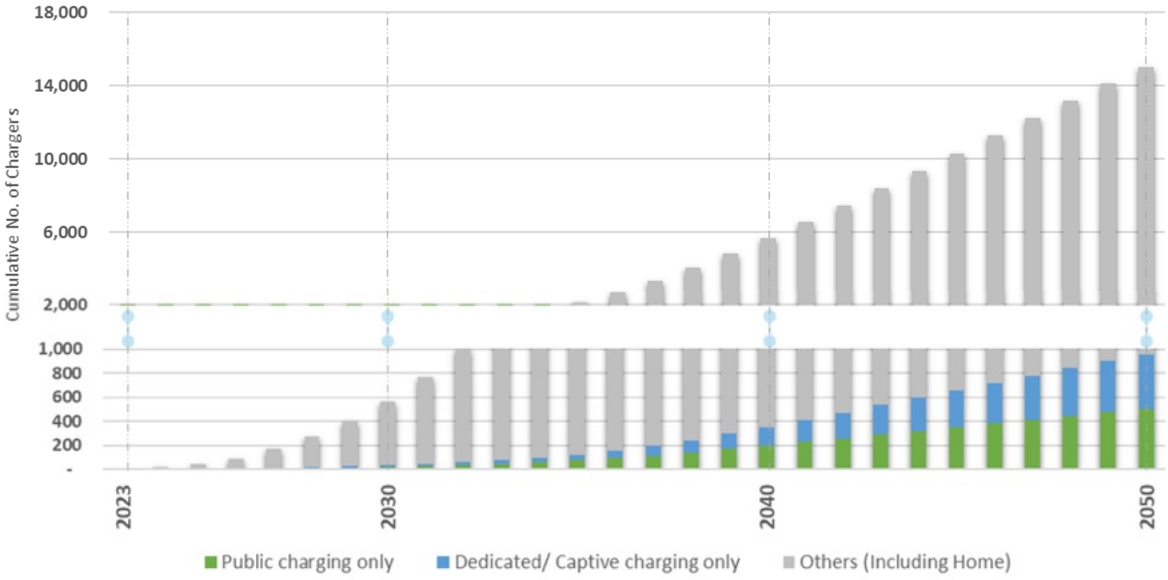
Vehicle Segment	Public charging	Dedicated/ Captive charging	Others (Including Home)
2W-Personal	Level 1	Level 1	Level 1
2W-Commercial	Level 1	Level 1	Level 1
3W-Commercial	Level 2	Level 1	Level 1
4W-Personal	Level 2	Level 2	Level 1
4W-Commercial	Level 2	Level 2	Level 2
Buses	Level 3	Level 3	Level 2

The estimated numbers of different types of chargers required in the STP to support its EV adoption targets are shown in *Table 4*. These numbers are estimated based on charging times of different vehicle segments, their annual running distances (kms), and expected utilization of chargers.

Table 4 Estimated cumulative Chargers across different Charger Types and Charging Locations

Charger Levels	2025	2030	2040	2050
Level 1	40	518	5,097	13,427
Level 2	6	46	519	1,402
Level 3	1	3	51	185
Total	**47**	**567**	**5,667**	**15,014**
Public Chargers	5	22	198	503
Dedicated Chargers	3	12	155	455
Others (including Home charger)	39	533	5,314	14,056

Figure 15 Estimated Cumulative Chargers across different Charging Locations



4 e-Mobility Policy Measures

With reference to the e-Mobility Roadmap Framework as elaborated in *Section 1.3 Methodology*, Targets setting for EVs and Chargers was carried out in *Section 3 e-Mobility Targets,* and Demand and Supply-side policy measures needs to be identified and assessed. This chapter explains the Demand-side Policy measures aimed at encouraging and enabling users to purchase and operate EVs, making EVs attractive for purchase and use. Similarly, Supply-side Policy measures are detailed to support market establishment, offset fossil fuel usage, discourage polluting vehicles, standardize vehicles (ICEVs and EVs) import, registration, and usage (operation, charging, and maintenance), as well as the disposal of both new and old fleets and batteries for EVs. Additionally, measures are outlined to build capacity for EVs adoption through technical and institutional strengthening.

4.1 Demand-side Policy Measures to increase EV Adoption

The low EV adoption in STP is resulting from key barriers including high purchase cost, low awareness about EV technology, lack of business models, and limited capacities of stakeholders. The recommended Demand-side Policy measures[7] for EV adoption are detailed below with following objectives:

- Reduce overall upfront cost and TCO of EVs when compared to ICEVs
- Make use of EVs convenient and accessible
- Discourage ICEVs use
- Improve awareness for EVs

[7] It is advisable to revise these policy measures every 3 to 5 years, taking an account of achieved EV adoption and identify changes required in the policy if any, as per the changes in technology, government priorities and any other influencing factors.

4.1.1 Financial Incentives for EVs

In many of the global examples of EV adoption strategies it can be clearly seen that the Incentives make tangible impacts on adoption of EVs and found effective on increasing the rate of adoption over the years. The financial incentives are aimed at reducing upfront cost and TCO of EVs and make them a more desirable option for end-user. The Fiscal incentives proposed for EV adoption in STP are given:

Proposed Policy Measures for STP

- **Reduction of Custom Duty on EVs**
  Tax decrease till 2030 and then gradual increase till 2050

	2024	2025	2030	2035	2040	2050
e-2W Personal	20%	0%	5.0%	10%	15%	15%
e-2W Commercial	20%	0%	5.0%	10%	15%	15%
e-3W	0%	0%	5.0%	10%	15%	15%
e-4W Personal	0%	0%	0%	5%	10%	15%
e-4W Commercial	0%	0%	0%	5%	10%	15%
e-Buses	0%	0%	0%	0%	0%	0%

- **Reduction of VAT on EVs**
  Tax decrease till 2030 and then gradual increase till 2050

	2024	2025	2030	2035	2040	2050
e-2W Personal	15%	0%	7.5%	15%	15%	15%
e-2W Commercial	0%	0%	7.5%	15%	15%	15%
e-3W	0%	0%	7.5%	15%	15%	15%
e-4W Personal	0%	0%	0%	7.5%	7.5%	15%
e-4W Commercial	0%	0%	0%	7.5%	7.5%	15%
e-Buses	0%	0%	0%	0%	0%	0%

- **Exemption of vehicle registration** charges and other repeat taxes on EVs

- **Prioritization of advanced battery systems**
  - Extend Govt. incentives only for advanced battery chemistries

Examples

Why: To achieve price parity and make EV purchase attractive for end-users and boost adoption

Basis to suggested measures:

- **Regional Example:**
  - **Kenya:** National incentives in the form of reduced excise tax for EVs from 20% to 10% in 2019; ongoing further work to reduce taxation and to facilitate importation and registration.
  - **Rwanda:** Exemption on import, excise duties and zero-rated VAT on EVs, spare parts, batteries and charging station equipment.
- **Global Example**:
  - **China:** EVs are exempted from purchase tax from January 1, 2021 to December 31, 2022
- **Analysis**:

Impact Assessment

These concessional taxes offered to the EVs will result in reduced government tax collection linked to the sales of vehicles.

Net Cumulative Tax collection to Government from Sales of EV with proposed tax structure for the period of 2024-50 are estimated to be 67 Mn USD

TCO Ratio – EV to ICEV

	Without Incentives	**With Concessional Tax** *(Custom Duty and VAT)*	**With Concessional tax and Capital Subsidy** *(only on Bus)*
2W Personal	0.85 x	0.67 x	0.67 x
2W Commercial	0.65 x	0.58 x	0.58 x
3W	0.79 x	0.68 x	0.68 x
4W Personal	1.22 x	1.02 x	1.02 x
4W Personal	1.17 x	0.92 x	0.92 x
Buses	1.31 x	1.1 x	1.01 x

Proposed Policy Measures for STP	Examples	Impact Assessment
including Lithium-ion based. Lead acid batteries to be discouraged.	- Combination of Tax incentives (reduction in custom and VAT) has potential to achieve price parity for EVs in all vehicle segments except buses (as shown in TCO ratio table in next column) - With addition of Capital subsidy after reduction in custom and VAT, Bus segment was also achieving TCO Parity as of today (as shown in TCO ratio table in next column)	
• **Capital Subsidy for select EVs** - As TCO parity is not being achieved for e-Bus segment despite of reduction in custom and VAT, proposed capital subsidy is proposed for e-Bus only and is linked to its battery size. This is proposed as 100 USD/kWh of battery considering average battery size. The subsidy is provided in initial years till 2030 and can be phased out later as EVs' price parity with ICE vehicles is achieved.		Cumulative cost to Government for the period of 2024-50 from the Capital subsidy offered to e-Bus are estimated to be 21 Mn USD.

** It is recommended to extend similar but differentiated financial incentives also for pre-owned EVs and ICEV-to-EV Retrofits, as compared to New EVs; provided they follow defined quality and safety standards.*

4.1.2 Financial Disincentives for ICEVs

The ICEVs are contributing to the emissions and discouraging their purchase and use would help shifting focus from ICEVs to EVs and make EVs favorable product. This could be done through increasing vehicle & fuel taxes, parking, registration and other recurring taxes and fees applicable on ICEVs. This could also include, leavy of any more taxes and fees such as carbon/green taxes and congestion fees on ICEVs. Following measures on ICEV dis-incentivisation are proposed based on evaluation of suitable option for STP.

<table>
<tr><th>Proposed Policy Measures for STP</th><th>Examples</th><th>Impact Assessment</th></tr>
<tr>
<td>

- **Increase of Custom Duty for ICEVs**
  Gradual tax increase till 2050

	2024	2025	2030	2035	2040	2050
ICE 2W Personal	20%	15%	18%	21%	25%	30%
ICE 2W Commercial	20%	15%	18%	21%	25%	30%
ICE 3W	10%	15%	18%	21%	25%	30%
ICE 4W Personal	10%	15%	18%	21%	25%	30%
ICE 4W Commercial	10%	15%	18%	21%	25%	30%
ICE Buses	5%	5%	8%	11%	15%	30%

- **Increase of VAT for ICEVs**
  Gradual tax increase till 2050

	2024	2025	2030	2035	2040	2050
ICE 2W Personal	15%	15%	18%	21%	24%	27%
ICE 2W Commercial	15%	15%	18%	21%	24%	27%
ICE 3W	15%	15%	18%	21%	24%	27%
ICE 4W Personal	0%	15%	18%	21%	24%	27%
ICE 4W Commercial	0%	15%	18%	21%	24%	27%
ICE Buses	0%	7.5%	11%	14%	17%	20%

If VAT is not allowed to be increased beyond 15%, then this addition of tax can be reflected in additional customs duties or special taxes.

</td>
<td>

Why: Discourage ICEVs use through increase in its cost of acquisition; and thereby improving EVs parity.

Basis to suggested measures:

- **Regional Example**:
  - **Rwanda:** Ban the sales of ICEVs by 2040
- **Global Example**:
  - **Malaysia:** Import duty is increased to 30% for ICEV and exempted EV from variety of taxes
  - **Thailand**: Custom duty of 80% is applicable on imported ICEVs while, the duty on import of EVs was reduced up to 40% alongside reduction in other taxes applicable on import of EVs.
- **Analysis:** Combination of Tax disincentives will lead to increase cost of ICEVs (both purchase and operational costs) and discourage their use; and help EVs achieving price parity (both TCO and purchase price) with ICEVs

</td>
<td>

Increase in Custom Duty will result in additional tax to Government, but this will also result in reduction in ICEV sales. This will cumulatively result in reduced government tax collection linked to the sales of vehicles and fuel.

Net Cumulative Tax loss to Government from Sale of ICEV for the period of 2024-50 is estimated to be 5 Mn USD.

</td>
</tr>
</table>

4.1.3 Financial Disincentives for Fossil Fuels

The ICEVs are contributing to the emissions and discouraging their purchase and use would help shifting focus from ICEVs to EVs and make EVs favorable product. This could be done through increasing vehicle & fuel taxes, parking, registration and other recurring taxes and fees applicable on ICEVs. This could also include, leavy of any more taxes and fees such as carbon/green taxes and congestion fees on ICEVs. Following measures on ICEVs are proposed based on evaluation of suitable option for STP:

<table>
<tr><th>Proposed Policy Measures for STP</th><th>Examples</th><th>Impact Assessment</th></tr>
<tr>
<td>

- **Increase of taxes on Gasoline**

Addition of Green Cess *(as shown in table below);* and this pool of fund to be used only for EVs growth, incentives and market development.

	Unit	2024	2025	2030	2035	2040	2045	2050
Green Cess (New addition)	% of CIF	0%	0%	3%	5%	7%	10%	12%
	USD/Litre	0.00	0.00	0.03	0.06	0.10	0.16	0.22

- **Increase of taxes on Diesel**

Addition of Green Cess *(as shown in table below);* and this pool of fund to be used only for EVs growth, incentives and market development.

	Unit	2024	2025	2030	2035	2040	2045	2050
Green Cess (New addition)	% of CIF	0%	0%	3%	5%	7%	10%	12%
	USD/Litre	0.00	0.00	0.04	0.07	0.11	0.18	0.25

</td>
<td>

Why: Discourage ICEVs use through increase in fossil fuel cost

Basis to suggested measures:

- **Global Example**:
  - **Norway:** Imposed carbon tax on fossil fuels, to discourage their use and encourage cleaner alternatives like electricity. In 2023, the tax rates are 70 and 60 USD per ton of CO2 for petroleum and domestic aviation sector respectively.
- **Analysis:** Fossil fuel tax increase will lead to increase operational cost for running ICEVs and hence discourage their use; and help EVs achieving price parity better.

</td>
<td>

Increase in fuel taxes will result in additional taxes for the government. However, there is also reduction on ICEV sales, and hence lower fuel consumption and associated taxes.

Consequently, this will cumulatively result in reduced government tax linked to the sales of fuel.

Net Cumulative Tax loss to Government from Sale of Fuel for the period of 2024-50 is estimated to be 91 Mn USD.

</td>
</tr>
</table>

4.1.4 Easy Access to EV Financing

To ease purchase of EVs by users, finance need to be made easily accessible and at low-interest rates from banks and other financial institutions, both for individuals and commercial fleets.

Proposed Policy Measure for STP	Examples	Impact Assessment
• **Easy access to finance and lowering cost of finance to EV users** to make EV purchases attractive and help bring parity with ICEV counterparts.	**Why:** To make EV purchase attractive for end users and boost adoption Basis to suggested measures: • **Global Example**: - **India:** Potential financing measures identified are, priority-sector lending and interest-rate subvention, better partnerships between OEMs and financial institutions by providing product guarantees and warranties, developed and formal secondary market can improve the resale value of EVs and improve their bankability.	This process and mechanism will allow easy and attractive retail (B2C) and commercial fleet (B2B) financing for EVs at preferential lower interest rates. Various banks in STP like BISTP, Ecobank, Afriland First Bank, BGFI bank, Energy bank, Banco Equador, and Commercial Banks are already offering finance to ICEVs at 15% - 17% interest rates.

4.1.5 Ease of Registration and Preferential Access to Roads and Parking

Along with Financial incentives, the non-financial incentives play a pivotal role especially in making process easier, accessible, and making an enabling environment for EV adoption. For EVs the registration, access to parking with charging would be most essential from administrative and usefulness of the facilities.

Proposed Policy Measures for STP	Examples	Impact Assessment
• **Ease of process of imports, registration, permits**, transfers and ownership **of EVs** (as per new/ updated vehicle classification system) • **Green or suitable plate for EVs** for easy identification	**Why:** To encourage EV adoption and induce preferential shift towards EVs Basis to suggested measures: • **Regional Example** - **Rwanda:** Green license plate to allow preferential parking for EVs and free entry into any future congestion zones. Establish restricted zones where only green vehicles can have access**.** • **Global Example**: - **Ireland**: reduced tolls by more than 50% for BEVs from July 2018 to 2022. Ministry of Transport announced the incentive to attract more drivers to EVs (PHEVs, BEVs,), and is administered by Transport Infrastructure Ireland (TII).	This enables end-users and make EVs an attractive alternative to ICEV counterparts
• **Preferred (or discounted) access to EVs** in public parking spaces (off-street and on-street) **and also appropriate road usage charges/ tolls.** - This support could be tied to EV penetration - say until EVs annual registrations reach 25% of the total, or to a period say until 2035.		

4.1.6 Mass Awareness on EVs

e-Mobility is an evolving sector in STP and a huge gap lies in awareness about EV technology overall. Introducing e-Mobility would require user confidence to own and operate EVs. Strategic awareness programs through social, print, and other digital media, advertisements would help general public knowing more aspects of EV technology, benefits, government initiatives, incentives, financing schemes and make EVs attractive to purchase. This may also include the publicity of the Bus electrification, fleet electrification by government. News bulletins and articles on shaping e-Public Transport and Government Fleet in STP for greater awareness and making EVs visible in STP.

Proposed Policy Measure	Examples	Impact Assessment
• **EV Mass Awareness Programs** for - End-users - Businesses - Government Agencies	**Why:** To raise awareness and help reducing apprehension for EVs adoptions Basis to suggested measures: • **Global Example**: - **Laos PDR:** Formulated an EV National Communication strategy to raise awareness about the benefits of EV adoption among various stakeholders, including consumers. This strategy involves a series of activities designed to engage stakeholders and disseminate information effectively. Also, they are shortly releasing EV Online Platform/Website for public having useful FAQs, TCO calculator, EV providers contact, News, charging infrastructure, and more.	To raise awareness and help reduce apprehension about EVs adoptions

4.2 Supply-side Policy Measures to build Local EV Ecosystem

Land Transport in STP is entirely dependent on imported vehicles (98% of imports from Japan, China, Germany, France, and Portugal). The same trend is likely to continue for new and used EVs adoption in STP. However, a local supply chain for import, servicing, maintenance, spare parts, and other services would be necessary for EVs to hold the roots and grow the market in STP. The recommended supply side Policy measures, summarised below, focus on enabling EV Market and strengthening of local supply chain as these are most important components to sustain any given market.

4.2.1 EVs Classification and Standards for EVs, Chargers, Batteries

EVs necessitate numerous foundational components, including Power Electronics, Electric Machines, Motors, Vehicle spare parts, and Batteries, which encompass various chemistries like LFP, NMC, LTO within the Lithium-ion segment, alongside alternative materials. These components are in a constant state of evolution to meet diverse functional requirements. While EVs have benefited from favorable policies such as tax exemptions and fee waivers in STP, the absence of a clear classification system and segmentation for different vehicle types (2W, 3W, 4W) and their intended usage (private vs. commercial) hampers the potential for segment-specific incentives and policies. Consequently, the establishment of EV Classification and Quality and Safety Standards, along with the development of charging infrastructure and other pertinent components, is imperative to ensure the quality, safety, efficiency, and interoperability of EVs, chargers, and batteries.

Proposed Policy Measures for STP	Examples	Impact Assessment
• **Revision of vehicle classification system to differentiate xEVs** Provide separate classification for passenger and freight transport and different applications. - Classification of xEVs to be based on battery energy capacity (kWh) and traction motor size (kW) as counter to engine capacity (cc) for ICEVs. (For Hybrid vehicles both criteria of ICEVs and BEVs will be applicable) - Classify individual technologies separately based on their power train, fuel type,	**Why:** To maintain and govern manufacturing, import, service quality of EVs, Charging Equipment, Batteries, and other spare parts. Also, to ensure standardized practices and safety across the country. **Basis to suggested measures:** • **Regional Example** - **Kenya:** Kenya Bureau of Standards (KEBS) have adopted	Accommodating several types of EVs and any other future vehicle technology, improve ease of record keeping and any further transactions

Proposed Policy Measures for STP	Examples	Impact Assessment
vehicle-emissions, manufacturing year, etc. and maintain strong dataset of all vehicles entering into the country and getting registered.	EVs standards in 2019. Up until now, a total of 24 standards have been developed and adopted, covering specifications and testing procedures for safety aspects as well as performance and power consumption elements • **Global Example:** - **China:** EV Manufacturers are mandated to comply with design, development, production, after-sale services, and other capabilities of EVs and EVs should satisfy all technical standards and pass safety inspections before entering into the market	
• **Formulation of EVs, Batteries, and Charging - Quality and Safety standards for safe import, local production, in-country operations, spare-parts, repairs and disposal** - Adopt suitable International standards and guidelines (like IEC, UNECE and others well harmonised with African Regional Communities) for New, pre-owned and retrofit EVs, and their required sub-systems like batteries, chargers, etc - Exporting country type approval certificates meeting STP defined EV standards to be allowed for imports at customs with appropriate inspections - Only approved quality EVs and systems to be eligible for Govt. incentives.		Following defined standards for EVs will ensure quality imports and high performance of EVs.
• **Formulation of National standards for EVs charging** for both AC and DC types across vehicle segments, locations and configurations (fixed and battery swapping). This to be well harmonised with African Regional Communities. • **Public charging:** Type-2 for AC charging (3.7/ 7.2/ 22 kW); CHAdeMO and/or CCS Combo 2 for DC charging (30/ 50/100 kW) given high mix of respective Japan and EU vehicle imports.	**Why:** Adopting clear charging standard for AC and DC charging will help build standardized charging infrastructure across the country, which in turn will attract users to shift to xEVs. **Basis to suggested measures:** • **Regional Example** - **South Africa**: Primarily revolves around the Type-2	Defined charging standards will allow compatible xEVs to be imported and building of right interoperable public charging infrastructure; thereby addressing to range anxiety from use of xEVs.

Proposed Policy Measures for STP	Examples	Impact Assessment
Public EV charging should be designed for **interoperability** (easy access to any EV charging platform at any time to charge an electric vehicle, including availability of and access to charging stations, hardware and software systems, connector capabilities, etc.) The numbers, types, mix and tariffs of charging can be left open for market forces to decide. • **Home/ work charging:** Standard 3 pin AC plug for slow AC charging. Compact smart charger recommended for utility load and time of use (TOU) management.	Mennekes connector, commonly used for both AC and DC charging. Additionally, CCS is gaining popularity for fast charging. • **Global Example**: - **India**: Developed a guideline for charging infrastructure and standards. For public charging station, Bharat standards are adopted for slow and moderate charging and CCS and CHAdeMO is adopted for fast charging.	

4.2.2 Fiscal Incentives for Chargers

Demand-side fiscal incentives for EVs seek to reduce purchase cost of EVs to the end-users. High charging infrastructure capital cost and its lower utilization, specially in early market development period, pose viability challenge to businesses to invest in it, risking EV adoption. Below supply-side fiscal measures focus on reducing capital cost of EV chargers.

Proposed Policy Measures for STP	Examples	Impact Assessment
• **Reduction of Custom Duty on Public and Fleet Chargers** - Tax exemption till 2035; and further resumed to normal • **Reduction of VAT on Public and Fleet Chargers**	**Why:** To encourage development of public charging infrastructure, attract more private investments, and improve charging business viability Basis to suggested measures: • **Regional Example**	These concessional taxes offered to EV chargers are leading to a cumulative loss for the government from 2024 to 2050, amounting to 0.36 Mn USD compared to no exemption. This will encourage private, public, and

Proposed Policy Measures for STP	Examples	Impact Assessment
- Tax exemption till 2035; and further resumed to normal	- **Rwanda:** EV, spare parts, batteries, and charging station equipment are exempted from import and excise duties. All of these would also be treated as zero. • **Global Example** - **India:** Commercial public EV charging stations for 2 wheelers, 3 wheelers, cars and buses are eligible for 25% capital subsidy on equipment/machinery (limited up to INR 1 million per station) for first 250 commercial public EV charging stations. - **India**: FAME II subsidy for establishment of public charging stations total 11 Mn USD.	utility companies to set up EV public charging stations.
• **Capital Subsidy on Public and Fleet Chargers** - **AC chargers:** 25% of cost till 2035 and then no subsidy after 2035 - **DC chargers:** 50% of cost till 2035 and then no subsidy after 2035		These Capital subsidies offered to EV charger will result in cost to Government. This is estimated as 1.8 Mn USD of cumulative cost for the period of 2024-50.

4.2.3 Easy and Affordable Access to Land & Electricity for Public Charging

STP has absence of a proper land information system and a weak land governance framework. Despite experiencing various land tenure structures since independence in 1975, the country lacks efficient facilitation mechanisms. Therefore, ensuring timely provisioning of land and electricity connections for public charging stations, along with establishing clear guidelines and processes for involved stakeholders like city councils and local electricity distribution utilities, can accelerate investments and the setup of necessary charging infrastructure. This measure would streamline processes, reduce bureaucratic hurdles, and encourage investment in the development of EV charging infrastructure in STP.

Proposed Policy Measures for STP	Rationale	Impact Assessment
• **Low-cost land allotment on long lease for public and fleet charging**	**Why:** To encourage development of public charging infrastructure and improve business viability for charging operator Basis to suggested measures:	This supports land identification and enables access to Govt. land on low for establishment of public charging infrastructure.

Proposed Policy Measures for STP	Rationale	Impact Assessment
	• **Regional Example** - **Rwanda:** Rent free land for charging stations on land owned by the government	
• **No additional connection and demand charges for EV Charging** in first 5 years for public and fleet charging stations • **Discounted EV electricity tariff for public and fleet charging** • **Differential Tariff system to reflect** time-of-day (TOD) or time-of-use (TOU) for Grid load management to differentially charge peak and off-peak charging times.	**Why:** To lower the operational cost of EVs charging and make them attractive as economic mode of transport for end-users Basis to suggested measures: • **Regional Example** - Rwanda**:** Electricity tariffs for charging stations to be capped at the industrial tariff. This means that charge point operators will be billed at close to USD 10 cents/kWh instead of close to 20 cents/kWh - **India**: There is no specific uniform discount rate on EV charging tariffs, but in almost all states, it is less than commercial electricity tariffs. This tariff varies across all states based on what the state has set. (Also, HT and LT rates are set differently across all states). Additionally, there are some states where demand charges are exempted, or there are no or reduced wheeling charges for captive or RE power sourcing.	This will lower the operational electricity cost of EV charging to users.

4.2.4 Grid Integration for EVs and RE Scale-up

Reliability of the power infrastructure is a major concern, with frequent power cuts posing a challenge to uninterrupted EV charging. In the future, increased load due to EVs, without corresponding upgrades to the grid capacity, could exacerbate power cuts, impacting both EV users and the general populace. Therefore, Grid Management initiative is important to enable smooth, reliable, seamless electricity supply to end-use through ensuring grid stability and provision of adequate and superior quality infrastructure. Implementing this measure is crucial to boost end-user confidence to operate EVs by means of adequate access and reliable power supply. This also focuses

on reducing dependency on fossil fuel and integrating and increasing more RE share in the energy production to offset the diesel/fossil fuel generated electricity.

Proposed Policy Measures for STP	Examples	Impact Assessment
• **Expansion of Grid & Off-Grid Infra (and also Power Quality)** additionally over and above normal load-growth rates (without EVs) to accommodate additional peak load and electricity unit requirements for EVs charging, as appropriate for small island requirements	**Why:** To provide and improve access to electricity and improve reliability and reduce dependency on fuel imports for conventional fossil power generation. EVs and their battery packs have potential to act as storage for RE and reducing grid upgradation capex. **Alignment to National Policies**, regulation, targets and priorities as stated under National Renewable Energy Action Plan (NREAP). Basis to suggested measures: • **Regional Example** - **Rawanda:** Integrated solar PV system to a grid for the EV charging, resulted in reliable, affordable, and sustainable energy access. • **Global Example:** - **India:** Central Electricity Authority (CEA) has suggested measures to standardize and ensure the interoperability of batteries to facilitate the integration of EVs with the grid	EV charging is expected to add 6.3% of peak load and 45 Mn units in 2050 over and above non-EV load growth. This to be appropriately added to grid upgradation planning and investments by the Utility. Overall grid augmentation will improve reliable energy supply and access for both normal consumption and EV charging. In that way, end-users will be able to put higher confidence in going for purchase of EVs.
• **Formulation of Guidelines and Standards for Grid and Chargers Interconnectivity** across all locations; including future facilitation of smart and bi-directional charging (V2G and V2X), as appropriate for small island requirements		This will improve grid stability from chargers' connectivity and RE integration.
• **Renewable Energy scale-up to meet country targets and increase integration with EVs charging** Increase RE mix into the grid and keeping grid stable with appropriate BESS additions and network management best practices.		RE mix of 100% by 2050 will lead to GHG cumulative savings of 0.45 Million Tons from use of EVs for the period of 2024-50. *(Refer Section 5.2 Impact on CO2 Emissions).*

4.2.5 Stricter Vehicle and Fuel Emissions Standards for ICEVs

STP is a net importer of vehicles like almost all other countries in Africa. Vehicles' countries of import are China, South Africa, Germany, France, Portugal, and Japan. It does not undertake type approval testing but only control via vehicle import inspection & registration process and enforcing Certificate of Compliance (COC) from exporting OEMs. The imported new and pre-owned vehicles entering STP typically has lower Euro 2 or Euro 3 vehicle (tail-pipe) emissions standard.

STP would need a big leap to shift to the improved vehicle emissions standard, aligned with global standards such as EURO V or VI to cut down vehicle emissions significantly. There must be matching fuel standard as well. This is detailed in *Fuel Economy Roadmap Report.*

<table>
<tr><th>Proposed Policy Measures for STP</th><th>Examples</th><th>Impact Assessment</th></tr>
<tr>
<td>
• Stricter Vehicle emissions standard and enforcement for ICEVs
Below is minimum proposed vehicle emissions standard for adoption from the Fuel Economy Roadmap Report:
<table>
<tr><th></th><th>2024</th><th>2030</th><th>2035</th></tr>
<tr><td>BAU</td><td>EURO IV</td><td>EURO IV</td><td>EURO V</td></tr>
<tr><td>BTB</td><td>EURO IV</td><td>EURO V</td><td>EURO VI</td></tr>
</table>
• Stricter Fuel standard and enforcement for Gasoline & Diesel
STP has no refinery capacity of its own, and it imports its fuel supply from Angola, Togo, and Nigeria who in turn import from Netherlands. Below is minimum proposed vehicle emissions standard for adoption from the Fuel Economy Roadmap Report:
<table>
<tr><th></th><th>2024</th><th>2028</th><th>2035</th></tr>
<tr><td>BAU</td><td>EURO IV</td><td>EURO IV</td><td>EURO V</td></tr>
<tr><td>BTB</td><td>EURO IV</td><td>EURO V</td><td>EURO VI</td></tr>
</table>
-
</td>
<td>
Why: Discourage and phase-out low-performing ICEVs from the system.

Stricter vehicle emissions and fuel standards would also increase cost for ICEVs and fuels and thereby help improve faster TCO parity with EVs.

Basis to suggested measures:

• Regional Example:
- Rwanda: Enforced EURO IV emission standards since 2019 to discourage the purchase of older polluting vehicles
• Global Example:
- Europe: Launched Euro 6 standards since 2017 to shift to stricter emission norms and reduce pollution
</td>
<td>Implementation of the proposed vehicle emissions and fuel standards will help clean local air with simultaneous increased EV use. Cumulative air pollutant saving from the period of 2024 to 2050 for PM, NOx and SOx are 172 Tons (28% saving wrt BAU); 2,980 Tons (36% saving wrt BAU) and 31 Tons (10% saving wrt BAU) respectively.</td>
</tr>
</table>

4.2.6 Environmental Safe End-of-life Management for Vehicles and Batteries

The implementation of an Environmentally Safe End-of-life Management for Vehicles and Batteries policy measure in STP is imperative due to several pressing reasons. Firstly, the country exhibits a heavy reliance on vehicle imports, a trend expected to persist with the anticipated adoption of EVs. Consequently, National Fleet has aged significantly, boasting an average age of 22 years. This aging fleet not only suffers from low performance and heightened pollution levels but also lacks standardized measures to uphold vehicle quality, thereby compromising its safety. To address this, a gradual phase-out of outdated vehicles from the National Fleet is essential, coupled with the introduction of low emission or zero-emission alternatives. Presently, STP lacks concrete disposal policies and regulations, exacerbating the challenge of managing automotive waste effectively. Moreover, the country's limited land capacity exacerbates concerns regarding the accumulation of automotive waste, which would further strain waste management efforts. Implementing scrappage guidelines, enforced through stringent disposal norms like Extended Producer Responsibility (EPR) for Batteries, becomes imperative to manage the burgeoning volume of automotive and battery waste, particularly with the advent of EVs.

Proposed Policy Measures for STP	Examples	Impact Assessment
• **Periodic testing and enforcement of End of Life (EOL) of vehicles.** This is detailed in *Fuel Economy Roadmap Report.* - Enforce 15-year vehicle age limit, with inspections and management system. - Give priority to replacing taxis over 20 years with clean car discounts in 2028. • **Vehicle scrappage guidelines**	**Why:** To phase-out old, non-performing and polluting ICEVs from national fleet Basis to suggested measure: • **Regional Example:** - Kenya: Kenya has placed a ban on used passenger vehicles with age exceeding 8 years and/or 150,000 kms • **Global Experience** - India: According to the new policy, commercial vehicles of >15 years and passenger vehicles of >20 years will have to be mandatorily scrapped if they do not pass the fitness and pollution/emission tests	This measure will have following potential impacts: • Faster vehicle renovation thus allowing for usage of vehicles with new technologies and lower emissions. • Less problems of vehicle deterioration and problems caused due to tear and wear and lack of maintenance. • Lowering of air pollution, fuel consumption and also accidents
• **Battery Repurpose and Recycling (with suggestive Extended Producer Responsibility - EPR)** - Design and enforcement of EPR for Lithium and other chemistry battery waste across appliances in STP - Capital subsidy and other support (land, electricity, others) for setting up environmentally safe scrappage and battery re-purpose/ recycling facility.	**Why:** To ensure after life waste-management of battery, material recovery and reuse for sustainable supply chain of EV batteries Basis to suggested measure: • **Global Example:** - China: Government has put the responsibility of battery recycling on the OEMs. Mandate also states that, automakers set up a national network of service stations where car owners can discard or exchange old batteries. Rules further obligate battery makers to standardize their products to facilitate end-of-life recovery	• This would avoid contamination of natural resources from wrong disposal of batteries • This would facilitate establishing price for battery waste, which would act as incentives for users of EVs

4.2.7 Fiscal Incentives for Local EVs and Sub-system Suppliers & Assemblers

Vehicle supply landscape in STP face several barriers, hindering the development of a robust automotive industry. These challenges primarily revolve around the absence of local skilled capabilities, the dominance of imported vehicles, especially those with considerable age, etc. Henceforth, Supply-side financial incentives serve as a catalyst in overcoming barriers by alleviating the capital and operational burdens associated with early EVs and chargers market development and encouraging the participation of sub-system suppliers and assemblers for EV adoption. Such measures could include capital incentives, offering low-cost land allotment, low-cost electricity, and other incentives.

Proposed Policy Measures for STP	Examples	Impact Assessment
• **Fiscal incentives for local EVs and Sub-system suppliers and Assemblers** doing full CBU import, or CKD/ SKD local assembly, or Retrofits, or sub-systems and spare-parts supply and services (for EVs, Batteries, Chargers, Motors, RE, etc.) in form of custom duty and taxes subsidy/ capital subsidy/ interest subsidy/ land and utility subsidy/ etc. Assemblers/ suppliers to be incentivized to grow localization to avail different Government fiscal incentives/ schemes	**Why:** To encourage part local supply chain and capacity build up around EVs ecosystem Basis to suggested measure: • **Regional Example:** - **Rwanda:** EVs, spare parts, batteries, and charging station equipment will all be exempted from import and excise duties. All of these would also be treated as zero rated VAT products and will also be exempt from withholding tax	These incentives would encourage local entrepreneurs to participate actively in building EV ecosystem in STP and mitigate some early market development risks.

4.2.8 Skilling, Capacity Building, and Innovations across EV Ecosystem

The mobility in STP is dependent on imported vehicles, leading to a limited skillset of local EV assembly, retrofitting, etc. Unlike some other African countries experiencing a transition to hybrids, STP lacks a significant hybrid vehicle presence, means that mechanics may not be equipped to handle the unique challenges posed by larger EV batteries (electronic systems and battery handling). With the advent of EVs, there will be significant need for upskilling mechanics to handle sophisticated electronics, larger battery systems and repair & maintenance skills. Therefore, training, capacity building and pilots are aimed at changing the behavioral patterns and moving towards higher acceptability of upcoming new, advanced, and clean technologies, their usage and overall adoption in STP.

Proposed Policy Measures for STP	Examples	Impact Assessment
• Establishment of Industry-Academia EV Centre of Excellence (COE) • Support for EV pilots and Experimentations • Setup EVs Training and Capacity Building ecosystem • Strengthen EV repairs and services across the nation	**Why:** To develop and build necessary skills, knowledge and training mechanisms for adopting and operating EVs. Also, to facilitate necessary human resource and technology developments in EV industry. Basis to suggested measure: • **Regional Example:** - **Rwanda:** The government is planning to pilot the use of electric buses, while in Uganda, Kiira Motors wants to manufacture solar-powered buses • **Global Example:** - **India**: Under make in India initiative, the government has decided to fund up to 60% of the research and development (R&D) cost for developing indigenous low-cost electric technology that will help power 2W, 3W and commercial vehicles operating in public spaces	Skilling, capacity building and innovations are aimed at changing the behavioral patterns and moving towards higher acceptability of upcoming new, advanced, and clean technologies, their usage and overall adoption in STP.

5 Impact Assessment

This section analyses the impact of e-Mobility scale-up adoption over years on Fuels, GHG, Air and Grid. Later in *Section 6.2 Proposed Institutional Structure*

To ensure smooth implementation of e-Mobility Policy Measures of the above-mentioned category, roles have been demarcated at the policy level to establish clear ownership and different execution responsibilities. Even the policy are broken down to specific thematic area for clear role establishment. Table 6 shows the institutional structure for each policy measure, as built in with consultation from stakeholders.

Table 6 Government Budget Impact and Requirements for EVs Growth

		e-Mobility Policy Measures	Primary Responsibility of Planning, Legislation and Execution	Secondary Support Responsibility	Regulator
Demand-side Policy Measures to increase EV Adoption					
	1	**Financial Incentives for EVs**	Ministry of Finance/ Directorate of Finance		
	2	**Financial Disincentives for ICEVs**	Ministry of Finance/ Directorate of Finance		
	3	**Financial Disincentives for Fossil Fuels**	Ministry of Finance/ Directorate of Finance		
	4	**Easy Access to EV Financing**	Ministry of Finance/ Directorate of Finance		Central Bank
	5	**Ease of Registration and Preferential Access to Roads and Parking**	MIRN/ INTT		
	6	**Mass Awareness on EVs**	MIRN/ DGRNE		
Supply-side Policy Measures to build Local EV Ecosystem					
	7	**EVs Classification and Standards for EVs, Chargers, Batteries**	DGRNE	Directorate of Industry (SENAPQ), INTT, AGER	
	8	**Fiscal Incentives for Chargers**	Ministry of Finance/ Directorate of Finance		
	9	**Easy and Affordable Access to Land & Electricity for Public Charging**	Municipal Councils		President Office
	10	**Grid Integration for EVs and RE Scale-up**	DGRNE	EMAE	AGER
	11	**Stricter Vehicle and Fuel Emissions Standards for ICEVs**	Ministry of Economy/ Directorate of Industry	DGRNE	
	12	**Environmental Safe End-of-life Management for Vehicles and Batteries**	Ministry of Environment/ DAAC		Ministry of Environment
	13	**Fiscal Incentives for Local EVs and Sub-system Suppliers & Assemblers**	Ministry of Economy/ Directorate of Industry (SENAPQ)		
	14	**Skilling, Capacity Building, and Innovations across EV Ecosystem**	Ministry of Work	Ministry of Education	

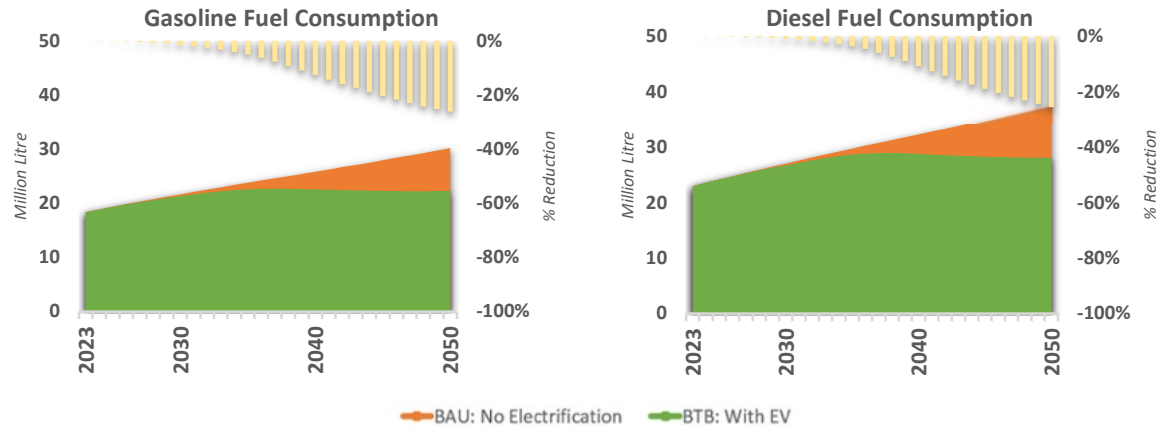
Government Budget Requirements, the Govt. Budget requirements to support and grow e-Mobility in STP is also estimated.

5.1 Impact on Fuel Consumption

The EV adoption will reduce the consumption of both gasoline and diesel fuels. As per the projections, the annual requirement for gasoline may fall by 0.3 Mn liters in 2030, and this gap may widen to 8 Mn liters in 2050. Similarly, the demand for diesel may decrease by 0.28 Mn liters in 2030 which can widen to 10 Mn liters in 2050 as shown in Figure 16. However, this reduction in fuel demand will be compensated by the increase in electricity demand. Therefore, the utility grid needs to be upgraded to meet the power demand from EVs charging. Details are given in *Section 0*

Impact on Electric Grid.

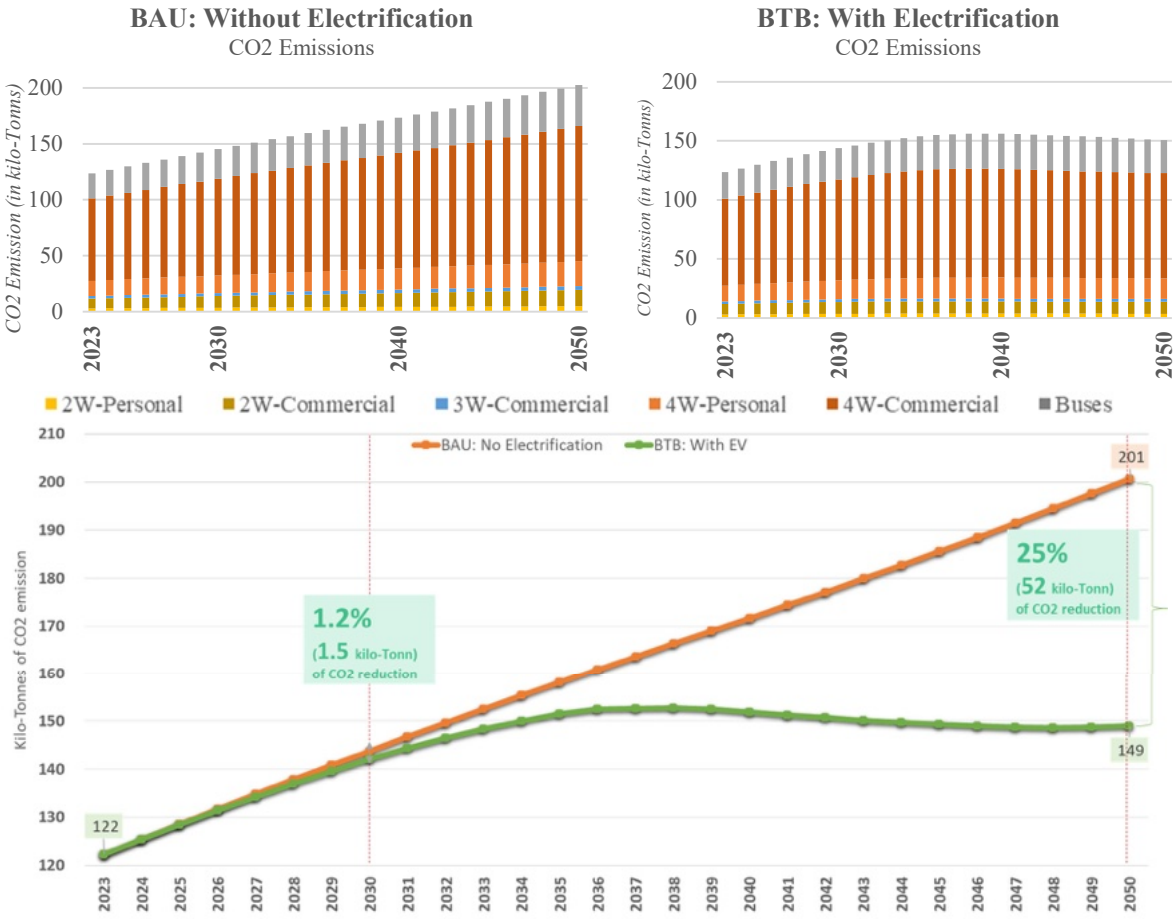
Figure 16 Gasoline and Diesel Fuel Consumption - BAU vs. BTB Scenario



5.2 Impact on CO_2 Emissions

As STP economy has grown over the years, the no. of vehicles on the road has also increased. As a result, the energy consumption by vehicles has also increased. The major sources of CO_2 in the transport sector are 4W – Commercial (60%), followed by Buses (18%) and 4W – Personal (11%). As per the pManifold's developed emission model, under BAU scenario, emissions from the domestic transport may reach to 201 kt- CO_{2eq} in 2050 from 123 kt- CO_{2eq} in 2024 as shown in the Figure 17.

Figure 17 Combined All Transport CO_2 Emission - BAU vs. BTB Scenario



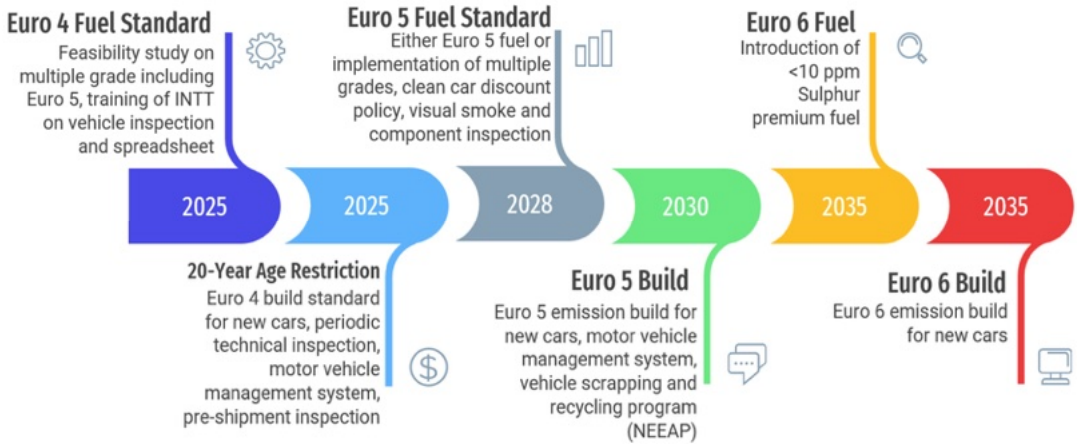
5.3 Impact on Air Pollutant

STP sees majority import of old used vehicles, and there is no data keeping of vehicle emissions standards of registered vehicles. Hence, to estimate the air-pollutant emissions, the following assumptions are made in BAU Scenario:

- Euro 4 norms for the year 2024 to 2034
- Euro 5 norms for the year 2035 to 2050

For BTB Scenario, Option-1 in the proposed *Fuel Economy Roadmap Report* is assumed. This proposes Euro 4 fuel as the minimum standard for gasoline and diesel in STP by 2025, Euro 5 by 2028 and Euro 6 by 2035 as shown in Figure 18.

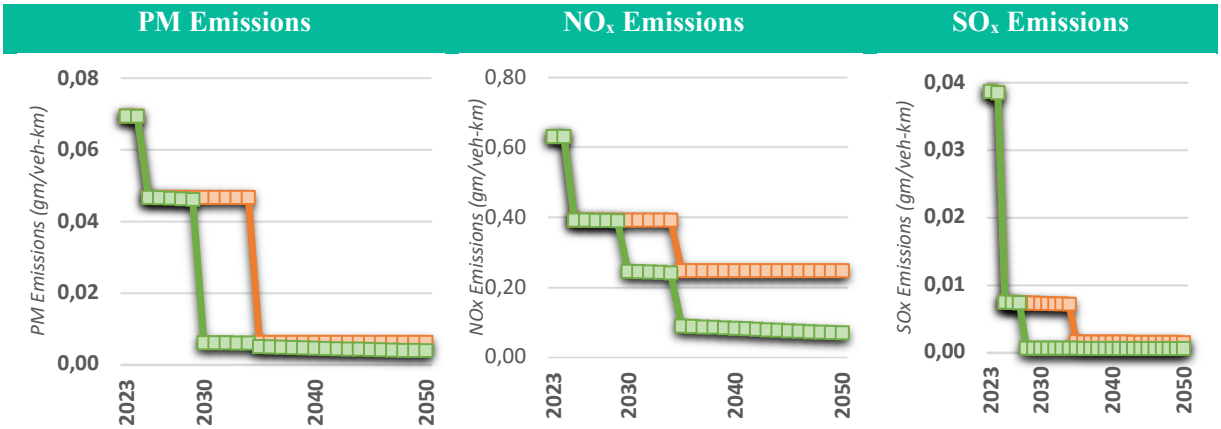
Figure 18 Fuel Economy Roadmap Recommendations (Option-1)

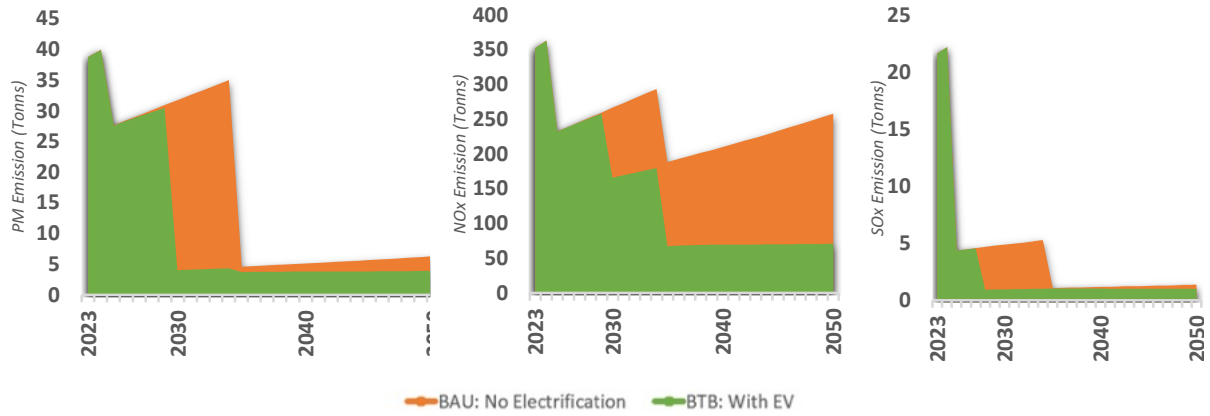


The implementation of the above vehicle emission standards will be helpful in improving the air quality and reduce the indirect economic impact substantially over time. The PM, NO_x and SO_x emissions trend for the year 2024 to 2050 is shown in Figure 19. For 2050, in BTB Scenario,

- PM emission is reduced to 0.004 g/veh-km from 0.07 g/veh-km. This is reduction of ~95% when compared with base year 2024.
- NO_x emission is reduced to 0.07 g/veh-km from 0.63 g/veh-km. This is reduction of ~90% when compared with base year 2024.
- SO_x emission is reduced to 0.0004 g/veh-km from 0.04 g/veh-km. This is reduction of ~90% when compared with base year 2024.

Figure 19 Combined All Transport Air Pollutants Emissions – BAU vs. BTB Scenario





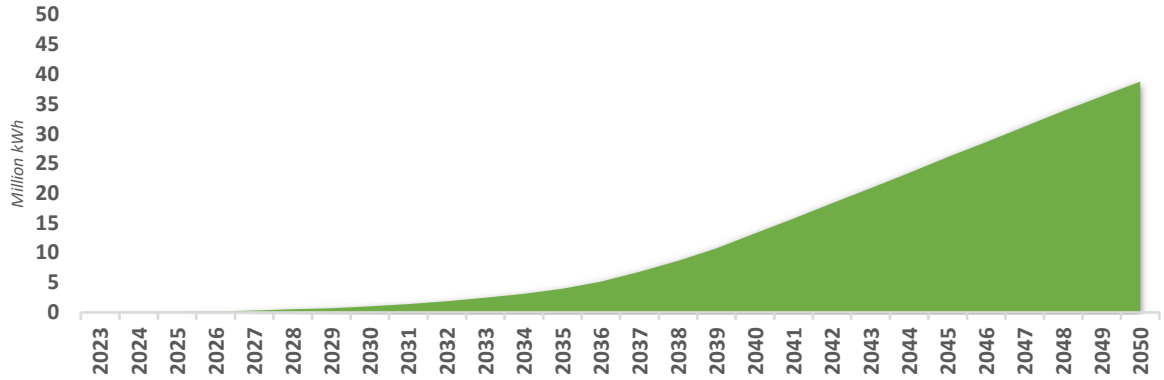
5.4 Impact on Electric Grid

With the increase in EVs adoption, the annual requirements for gasoline and diesel will reduce. This reduction in fossil fuel demand will be compensated by the increase in electricity demand, and with rising RE mix, this electricity can become cleaner.

EVs Charging Electricity Requirements

The projected electricity demand curve for the period 2024-2050 is shown in Figure 20.

Figure 20 Electricity Impact from EVs Charging

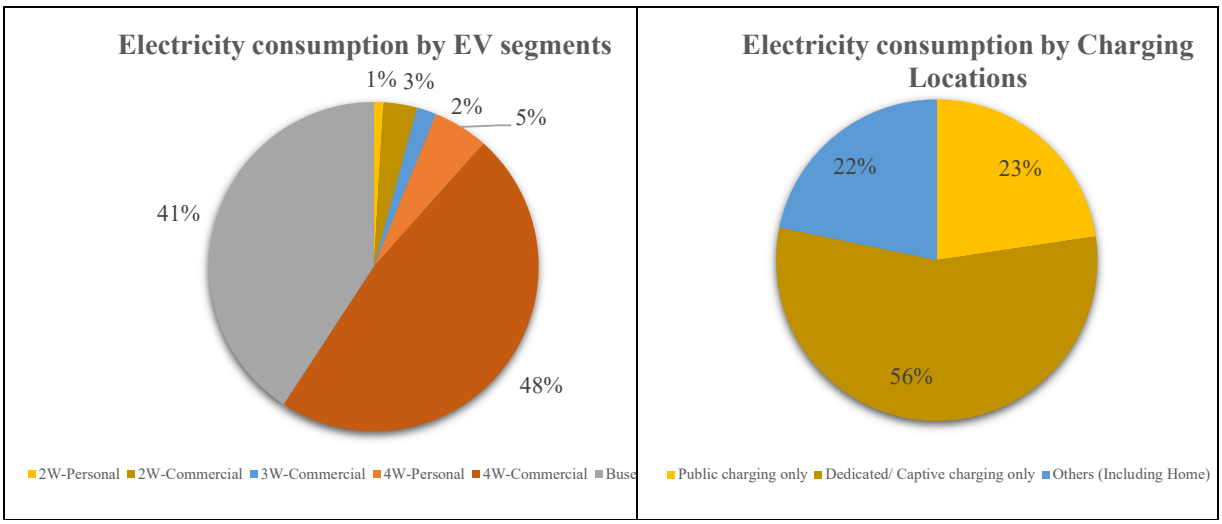


It is estimated that if STP achieves 100% annual EV sales target by 2050, approx. 39 million units of electricity will be required to charge the EV across different locations (home/ public/ workplace/ commercial). This is expected to add 6.3% of peak load over and above non-EV load growth. Therefore, the utility grid needs to be upgraded to meet the rise in power demand expected from the EV adoption path.

As of 2050, charging electricity share of e-4W Commercial (48%) is highest followed by e-Buses (41%) as shown in Figure 21. In terms of charging models, Home and Office charging are

estimated to have the highest share (22%), followed by dedicated/ captive (56%), and Public Charging (23%), measured in terms of charging electricity consumed.

Figure 21 Electricity Consumption by EV Segments and Charging Locations (2050)



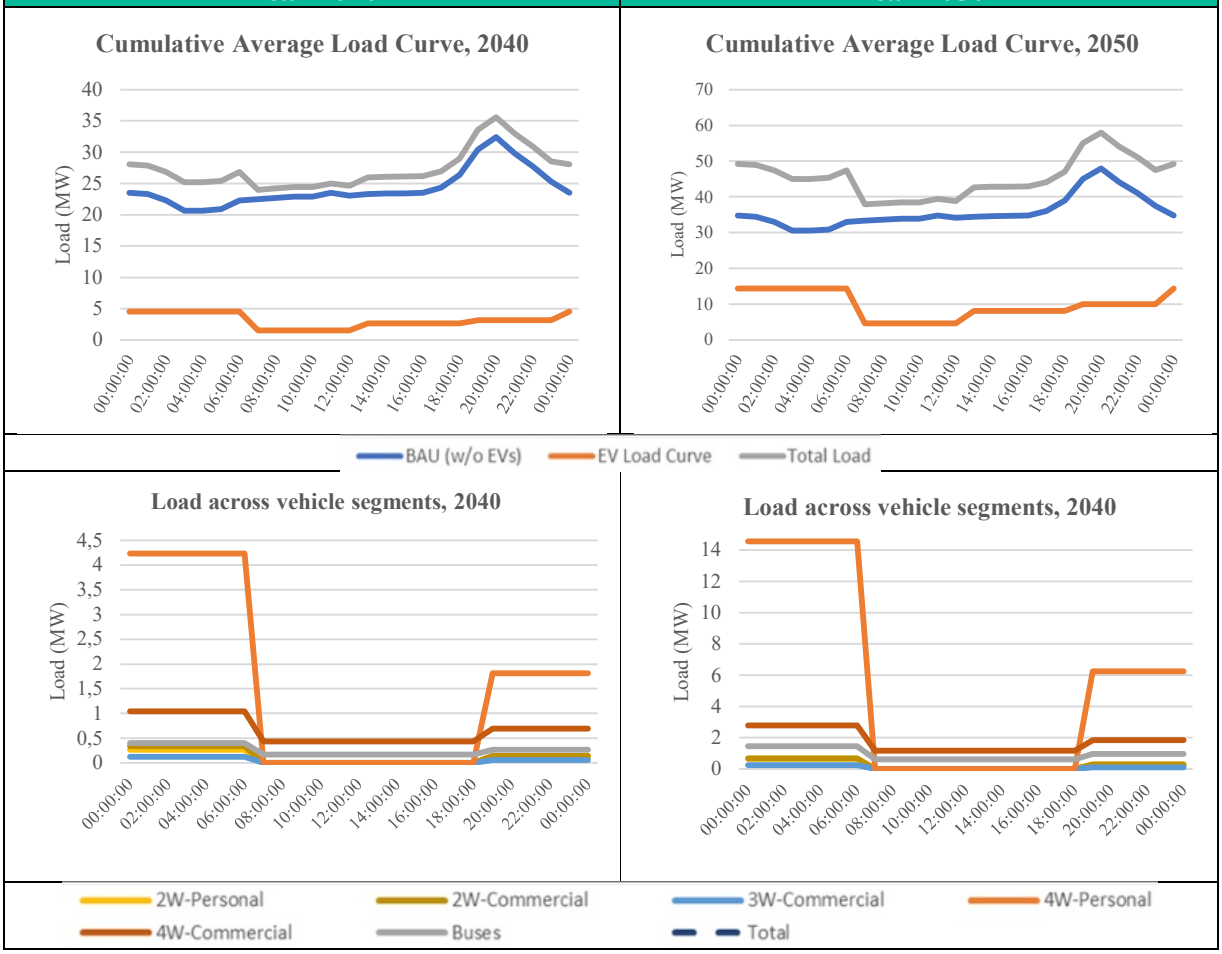
EVs Charging Peak Load Requirements

The estimated EV charging load in STP is projected to be approximately 0.9 MW, 10.2 MW, and 32 MW, contributing to peak loads of 0.3 MW, 3.9 MW, and 12.4 MW in 2030, 2040, and 2050, respectively. This translates to an EV peak load impact of about 0.4%, 2.6%, and 6.3% in addition to the peak load without EVs.

Table 5 illustrates the estimated national-level load curves for: 1) BAU (without EVs); 2) BTB (with EVs); and 3) Combined load curve, for the years 2030 and 2050. This increase in peak load can be accommodated through a modest enhancement in the existing annual generation capacity growth rates, from 3.9% to 4.7%. Further optimization of generation capacity can be achieved through improved generation plant load factors (PLFs) and appropriate batching across different fuel types.

Future grid upgrades in STP should consider this impact in their planning. The peak power impact may be more pronounced at the local distribution transformer level, depending on the types of EV connections and charging schedules. Adoption of smart-charging hardware, appropriately integrated with the grid and utilizing Time-of-Use (ToU) tariffs, can facilitate grid peak shaving and optimization.

Table 5 Peak Load Impact from EVs Charging

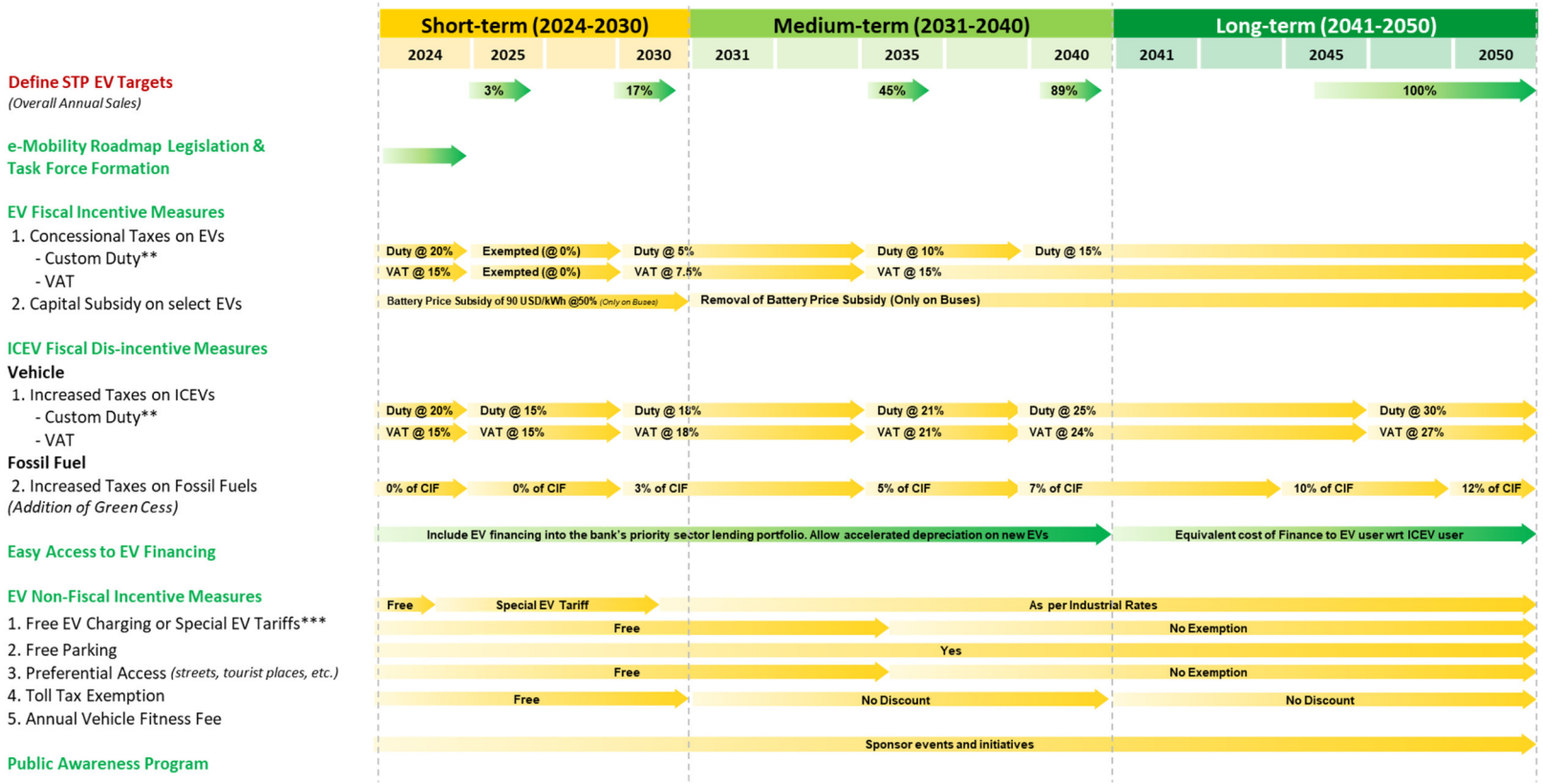
Year 2040	Year 2050
	

6 e-Mobility Roadmap

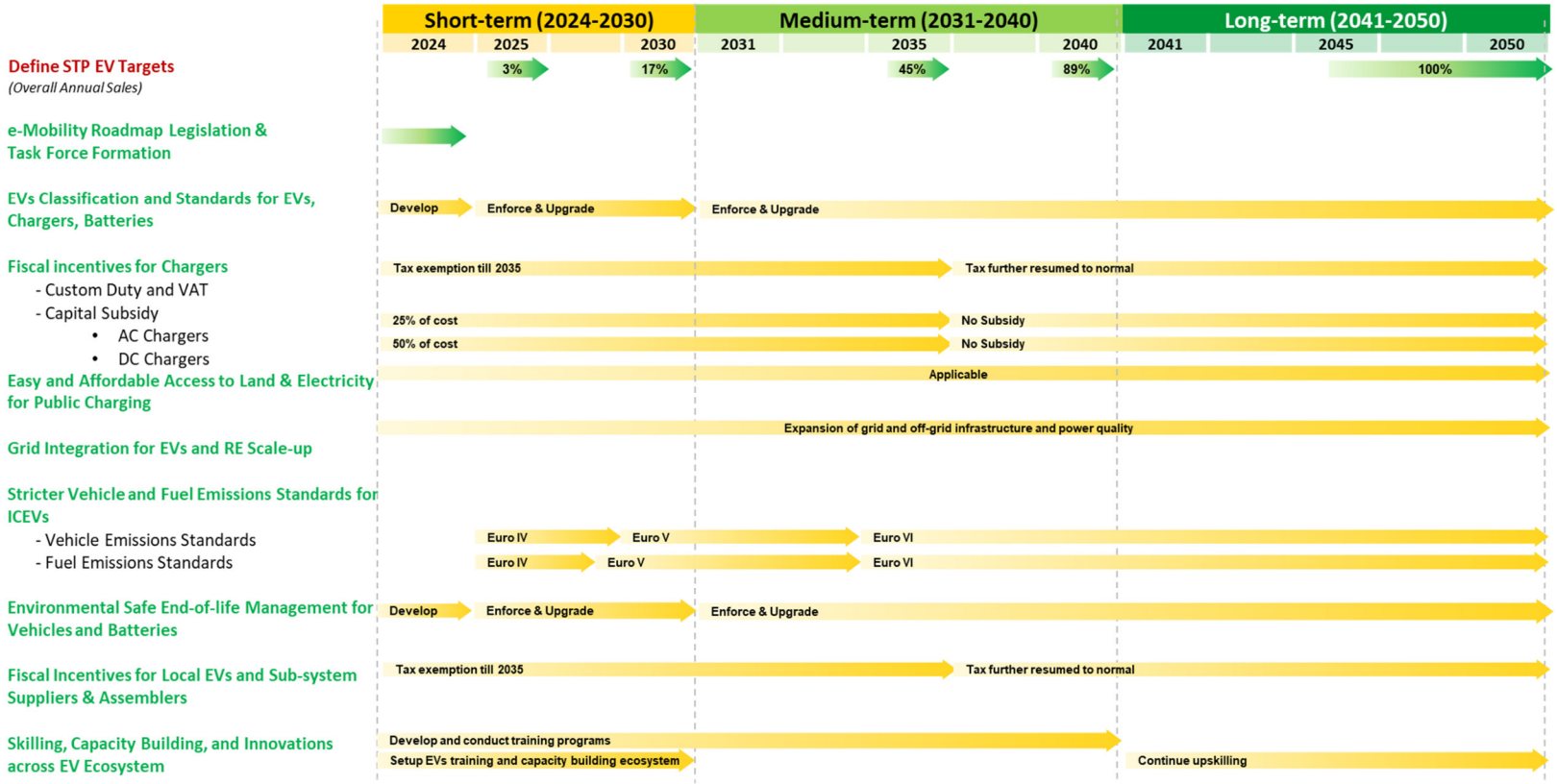
e-Mobility Roadmap summarizes list of policy measures including target setting, demand-side and supply-side measures and their appropriate action timelines till 2050. It covers the Government Budget impact and requirements to drive active e-Mobility market development and sustained growth.

6.1 Implementation Plan

Demand-Side Policy Measure: The recommended Demand-side Policy measures for EV adoption along with implementation timelines are summarized as follows:



Supply-Side Policy Measure: The recommended Supply-side Policy measures to build Local EV Ecosystem along with implementation timelines are summarized as follows:



6.2 Proposed Institutional Structure

To ensure smooth implementation of e-Mobility Policy Measures of the above-mentioned category, roles have been demarcated at the policy level to establish clear ownership and different execution responsibilities. Even the policy are broken down to specific thematic area for clear role establishment. Table 6 shows the institutional structure for each policy measure, as built in with consultation from stakeholders.

Table 6 Government Budget Impact and Requirements for EVs Growth

		e-Mobility Policy Measures	Primary Responsibility of Planning, Legislation and Execution	Secondary Support Responsibility	Regulator
Demand-side Policy Measures to increase EV Adoption					
	1	**Financial Incentives for EVs**	Ministry of Finance/ Directorate of Finance		
	2	**Financial Disincentives for ICEVs**	Ministry of Finance/ Directorate of Finance		
	3	**Financial Disincentives for Fossil Fuels**	Ministry of Finance/ Directorate of Finance		
	4	**Easy Access to EV Financing**	Ministry of Finance/ Directorate of Finance		Central Bank
	5	**Ease of Registration and Preferential Access to Roads and Parking**	MIRN/ INTT		
	6	**Mass Awareness on EVs**	MIRN/ DGRNE		
Supply-side Policy Measures to build Local EV Ecosystem					
	7	**EVs Classification and Standards for EVs, Chargers, Batteries**	DGRNE	Directorate of Industry (SENAPQ), INTT, AGER	
	8	**Fiscal Incentives for Chargers**	Ministry of Finance/ Directorate of Finance		
	9	**Easy and Affordable Access to Land & Electricity for Public Charging**	Municipal Councils		President Office
	10	**Grid Integration for EVs and RE Scale-up**	DGRNE	EMAE	AGER
	11	**Stricter Vehicle and Fuel Emissions Standards for ICEVs**	Ministry of Economy/ Directorate of Industry	DGRNE	
	12	**Environmental Safe End-of-life Management for Vehicles and Batteries**	Ministry of Environment/ DAAC		Ministry of Environment
	13	**Fiscal Incentives for Local EVs and Sub-system Suppliers & Assemblers**	Ministry of Economy/ Directorate of Industry (SENAPQ)		
	14	**Skilling, Capacity Building, and Innovations across EV Ecosystem**	Ministry of Work	Ministry of Education	

6.3 Government Budget Requirements

Based on the Targets and Policy measures for EV adoption, the budget requirements have been estimated. The cost implications to the government for EV adoption are in terms of the Tax collection changes from vehicles and fuel sales (both EVs and ICEVs), capital subsidy provided for EVs purchase and public/fleet chargers installations, forex savings from lower fossil fuel imports, Tax changes from increased electricity sales, etc. The net impact of required Budget resources is estimated and shown below in Table 7.

Table 7 Government Budget Impact and Requirements for EVs Growth

		2025-30	2031-40	2041-50	2025-50	Remarks
Net Govt. Tax Collection from Vehicle Sales		**10**	**18**	**33**	**61**	Loss of tax from reduced ICE sales
Sale of ICE Vehicles	Million USD	10	8	(23)	(5)	
Sale of Electric Vehicles	Million USD	0	10	56	67	Revenue addition from EVs sales
Net Govt. Tax Collection from Fuel Sales & Electricity		**0.4**	**(0.3)**	**(78)**	**(78)**	Loss of tax from reduced Gasoline & Diesel sales
Sale of Gasoline	Million USD	(0.2)	(7)	(61)	(68)	
Sale of Diesel	Million USD	0.5	5	(28)	(23)	Revenue addition from Electricity sales
Sale of Electricity	Million USD	0.1	2	11	13	
Capital Incentives for EVs & Chargers		**(0.7)**	**(4.3)**	**(17)**	**(21)**	Subsidy outlay for e-Bus
Capital Subsidy for e-Buses	Million USD	(0)	(3)	(17)	**(21)**	
Capital Subsidy for Charger	Million USD	(1)	(1)	-	**(1.8)**	Subsidy outlay for Chargers
Net Forex Saving from Fuel Import		**2.5**	**42**	**229**	**274**	
Gasoline	Million USD	1.7	20	98	119	
Diesel	Million USD	0.9	22	131	154	
Net Tax Revenue Loss / Increase	Million USD	**13.1**	**60**	**184**	**257**	Net Outgo from Government Budget
Other Revenue						
Additional Revenue to Utility Company from Sale of Electricity	Million USD	1	32	189	**222**	
Other Indirect Economic Benefits						
Reduction in GHG Emission	k-Tons	(4)	(80)	(359)	**(443)**	Other indirect positive impact on overall economy
Reduction in Fuel Import Requirement	Million litres	2	31	128	**161**	
Reduction in Economic cost of Pollutant	Million USD	4	14	37	**56**	

The net increase in Government budget of all these measures is estimated to be 257 million USD over 25 years.

6.4 e-Mobility Opportunities and Projects

Potential projects relevant to the STP context for short-term implementation have been identified and listed in Table 8.

Table 8 EV Potential Projects for Early Market Development

EV Fleet	**e-2W**	Electric 2-Wheeler Passenger Taxi (and combined Commerce Delivery) Fleet
	e-3W	Electric 3-Wheeler Passenger Taxi Fleet (with Battery swapping and charging)
		Electric 3-Wheeler in Resorts for Tourist and Goods mobility
		First and Last mile electric 3-Wheeler Cargo (with Battery swapping and charging)

	e-4W	Procurement of electric cars (dry or wet lease) for Govt. fleet across different Departments (including Police)
		Electric utility van/ truck for waste collection
		Electric car Taxis for Ride hailing (including shuttle applications from airport)
	e-Bus	Electric buses (5-7m, 11-25 seat capacity) for intra and inter public transportation
EVs Charging	**Public Charging**	Public charging stations in strategic locations with 1 AC and 2 DC chargers. Integrating captive solar and BESS on couple sites. (Strategic locations can include key Govt. offices, Hotels, Tourist destinations, Public Parking sites, Airport, market areas, others)
	Battery Swapping	Battery swapping and charging stations coupled with electric 3-Wheelers and 2-Wheelers. Integrating captive solar on couple sites.
	On-street Kerb side charging	On-street kerb side EV chargers in dense market and residential areas to allow long parking and charging together
	CaaS Business model	Third party EV charging-as-a-service (CaaS) at bigger residential, office, hotel, logistic-business premises
	Smart Charging	Smart EV chargers to avoid charging during grid-peak hours and optimise charging cost with Time-of-use (ToU) tariff regime. Potential extension to integrate V2X (Vehicle-to-Grid, Vehicle-to-Home) and RE integration.
EV Local Industry	**EV Assembly unit**	Local EVs (2W and 3W) assembling from SKD and CKD
	EV Retrofit	Local Retrofit of ICEV to EV for 3-Wheelers, Cars and goods delivery Vans/ Trucks
	Battery Repurpose & Recycling	Setup to collect different battery waste and their re-purposing and recycling appropriately
EV Capacity Building	**EV Technician Training**	EV Technicians Training for repairs and maintenance of different EV segments. Building local capacity in one National institute to undertake such trainings. Establishing National Certification program for EV Repairs and Maintenance.
	EV Professional & Entrepreneurship Programs	Collaborative Degree programs (Diploma, Undergrad Engineering) in EVs and broader New Energy Technologies with one National institute.

7 Conclusion

Above proposed Policy for adoption of EVs at National level holds significant potential for the nation's sustainable transport journey. The nation as an archipelago heavily relies on imported fossil fuels, faces various challenges related to automotive market, GHG emissions, congestion, energy security, environmental sustainability, and economic resilience. The implementation of an EV Policy can address these challenges and unlock multiple environmental, economic, and social benefits and improve overall quality of transport, services, and life.

Firstly, transitioning to EV in STP will significantly help reduce the country's carbon footprint. With zero tailpipe emissions, EVs offer a clean and sustainable transportation solution, mitigating the adverse effects of GHG emissions on the environment and human health. EVs combined with strong grid management and RE integration will help offset partial fossil fuel dependency, grid emissions, move towards energy independence and save forex bill. This aligns with global efforts to combat climate change and promotes the STP's commitment to international agreements like the Paris Agreement.

Furthermore, the development of an EV ecosystem in STP presents economic opportunities. The establishment of EV charging infrastructure, assembly (at least for small vehicle segments) facilities, and related services (supply of battery, spare parts, motors, maintenance services, roadside assistance, periodic servicing, etc.) will create new jobs and stimulate economic growth. As the global demand for EVs continues to rise, STP with its active involvement and commitment, can position itself as a leader amongst island nations for EV technology, attracting investments and fostering innovation in the sector.

However, it is important to understand that implementing an EV roadmap in STP will require a comprehensive approach. The government, in collaboration with relevant stakeholders, would need major focus on addressing key challenges, making EV enabling environment including initial infrastructure investments, battery technology advancements (imports and assembly), and consumer awareness, institutional and legal framework strengthening, education and acceptance. An effective regulatory framework with support of right financial incentives, and public-private partnerships will play a pivotal role in driving the successful adoption of EVs across the archipelago.

In conclusion, the development of an EV Policy for STP represents an opportunity to achieve sustainable development, in transport, energy and built environment by leveraging existing efforts, incentives and strengths of the country; combat climate change, enhance energy security, and stimulate economic growth. By embracing electric mobility, STP can pave the path for a cleaner and more resilient future, while positioning itself as a leader in the transition to a low-carbon transportation system amongst first in island countries.

8 Annexure

8.1 Annexure 1: Details from Stakeholder Consultation during Mission Visit

Stakeholder's name		Notes
1	**Institute of Land Transport (INTT)**	• This department is responsible for **registration of vehicles**, provide number plates and licenses to people. • It is also supposed to carry out **periodic technical inspection of vehicles** but it's not carried out there. • The **condition** of two-wheelers here is good but **not with the taxis**. • The taxis are **painted yellow**. Saloon cars are used as taxis. • **Toyota and Corolla** are majorly used OEMs in STP. • Few vehicles are used as **Para-transit modes – Toyota Ace**. • Private vehicle fleet is new one. • **2W- Motorcycles** are used a lot. • The electricity grid is very dirty. It has a capacity of **15 MW**. • **95% of thermal electric plants** are powered by diesel. • There are **3 electric vehicles** in the country – (1-Tesla, 2-e-2W) • The electricity **supply is very fluctuating**. (goes on and off 10 times in 20 minutes). • Use of solar mini-grids seems better solution and that too only for 2W segments. • São Tomé has **hydro-capacity plans**. • This island is very small. So, it **does not require long range** for operations. • The travel from São Tomé to Príncipe is only by sea or air. • The **electrification rate** of Príncipe is 100% while for São Tomé is 73-74%. • There exists a huge human resources limitation, **no trained people**. • Country **doesn't have transport engineer** thus no one holds the responsibility to manage the transport concerns. • Voice of America is a foreign news agency and has a **huge vehicle fleet**. They manage their own vehicles, have their own fuel and even own mechanics.
2	**Customs Directorate**	• The country has recently developed a **new policy on incentives for BEVs** starting from Nov 1st. Under this policy, BEVs will pay half of out volume tax that they are required to pay. There will be no VAT for BEVs. • Hybrids- 5 years and below is **free of tax**, VAT, fees 5-7(5% Advolareom tax, VAT 15%). • There are **no age restrictions** on vehicles entering the country. Citizens can bring any vehicles into the country. • Citizens need **proper training and knowledge-sharing** sessions for the identification of EVs. • The directorate recommended prohibition on old vehicles entering the country.
3	**Visit to Príncipe**	• Principe is a very small island. Tentatively 40 mins ride by air from Sao Tome and 8 hours journey by sea. • There are wide routes with highly variable terrain. • The roads here feel like climbing a mountain. • There is no commercial/public transport here. • There are no yellow taxis on road and there is no need of it as well because the stretch of the island is also very less. • Motorcycles are majorly used here. • Cars are only used by UNEP, UNDP, NGOs, GEF, UNIDO, etc. organisations. • Pick-ups and 4X4 are also preferred. • Motorcycle taxis are used. • People walk usually.

Stakeholder's name		Notes
		• Principe is completely different from Sao Tome in terms of transport preferences thus need different interventions. • Directorate of Water and Electricity are different for Principe and Sao Tome. The one in Principe is called as Secretariat II. He also heads Land Transport department.
4	**National Oil and Fuel Company (ENCO)**	• There are **no national standards** for fuel. • There is **no fuel testing** in the country. • ENCO has the responsibility of importation, distribution and retail of fuel. • There is **no monitoring of fuel emissions** from vehicles. • It sells the fuel to energy company for the production of energy as 95% are diesel plants. • STP mostly imports fuel from **Angola and Nigeria**. • The country **does not have the capacity** to test the fuel quality.
5	**National Water and Energy Electricity (EMAE)**	• Its responsible for generation, distribution and transmission of electricity. • Principe does not depend on Sao Tome for electricity. • There is a market place for picking up motorcycles as motorcycle taxis. • Motorcycles seems expensive to local people. • There is no Public Transport in Principe. • The roads are bumpy with mountaineous terrain. • Toyota and Corolla are the most popular brands here. • CIEM is the official distributor of vehicles. Caterpillar generators are also sold here. • Principe has one fuel station.
6	**HBD**	• It is the single biggest fleet owner in Principe. • These vehicles are used for tourists transport purpose. • They also operate buses to pick workers from their homes to sites. • They recommended the need for commercial transport as the operational cost of motorcycles is high. • They had started electric go-carts to Sandy Beach. • It was used for carrying food to restaurants. • Unfortunately all the 15 go-carts were damaged within 6 months. • Another reason was mountainous terrain. • In terms of charging, Principe uses diesel plants which was not sustainable, energy is not reliable as generators were used to charge these go-carts. • HBD specializes in sustainability. • HBD is not interest in Electric Mobility anymore. • They are concerned about the EOL batteries and battery recycling.
7	**Biker's Association, Association of Taxi Drivers**	• Cost of new Motorcycle is 75000 Db. • Preowned motorcycle costs 40000 Db. • They require 5 litres per day fuel. • 50 Dobras is the average fare. • They charge 100 Db to reach Sandy Beach. • Few people were interested in EVs but rest were not. • Sanya is the preferred motorcycle there. • Kawasaki, Suzuki are the preferred OEMs. • Sensitization and Education on EVs is much needed. • There are so many motorcycles greater than 20 years of age.