Market Feasibility study of e-Intracity Buses in Harare

D1: User Need assessment report (Draft)

Prepared for

UNEP DTU Partnership

Submitted by

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in consortium with

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DECEMBER 2021

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1. Introduction

1.1. Background

The Government of Zimbabwe with support from the Climate Technology Centre and Network (CTCN) and UNEP-DTU Partnership (UDP) are implementing an E-Mobility Project in Zimbabwe with Mobility for Africa (MFA) and pManifold as their partners. The objective of the project is to help Zimbabwe develop appropriate EV Policies and programs for the deployment and scale-up of Electric Vehicles. The project is being implemented in two phases as follows;

Phase 1: The Phase 1 of the project included development of **E-Mobility Policy and Market Readiness Framework and E-Mobility Road-map development**. The outcome will be a policy document to guide Government's efforts in terms of driving EV adoption. This is a work in progress document and there are scheduled inter-ministerial and broader stakeholder consultations for finalization.

Phase 2: As a part of prioritization analysis of the vehicles for e-Mobility, Intracity e-Buses have been assigned top priority by Zimbabwe stakeholders to drive adoption of low emission in public transport mode. The objective of the Phase-2 is to prepare a "**Market feasibility study for Intracity e-Buses deployment in Harare**" as a preparatory step for the next stage of a proposal preparation for implementation. This phase 2 of the project intends to do a pre-feasibility study for electrification of intracity buses in city of Harare. This will be focused on intracity buses and scaled-up adoption eventually.

As part of scope for Phase 2; User Need Assessment is the key step towards understanding stakeholder perspective towards e-Bus implementation explained below.

Scope of Phase-2: Market feasibility study for Intracity e-Buses deployment in Harare

Briefly the scope of project includes following activities and deliverables.

1) Analyze user needs for scale-up and implement electrification of e-Buses in Harare from stakeholders' perspective
   Deliverable 1: User Needs Assessment report

2) Business models and market feasibility for e-Buses and charging infrastructures in Harare
   Deliverable 2: Market feasibility report for e-Buses in Harare

3) Guideline for setting charging infrastructure for e-Buses in the city of Harare
   Deliverable 3: Concept note (paper) that provides guidelines for setting of charging infrastructure *for e-Buses in Harare*

4) Analyze Policy Measures for promoting e-buses in Harare
   Deliverable 4: Concept note (paper) that synthesizes the policy measures needed for creating an enabling environment for e Buses in Harare

5) Concept note for funding
   Deliverable 5: Concept note for funding of a project for intracity e-Buses

Current progress: Phase-2

Till the first week of December, inception report of the project is prepared which includes the detailed approach and methodology of the project with the proposed timeline. Furthermore, **User Needs**

Assessment is going on in which views and expectations of the key stakeholders (ZUPCO, City Government of Harare, Ministry of Local Government, Ministry of Transport, ZERA, ZETDC) from the project are being understood.

Based on the initial understanding on the project, the Level-0 concept note is developed, which is covered in detailed in next section 4.2 (Annexure).

1.2. Aims and Objectives

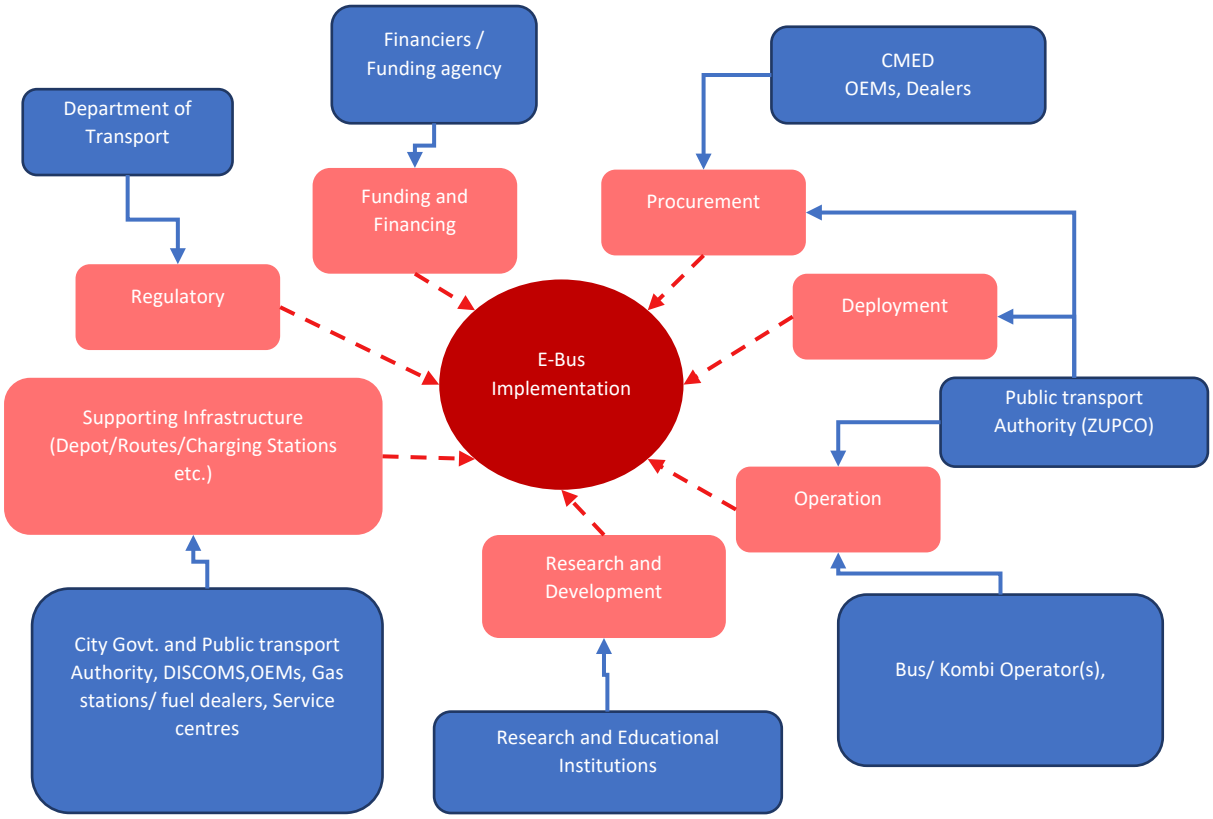
User Needs assessment (UNA) is carried out to understand and analyze needs for scale-up and implement electrification of e-Buses in Harare from stakeholders' perspective. It captures their interest, investment capacity, skill requirement, willingness to shift to **e-Buses** from existing ICE buses for **Intracity Public Transport**

1.3. Methodology

a) Comprehensive list of stakeholders and UNA assessment framework is prepared for consultations with potential key stakeholders important for e-Intracity Bus implementation were Identified (refer figure Figure 1.1). This Include
    a. Intracity bus and Kombi operators – public and private
    b. National and Harare city Govt.
    c. OEMs
    d. Dealers and service centres
    e. DISCOM vi) Gas stations/ fuel dealers vii) potential other EV charging operators
    f. R&D and Academia
    g. Financing companies and any others
b) The consultations are carried-out through virtual meeting platforms (zoom/google meet and others)
c) Project background, purpose of UNA was presented and inputs for e-Bus feasibility are recorded. The stakeholders perspectives are captured through specific questionnaires based on their respective roles in e-Bus implementation; broadly capturing inputs, on
    a. Scope of the study and project sizing
    b. Tech – commercial aspects
    c. Business models
    d. Institutional and regulatory structure
    e. Financial model
d) A first level e-Bus Use case (Concept note) developed for e-Bus implementation in city of Harare is presented to the respective stakeholders to obtain their value proposition and understand their adoption and willingness to support first pilot in Harare and later scale-up implementation in Zimbabwe
e) Among above mentioned list of stakeholders consultations are carried-out for Bus-operators, Drivers and ZUPCO. Consultations with other important stakeholders are scheduled and some are in process to be scheduled within 20 th to 31st December.
f) The Steering committee and UDP will support driving involvement finalising funding agency GEF/GCF

Following diagram showcases the stakeholders with key importance and role towards implementing e-Bus pilot in city of Harare.

Figure 1.1 List of potential Key stakeholders involved in implementation of e-Intracity Buses in city of Harare



2. Discussion

2.1. Existing Public transportation in city of Harare

Public transport system within the city includes both public and private sector operations. The former consists of ZUPCO buses and National Railways of Zimbabwe commuter trains.

Under a World Bank supported Economic Structural Adjustment Program (ESAP), the **urban public transport** industry in Zimbabwe was **deregulated** in 1993. The deregulation caused a significant increase in the number of privately operated public transport vehicles (mostly mini buses known as Kombis) and a substantial increase in capacity, an expansion of the urban transport network as new services was introduced by local authorities that were not served by public transport prior to deregulation, and a considerable reduction in average waiting times for passengers. There were, however, a number of adverse effects, including rapid growth in the number of small public transport vehicles that had an adverse effect on the environment.[1]

The **Zimbabwe United Passenger Company** (ZUPCO), franchise under the Ministry of Local Government was launched in 2019 as Government's attempt to solve the transport crisis in the wake of increased fuel prices. It began as a franchise for buses. The project began with 200 buses and now the project to date has about 900 buses throughout the country. After pandemic, the franchise now regulates Kombis as well.

City of Harare has some **more than 2000 intracity public transport vehicles** which include Kombis, Mini-Buses (majorly known as Kombis) and standard buses. (Refer Table 1). ZUPCO has some 1500

[1] https://www.afdb.org/fileadmin/uploads/afdb/Documents/Generic-Documents/11.%20Zimbabwe%20Report_Chapter%209.pdf

franchised Kombis, Mini-Buses and standard buses. About 40% Kombis (including Mini-Buses) in the city are not complying and following permits and rules. Fleet operators usually follow mix model of running some Buses/Kombis under ZUPCO and others in private to hedge their revenue and compliance risks.

Table 1 Existing Public transport vehicles in Harare (2021)

S.No.	Vehicle	Total Vehicles	Vehicles under ZUPCO Franchise	Common Models running	Seating Capacity	Standing capacity/ Overloaded[2]	Length (m)
1	Kombi	~1500	~+800	Toyota Hiace, Nissan Caravan	12-24 (15-seater most common)	-	4.42-5.26
2	Mini-Bus (referred as Kombi)		<50	Nissan Civilian, Toyota Coaster, Indian Tata, IVECO (UK)	25-39	10-15	6.2-7.7
3	Standard Bus	650	500	Faw, Golden Dragon, VW, Yutong/ Zhongtong, AVM/DAF (local model)	40-60 (some models-75)	25-30	11.48-12.45

2.1.1. ZUPCO Franchise operating model

To run a vehicle under ZUPCO franchise, an operator needs to provide a road worthy vehicle which at first inspected by the Vehicle Examination Department (VED) and further inspected by the **Central Mechanical Equipment Department** (CMED). After inspection, vehicle insurance and passenger insurance are required. The **documents of insurance and inspection** are to be submitted to ZUPCO along with the vehicle for enrolment after which a route is assigned to the operator.

ZUPCO **manages the route and provides with a conductor** who collects the cash and cashes it in everyday to the ZUPCO depot. The number of routes given to a particular individual is dependent on the number of vehicles they enrol under ZUPCO; however, operators usually ask to be assigned to the more lucrative routes for all their vehicles so as to insure easier management of the private fleet.

The table below gives the hiring fees paid by ZUPCO to operators. This amount does not change with the distance travelled.

Table 2 Hiring fees paid by ZUPCO to Operators

Hiring Fees paid by ZUPCO for	Zimbabwean dollar (ZWL) per day
Bus	$18,000
Kombi	$6,700

2.1.2. ZUPCO Fleet and Infrastructure

As stated in Table 1, ZUPCO has about 800+ Kombi operators, some 50 Mini-Bus operators and about 500 standard buses, operating under its franchise. ZUPCO also has its own residual fleet in operation.

[2] illegal after Covid 19

Their **own fleet currently comprises of 50 buses**. These are 61 to 63-seater FAW buses and some buses are allowed a particular standing capacity.

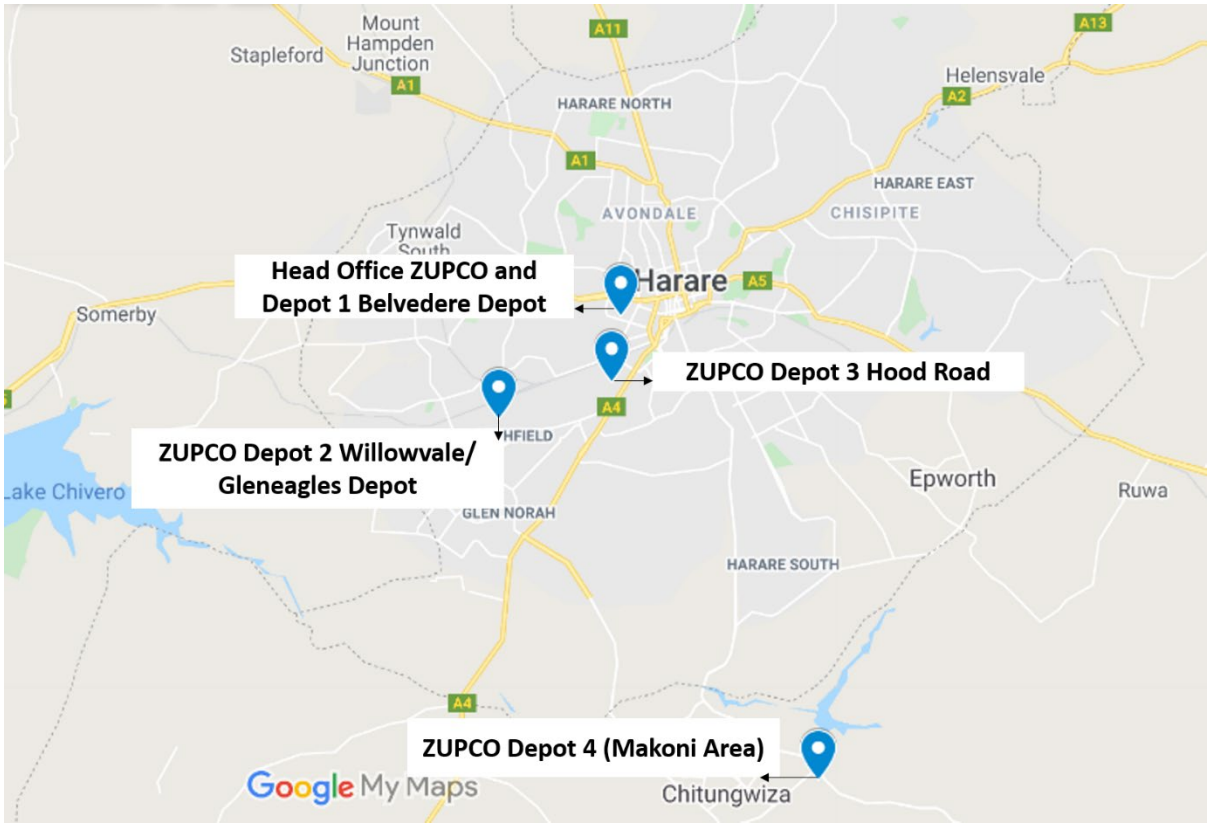
The CMED under ministry of Transport currently purchase buses and lease them to ZUPCO. The government through CMED is purchasing buses from Belarus, China and south Africa.

ZUPCO has around 900 buses nationwide among which about 250 are procured by Government through CMED, 50 are ZUPCO owned and the rest are owned by **the big four private operators** (Inter-Africa, CAG Tours, Trip Trans, Mupfumi) and other small operators. The standard buses are mainly the **Golden Dragon from Belarus, VW from South Africa (imported by Government/CMED/ZUPCO) and Yutong/Zhongtong from China** and locally assembled AVM/DAF buses as well as some imported from UK and Europe by private operators. Kombis are mainly **Toyota Hiaces** and Nissan Caravan, imported from Japan and UK as second-hand panel minibus vans which are then put in some locally assembled seats.

ZUPCO DEPOTS: There are 4 ZUPCO depots in Harare namely-

1) **Belvedere depot:** Mainly for buses (~500 buses capacity), also get Kombis (<50), behind ZUPCO head office
2) **Willowvale/ Gleneagles depot:** Mainly for buses (~500), mostly for parking, closer to suburbs, have biggest central workshop
3) **Hood Road depot**: Main depot for Kombis (500), No buses
4) **Chitungwiza (Makoni Area) depot:** Depot for buses and Kombi

Map 1 ZUPCO Depots



MAJOR TERMINI: Based on consultation with operators following major terminals were identified. This needs to be further confirmed by ZUPCO.

1. Mbare (All Inter-City routes and Most Intra-City suburbs) - (Major Terminus in Harare with Mbare-A and Mbare-B; For Buses and Kombis)
2. Market Square
3. Charge Office
4. Fourth Street
5. Ruzende Parkade
6. Copacabana
7. Machipisa

2.1.3. ZUPCO Fleet Schedule and Routes

Fleet run on demand with no specific schedule. Kombis ply up to 20 km routes while buses ply about 30 km routes. Buses do mainly 3-4 round trips per day while kombis do at least 6 round trips per day (round trip is one return journey to/from the surbub from the CBD or Mbare termini). Pvt operators provide vehicle plus its maintenance while ZUPCO provides fuel, conductor and overhead/management of routes (executive management, depot managers, route monitoring staff, office staff, fuel dispensers, bus dispatchers etc). Currently the normal route fares are 45ZWL for standard Buses and 60ZWL for Kombis and Mini-Bus.

However, recently ZUPCO has **enrolled the services of national railways of Zimbabwe** which are scheduled for 5 am in the morning and 6 pm in the evening, run from the suburbs to the city centre. The **demand from suburbs along the line are catered by the standard buses** by taking passengers from the rail way wagon to the CBD with a tariff of about 50 cents USD equivalent which is inclusive of the train and the shuttle to the suburb. There are only **3 routes for this train service**,

1. Ruwa-Mabvuku route
2. Tynwald Dzivarasekwa route
3. City center- Rugare-Kambuzuma- Mufakose route

There is a mix of operators running on these routes, some are ZUPCO owned and others are the private operators under ZUPCO.

2.1.4. Public Transportation Major Routes

There are about 121 urban city routes under ZUPCO for both Kombis and Buses[3]. Based on preliminary stakeholder discussions, major fleet routes are mapped and compiled in Table given below.

Table 3 Public Transportation Major routes

Major route from Central Business district (CBD)	Intra-city Suburbs Permits issued by local authorities under Ministry of Local Government now under ZUPCO	Inter-city/ rural / Satellite towns Permit issued by Road Motor Transportation (RMT) (permits suspended for buses)	Bus terminus (CBD rank)
Seke Road	Chitungwiza, Waterfalls,	Seke Rural, Hwedza	Charge Office

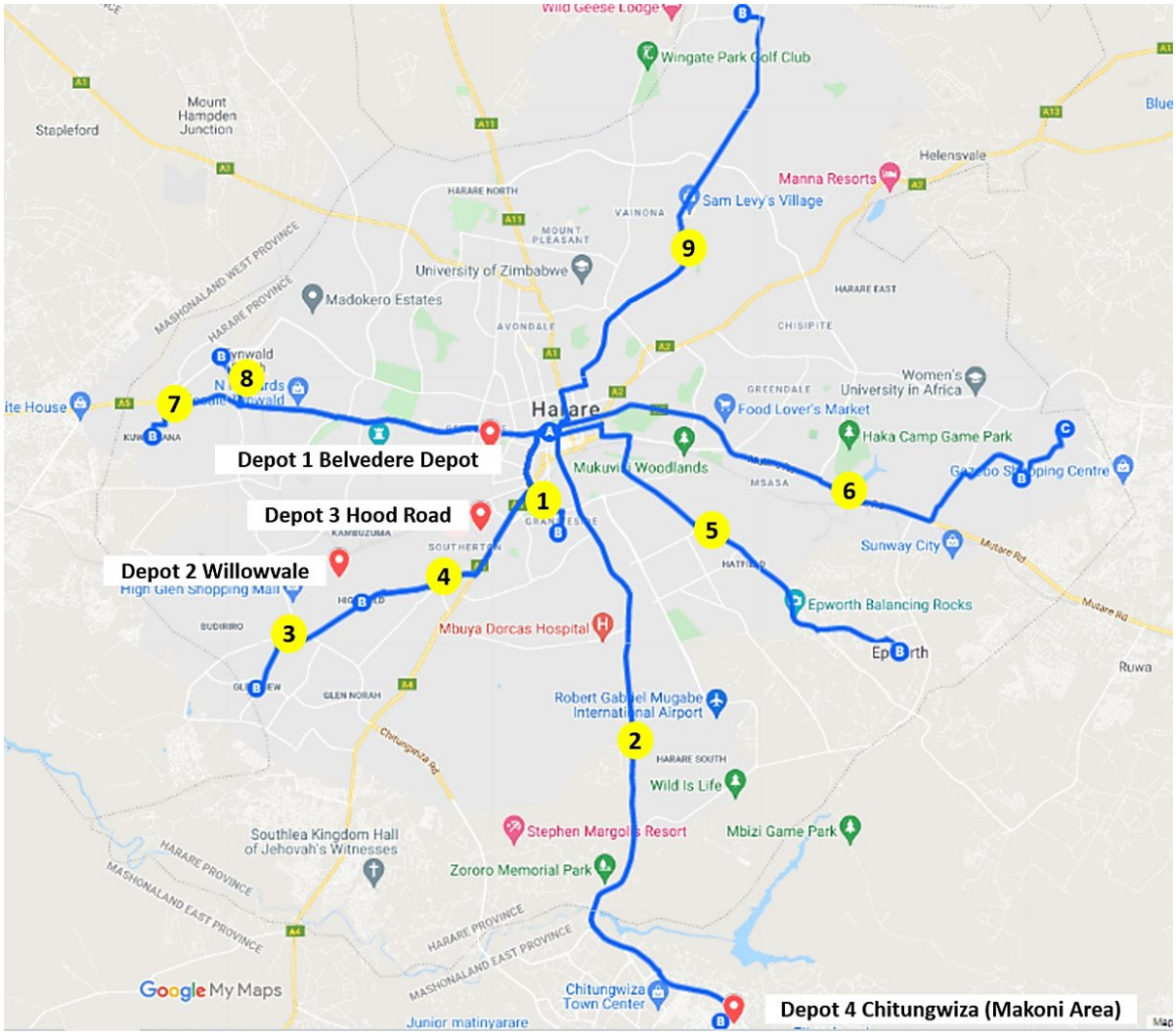
[3] http://www.zupco.co.zw/harare_urban.html

	Sunningdale, St Martins/Accadia, Braeside, Logan Park		
Remembrance Drive	Mbare, Ardbennie, Prospect		Market Square / Copacabana
Simon Mazorodze **A4 (Masvingo Road)**	Highfield, Glen Norah, Hopley, Stoneridge, Ushewokunze, Parktown, Houghton Park, Southerton, Glen View,	Beatrice, Chivhu	Market Square / Mbare
Lytton/Coventry Roads	Kambuzuma, Mufakose, Marimba, Budiriro		Market Square / Mbare
Bulawayo Road **A5 West**	Kuwadzana, White House, Warren Park, Norton, Dzivarasekwa, Belvedere, Westlea, Madokero, White House Glenary,	Chegutu, Kadoma	Copacabana / Mbare
Lomagundi Road **A1 (Chinhoyi Road)**	Marlborough, New Marlborough, Emerald Hill, Avondale	Mt Hampden, Stapleford, Gwebi, Banket, Chinhoyi	Copacabana / Mbare
Golden Stairs Road **A1 / A11**	Mt Pleasant, Belgravia	Bindura, Mt Darwin, Glendale, Christon Bank, Mazowe, Concession	Ruzende Parkade / Market Square / Mbare (Inter City only)
Borrowdale/Domboshava Road	Helensvale, Borrowdale, Hatcliffe, Vainona	Domboshava, Musana, Bindura	Fourth Street / Mbare
Enterprise Road **A2**	Chisipite, Highlands, Grange, Helensvale	Chishawasha, Juru, Murehwa, Mutoko, Mutawatawa,	Fourth Street / Mbare
Mutare Road **A5 East**	Msasa, Eastlea, Hillside, Rhodesville, Mabvuku, Tafara, Ventersburg, Zimre Park, Ruwa, Mabvazuva, Eastview	Goromonzi, Melfort, Bromley, Marondera, Macheke, Headlands, Headlands, Rusape	Fourth Street / Mbare
Chiremba Road	Epworth, New Sarum, Hatfield, Msasa Park, Cranborne		Fourth Street / Mbare

This project will be designed for implementation of e-**Buses on intracity routes**. Some of the major high demand routes are from city centre to following areas are identified and mapped in Figure 1

1) Mbare
2) Chitungwiza / Makoni
3) Glen View
4) Highfield
5) Epworth
6) Mabvuku-Tafara
7) Kuwadzana 1-7
8) Dzivarasekwa
9) Hatcliffe

Figure 2 Major Routes and Depots



The fleet size and routes for electrification will be identified, shortlisted and finalised based on further stakeholder consultation and inputs from Steering committee.

2.2. Importance of e-Buses and willingness to shift to e-Buses for city of Harare

e-Buses have high regards as future of Public transportation mode in the city of Harare perceived through discussions with Multiple stakeholders listed in chapter 1.3; as it is capable of reducing tailpipe emission and grow cleaner Public transport fleet in Harare. It is also seen important by stakeholders which will play key role in developing employment opportunities in e-Mobility sector.

Current public transport operators are keen for this venture and transformation to e-Mobility while have doubts regarding the profitability given the high cost and current renumerations by ZUPCO.

As per ZUPCO and Ministry of Local government, e-Bus pilot has potential to transform Public transport in Zimbabwe and the first pilot will establish the foundation for the same. This pilot will receive all policy, regulatory and technical support from these mentioned entities.

For the required infrastructure for e-Bus operations; City of Harare, ZUPCO has important role to facilitate the depot space for parking and charging, while ZETDC would support accommodating extra load for e-Bus charging with provision of separate connections. The power providers are also looking for renewable energy integration for e-Bus charging and will be explored once the project sizing is nearly finalised. The different business models for operations of e-Buses will further be explored during second round of consultations with the key stakeholders.

2.3. Pilot sizing

Based on received feedbacks and inputs from consultations and the given level of understanding, skills and experience in operating e-Buses, 30-50 e-Bus deployment is considered suitable for first pilot.

From early consultations for phase1 – EV Policy and Roadmap for Zimbabwe, it is perceived that Government is planning to re-organise the public transport and gradually phase-out the mini-buses and Kombis as they are responsible for high on-road emissions and causing congestion to the city routes. Currently the country also facing the issues with availability of fuel; in such case the standard bus size of 12 m with capacity of accommodating more than 70 passengers is desired.

For selection of potential e-Bus the cost of bus and city terrain are also considered as important factors. Given higher purchase cost of AC buses, and inconsistent terrain and road conditions in city of Harare, it is suggested to have Standard 12 Non-AC buses (No low floor buses).

2.4. Funding and financing

The pilot will require funds to implement in city of Harare. As the pilot is a public project, it will require considerable investment to build the infrastructure (deport, charging, buses, chargers etc.). It is yet to built clarity on the funding and financing of the project but there are possible ways of funding identified for the same.

Following potential sources of funds for Infra (e-Bus, chargers, grid, etc.) financing:

- **Donor Agency** (via Accredited Agency): like GEF, GCF, World Bank, GGGI, etc. in form of grant/ sub-ordinated loan;
- **Public/Private Banks**: like IDBZ etc. in form of commercial loan
- **Government**: in form of capital and/or interest subsidy; reduced or exempted different taxations on EVs import
- **Public/ Private Operator**: in form of project equity (e-Bus and chargers)

Based on the stakeholder consultations a Level 0 Concept not for e-Bus in City of Harare is developed and attached in Annexure (Chaper 4.2)

3. Appendix

3.1. Appendix 1: Questionnaires for stakeholder consultations

3.1.1. ZUPCO

A. **Organisation overview:**
- Constitution of ZUPCO, aim objective, relation with national govt./provincial govt. What delegation of powers?
- Broad ongoing/ planned reforms for organization

B. ZUPCO's focus for City of Harare

- **Existing and future fleet composition and changes**
- **Viability across vehicle segments**

B. Existing scenario of Public Transportation (Refer detailed data input template below)
- Network Planning & Specifications
  i. Vehicle Specification for existing Buses and Kombis
  ii. Depots and Terminals
  iii. Routes- Buses and Kombis
  iv. Operations- Buses and Kombis
- Operational and Business Model
  i. Institutional structure
  ii. Business model
  iii. Contract structure

C. Targets and plans specific to e-Buses
- Vehicle segment to focus for electrification? (Bus/Kombi)

3.1.2. Bus Operator

A. PT Landscape in city of Harare (spatial understanding)
- **Number of Buses and Kombis** – Total; Under ZUPCO Franchisee; Trends (last 3-5 years and future projections 5-10 years); Significant Mode shifts between Kombis and Buses;
- **High demand** Bus and Kombi **Routes**
- **Key Depots** and **Terminals**
- ZUPCO controlled Depots, Terminals, Routes

B. Operating Model
- **ZUPCO Franchisee model** - Structure; Asset ownership (Vehicle, Depot, Terminal); Typical Fleet size; Pros & Cons
  - Kombis
  - Buses
- **Operator Economics** (Comparison) - Trips per day; Kms per day; Tariffs; Typical Costs, Revenues and Savings per day etc.
  - ZUPCO Franchisee
  - Non-Franchisee
- **Operating Cycle** – Start time; End time; Dead-Mileage; Parking locations; No. of shifts; Trip schedules (existing/ followed);

- **Type of Vehicle** – New vs pre-owned; if pre-owned then age and Kms; Typical life (years and Kms) before discarding; Salvage value; Typical makes/ models;
- **Synergies and competition** - with other vehicle modes; ZUPCO vs Non-ZUPCO Franchise operators

C. Perception towards EV adoption – Availability; Costs; Financing; Government Support; Ease of Acquisition and Registration; Charging Infrastructure; Performance; Value for Money; Spares and Services etc.

D. Electrification Pilot for **Buses** in City of Harare
    - **Preferred Depot** – Why: space; dead-mileage; high-demand routes; high power electric connection; Mixed usage with Kombis; availability of last-mile modes/options;
    - **Preferred Routes** – Why: passenger demand; congestion; grade; waiting times;
    - **Business model options** – Investment/ Ownership/ Operations
        - e-Buses:
            - Purchase with Batteries
            - Purchase with Battery-leasing
        - Charging infra:
    - **Pilot Size**
        - **Ideas** on Pilot
        - **First deployment** – No. of e-Buses; investment and ownership with and without Govt. Subsidies (ZUPCO vs Private operator); Commercial Financing availability; any suggested changes in ZUPCO Franchise model for bus;
            - If **e-Kombis should be piloted together with e-Buses**?
        - Targets – year-on-year new e-Buses addition targets; 30% e-Buses by 2030;

3.1.3. Ministry of Local Government

A. Organisational Overview
    - Constitution of Ministry of Local government of Harare, aim objective, relation with national govt./provincial govt. What delegation of powers?
    - Broad ongoing/ planned reforms for organization
B. Current Focus on city of Harare
    - What National plans are currently being executed/already executed for development of city (infrastructure, social, environment, energy etc.)
C. Future plans for city of Harare
    - What future development plans for city of Harare?
    - Any plan/vision for development of transport sector? (Decongesting and decarbonising and others?)
    - What mechanisms planned to execute the future plans? What is role of ministry of Local government in implementing such plans?
D. Potential support for e-Bus implementation
    - What importance e-Bus pose for the nation and for city of Harare?
    - What potential support could ministry of local government extend?
    - What leverages city of Harare can extend for implementation of e-Bus? (Regulatory, policy, funds, land an others)?
E. Suggestions and recommendations

- What service area/coverage expectations if e-Bus implemented? Any specific areas (name) to be serviced? Why?
- What potential leverage options/locations for establishment of charging infrastructure for Intracity e-Buses?

3.1.4. City of Harare

A. Organisational Overview
   - Constitution of City government. of Harare, aim objective, relation with national govt./provincial govt. What delegation of powers?
   - Broad ongoing/ planned reforms for organization
B. Current focus on City of Harare
   - What are existing public bus transport characteristics? (Service area coverage, depots, PT infrastructure etc.)?
   - What important/high footfall areas (residential, commercial, institutional)?
   - Which are most busy routes? What local, regional importance?
C. Future plans for development in City and Public transport sector
   - What development plans for city of Harare (key developments)?
   - Any plan for Public Transport development and expansion?
   - Any plans for intracity public transport (with city planning)?
D. Potential support for e-Bus implementation
   - What importance e-Bus pose for the city?
   - What leverages city of Harare can extend for implementation of e-Bus? (Land, existing terminals/parking spaces and others?)
   - What other support city of Harare could extend?
E. Suggestions and recommendation
   - What service area/coverage expectations if e-Bus implemented? Any specific areas (name) to be serviced? Why?
   - What potential leverage options/locations for establishment of charging infrastructure for Intracity e-Buses?

3.1.5. ZETDC/ZERA

A. Organisational Overview
   - Constitution of ZETDC, aim objective, relation with national govt./provincial govt. What delegation of powers?
   - Broad ongoing/ planned reforms for organization
B. ZETDC's focus for city of Harare
   - Existing system for electricity generation and distribution (access, quality, conventional, renewable?)
   - Power supply throughout the day for city of Harare (domestic, industrial, commercial and others?)
   - Energy demand throughout the day city of Harare (domestic, industrial, commercial and others?)
   - Does current power supply cater to the demand?
   - Could existing infrastructure accommodate the extra load for e-Bus charging station? What extent?
C. Future plans for electricity distribution

- What future plans for electricity generation and distribution? Particularly for Harare?

D. Potential support for e-Bus implementation
   - Willingness to support e-Bus implementation
   - What initiative and or support could be extended by ZETDC for implementing e-Buses (and supporting charging stations/infrastructure?)

E. Suggestions and recommendations
   - What potential options to accommodate extra load from e-buses operations?
     - Micro Grids
     - Solar
     - Others
   - What extra preparation/infrastructure will be required to fulfil e-Bus energy requirement and adoption?
   - What suggested business models? (for setting-up charging infrastructure?)
   - What current tariff for electricity? What would be the tariff for e-Bus charging?
   - What spatial, financial, legal, policy requirements to facilitate adequate grid infrastructure and power for e-Bus charging?

3.1.6. CMED

A. What are Roles and responsibilities of CMED
B. What is Current mechanism for procurement of Vehicles/Fleet to government
   - Who all are served?
   - Does CMED serves private sector too?
   - What business model(s)?
   - What Procedure of Bus (Public transport) fleet procurement? What business model(s)?

C. Readiness to shift to e-Buses
   - What pros and cons you think of deploying e-Buses?
   - How much e-Buses will benefit to Public transport and its upliftment?
   - Any plans to procure e-Buses? What plans? Any known sources, OEMs, dealers for e-Buses?
   - What would be the purchase/procurement mechanism? What difference from ICE buses?

D. What mechanism would be followed if e-Buses to be procured for Intracity transport in the city of Harare? What will CMED Support?
E. Will CMED also support establishment of Charging infrastructure for e-Buses? if yes, on What T&Cs?
F. Up to what extent can CMED support e-Bus implementation (funding/financing, number of buses, infrastructure etc.)?

3.2. Appendix 2: Level 0 Concept Note for e-Bus in city of Harare

First Concept Note for e-Bus Intra-city in Harare

Note for validation of concept to undertake further Technical analysis

The Level-0 concept note is first hypothesized solution based on information collected so far. Its objective is to give visualization of end-outcome from the project and firm key decisions in overall solution **sizing, structuring and financing**. With key Govt. stakeholders it will be firmed up before proceeding to detailed techno-commercial analysis.

Funding (for infra for first pilot deployment)	20-35 million USD (~30-50 e-Buses with chargers and infra – assuming imports and taxes)
e-Bus Type and fleet size	**Intracity:** 30-50 no. of e-Buses; standard 12m length; Non- Air Conditioning (Non-AC)[4]; Standard floor[5]; ~250kWh battery;
e-Bus Operator	**ZUPCO** – The Zimbabwe United Passenger Company (ZUPCO) is a parastatal company in Zimbabwe, which operates both urban and long-distance bus routes in the country; in operations since 1980 (across Zimbabwe); own 4 depots in Harare. ZUPCO being a Govt. owned entity can host e-Bus asset (likely procured with some grant money).
Depot selection	• One Depot is preferred for first pilot e-Bus implementation • Top candidate is ZUPCO Willowvale Depot – owned by ZUPCO; mainly for Buses parking; ~500 bus parking space; have biggest central workshop; closer to suburbs
Route selection	• Select attractive revenue routes originating from the selected Depot (Willowvale) with below characteristics- — High daily run kms (>150kms per day; higher is better;) — High visibility — High ridership (hence high revenues) — Low traffic congestion (in peak hours) — Low grade terrain (both directions) — Good road conditions — Space and waiting time for Opportunity Charging, if required • Buses ply about 15km one way route with 3-4 round trips; average daily distance- ~120 km • Potential 4-5 intracity routes along major arterials of the city are identified as high demand routes; (Refer Appendix Major Public Transportation routes)

[4] Air condition (AC) for e-Buses can consume 20% battery energy capacity. Zimbabwe temperatures ranges between 21-31 degree Celsius. Initial deployment of fleet with non-AC and then planned deployment of AC fleet can be visualized for pilot. This can allow easier AC management and lighter load on the battery.

[5] Low floor e-Buses typically comes heavier (by ~20%), causing higher energy consumption and lower mileage (kms in one full charge). It can be evaluated if Zimbabwe needs Low floor e-Buses. For initial pilot standard floor buses can be deployed. OEMs compensate this by lowering payload capacity for low floor e-Buses.

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- Finalization of routes will be based on detailed survey, energy estimation for e-Bus and stakeholder consultations (part of detailed technical analysis)

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<tr><td>Chargers Type and Charging strategy</td><td>

- Fast DC chargers; plug-in type or down pantograph (to be evaluated in detailed technical analysis, keeping in view future technology evolution and interoperability of chargers for heavy commercial vehicles)
- Overnight Depot charging for intracity routes (and if required en-route, Terminal charging, depending on routes detailed study)

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<tr><td>Operational Model</td><td>

- Scheduled e-Bus operations
- Scheduled charging at Depot/ Terminals to align with e-Bus passenger schedules

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<tr><td>Business Model</td><td>

- **Existing ZUPCO models-**
  1. ZUPCO owned fleet with own staff and operations
  2. ZUPCO leases fleet from CMED and appoints staff for operations
  3. Third party operators operating with their fleet under ZUPCO Franchise
- **For e-Buses**: TBD with below options; to be developed in discussion with stakeholders; GCF identified as a potential funding agency;

	e-Buses investment	**e-Buses ownership**	**e-Buses operations**	**e-Buses maintenance**	**Chargers' O&M**	**Ticketing**
Model-1 (Conventional)	Donor agency + GoZ support	ZUPCO	ZUPCO	ZUPCO	ZUPCO	ZUPCO
Model-2 (GCC)	e-Bus OEM + GoZ support	e-Bus OEM	ZUPCO	e-Bus OEM	e-Bus OEM	ZUPCO
Model-3 (Hybrid)	Financing/ Leasing co. + GoZ support	Financing/ Leasing co.	ZUPCO	e-Bus OEM (contract from Leasing co.)	e-Bus OEM (contract from Leasing co.)	ZUPCO (paying to Leasing co.)

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<tr><td>Investment Funding Model</td><td>

- Following potential sources of funds for Infra (e-Bus, chargers, grid, etc.) financing:
  - **Donor Agency** (via Accredited Agency): like GEF, GCF, World Bank, GGGI, etc. in form of grant/ sub-ordinated loan;
  - **Public/Private Banks**: like IDBZ etc. in form of commercial loan
  - **Government**: in form of capital and/or interest subsidy; reduced or exempted different taxations on EVs import
  - **Public/ Private Operator**: in form of project equity (e-Bus and chargers)

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<tr><td>Phased Deployment</td><td>

- Harare city can target 200 e-Buses over 3 years; (follow guideline from National e-Mobility targets for intracity Bus –15% of new procurement by 2025 and 30% by 2030)

	Year-0	**Year-1**	**Year-2**	**Year-3**

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	Planning & Procurement	First 30[6] e-Buses	Second batch of 50 e-Buses	Third batch of 120 e-Buses	
	Plying		30 e-Buses	30+50=80 e-Buses	80+120=200 e-Buses
	Monitoring & Capacity Building		First pilot learning and capacity building	Capacity and fleet expansion and related capacity building	Scalable operations & monitoring

Support required from Govt. of Zimbabwe

1) Validation of Level-0 concept note, in particular:
    a. USD Investment size for first e-Bus deployment (this will decide e-Bus fleet size)
    b. Focus on 12m bus electrification only and not Kombis (for first pilot deployment)
    c. Targeted Donor Agency and it's empaneled Accredited Agency (to be able to engage them upfront for preparing pointed financial proposal)
    d. e-Bus hosting and operating model by ZUPCO
2) **Technical Working Group** with access to key stakeholders listed below for required data inputs and technical validation:
    a. ZUPCO
    b. City Government of Harare
    c. Ministry of Local Government
    d. Ministry of Transport
    e. Zimbabwe Energy Regulatory Authority (ZERA)
    f. Zimbabwe Electricity Transmission and Distribution Company (ZETDC)

[6] 30 to 50 buses; subject to discussion and finalization