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PARTNERING FOR ACCELERATED CLIMATE TRANSITIONS

Embracing e-mobility

Low carbon transitions across urban mobility

14 October 2021

Starts at 10:00

PANEL DISCUSSION | E-MOBILITY PROJECTS | FOCUSED Q&A

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PANEL DISCUSSION | E-MOBILITY PROJECTS | FOCUSED Q&A

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Today's agenda

Introduction from Simon Ball

Panel discussion with **Beth Morley**, **Walter Jokisch** and **Ivan Islas Cortes**

Project: Road to a green Bangladesh with **Mate Antosik**

Project: Transjakarts electric bus roadmap with **Faela Sufa**

Project: City of Johannesburg EV readiness programme with **Zanie Cilliers**

Focused Q&A with Fernanda Samman

Housekeeping

Any technical issues can go in the Zoom chat

Questions asked are NOT anonymous

The event is being recorded

Mute your mic and turn your camera off please

Please share questions during the Q&A at the end

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Road to a green Bangladesh

Mate Antosik of Ricardo Energy and Environment

Road to a green Bangladesh
‘সবুজ বাংলাদেশের পথে’

Development of an EV financing tool and business model to enable the scaling up of EV uptake in Bangladesh

Lead Partner

RICARDO

Consortum Partners

IDCOL TOGETHER FOR TOMORROW

LightCastle Partners

POLICY EXCHANGE BANGLADESH Catalyzing Growth Solution

Hivos people unlimited

ENERGIA INTERNATIONAL NETWORK ON GENDER & SUSTAINABLE ENERGY

Project objectives

Business models

Support business enterprises in Bangladesh scope and identify suitable EV-based and EV-enabled business models

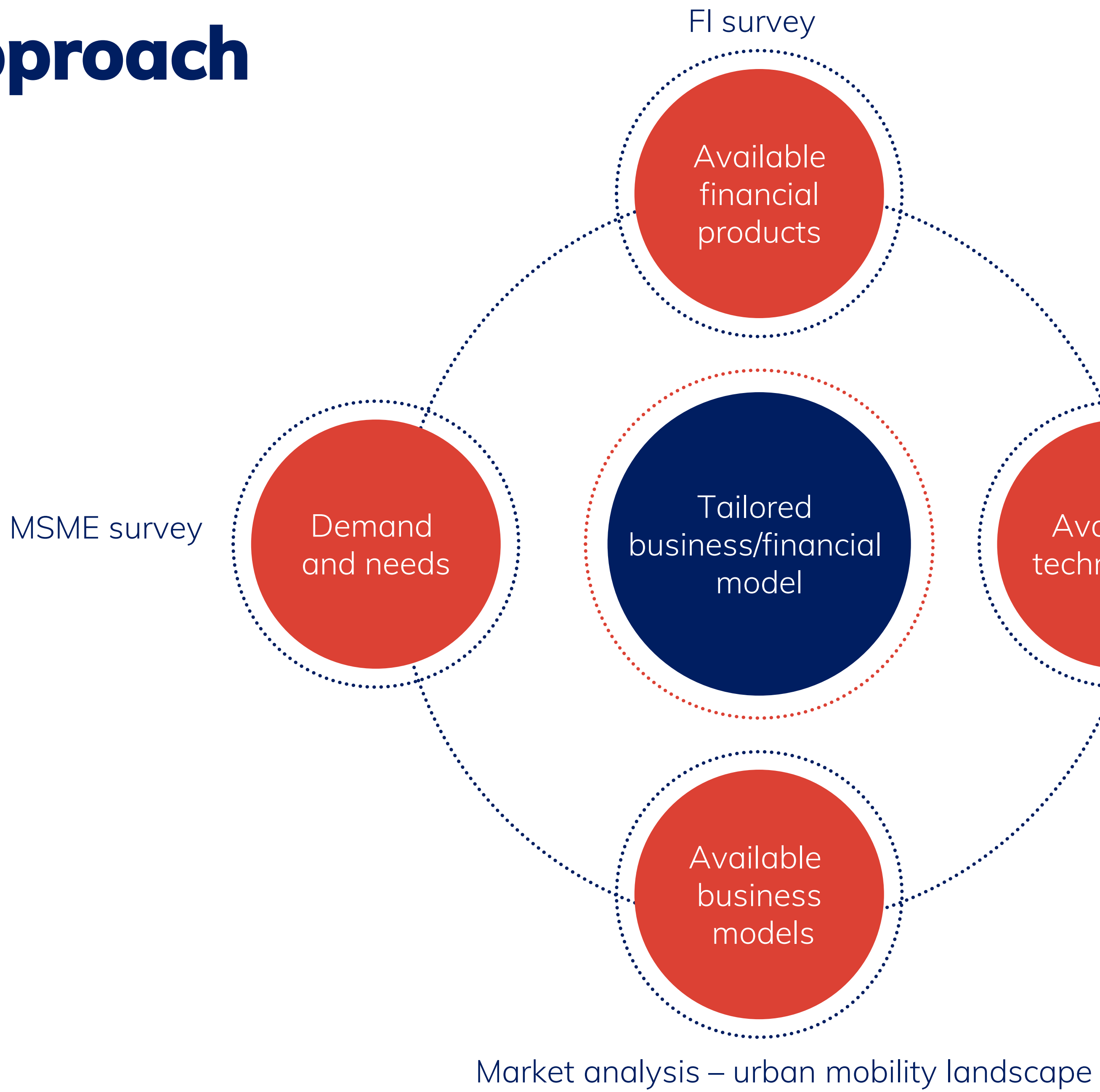
Financial models

Work with Banks & Investors to support identified business models

Gender & social inclusion

Enable gender and socially inclusive business models & supporting Women Entrepreneurs

Our approach



Needs assessment

A survey of 450 MSMEs asked about current demand for EVs among MSMEs in Bangladesh and key concerns & issues in consideration of EVs.

85%

of transport demand incidents are intermittent

55%

of daily usage is well within 50km

60%

of companies incur daily transport related expenditure less than 1000Tk (~USD 11.8)

45%

of vehicle owners own at least one EV

67%

of surveyed companies own at least one vehicle

Expectations from financial services

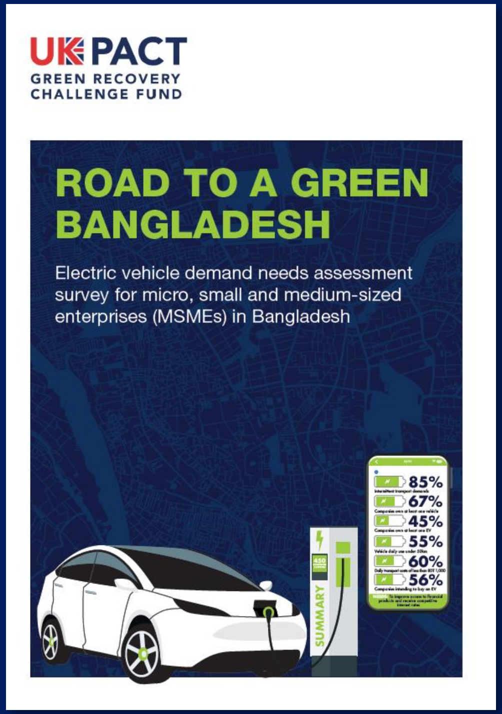
Interest rate is key

Improved product & service quality

Processing time

Access to finance

Type of collateral



https://britbanglabusinesssupport.co.uk/wp-content/uploads/2021/09/MSME-Demands-and-Needs-Bangaldesh-Septemb-2021.pdf

Supply assessment

A survey of 13 FIs asked about current loan processing practices, whether any focus is given to women customers and existing views on carbon products and associated financing (specifically MSMEs):

MFIs have the highest proportion of **women clients**

Solar technology is most attractive for low carbon loan products, followed by electric vehicles

Lack of sufficient collateral and documentation are main difficulties MSMEs are facing during the loan application process

Lack of registration and enabling legislation are considered the most significant barriers in providing loan for EV purchase

Commercial risk is considered the major risk involved in issuing loans to MSMEs and women owned enterprises

Availability of stable cash flow, required collateral and documentation are considered as the most important success factors in loan approvals https://www.ionenergy.co/resources/blogs/lithium-ion-battery-types/

Technology assessment

LI-ION BATTERY CHEMISTRY	NOMINAL VOLTAGE (V)	CYCLE (LIFE)	CHARGE CURRENT RATE (C)	DISCHARGE CURRENT RATE (C)	THERMAL RUNAWAY (°C)	PACKAGING (TYPICAL)	SPECIFIC ENERGY (Wh/Kg)	APPLICATIONS	REMARKS
Nickel Manganese Cobalt Oxide (NMC)	3.6 (3.0-4.2) range	1000+	0.7-1C	1-2C	210°C (410°F)	18650, 21700	150-220	E-Bikes, Medical Devices, EVs, Industrial	High-specific energy, Low self-heating rate
Lithium Iron Phosphate (LFP)	3.2 (2.5-3.65) range	2000+	1C	1C	270 °C (518°F)	18650, 32650, prismatic	90-120	Stationary Applications with high capacity, EV	Flat discharge voltage, high power, low capacity, safe
Lithium Nickel Cobalt Aluminium Oxide (NCA)	3.6 (3.0-4.2) range	500-1000	0.7C	1C	150 °C (302°F)	18650	200-260	Medical, Industrial, Electric Powertrain	Long life, fast charge, wide temperature range, safe & expensive
Lithium Titanate Oxide (LTO)	2.4 (1.8-2.85) range	3000-7000	1C	10C	Highest	Prismatic	50-80	Electric Vehicle and Energy Storage Systems	Highest capacity with moderate power
Lithium Cobalt Oxide (LCO)	3.6 (3.0-4.2) range	500-1000	0.7- 1C	1C	150 °C (302°F)	18650 Prismatic & pouch cell	150-200	Laptops, Mobile Phones, Tablets, Cameras	High energy, limited power
Lithium Manganese Oxide (LMO)	3.7 (3.0-4.2) range	300-700	0.7-1C	1C	250 °C (482 °F)	Prismatic	100-150	Medical Devices, Electric Powertrains, Power Tools	High power, less capacity; safer than LCO

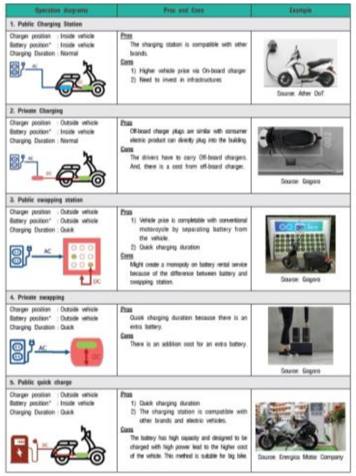
Vehicles

Batteries

Technology relevance assessment

Alternative methods

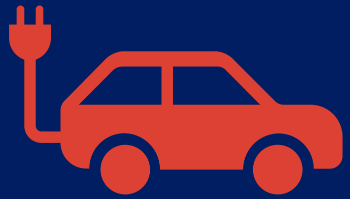
Charging infrastructure



https://www.thaiauto.or.th/2020/news/news-detail.asp?news_id=4748

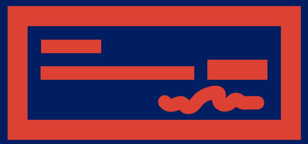
Business models in developing countries

Major cost sources for EV customers



Vehicle (without battery)

Battery



Electricity Charges

Business models in developing countries

Business models address key financial and technical barriers to EV adoption

	1. Electric vehicle (without battery)	2. EV battery	3. Electricity charging & infrastructure	
Direct sales	• EV Sale	• Battery sale (as part of EV)	• Private • Public	Slow Fast
Battery leasing variants	• EV Sale	• Battery leasing	• Private • Public	Slow Fast
	• EV Sale	• Battery leasing	• Battery Swapping	
EV leasing variants	• EV Leasing	• Battery leasing	• Private • Public	Slow Fast
	• EV Leasing	• Battery leasing	• Battery Swapping	
Rental variants	• EV (+ battery) rental		• Private • Public	Slow Fast
	• EV (+ battery) rental		• Battery Swapping	

Challenges of business models

Policy, operational and finance

HYBRID MODELS	Suitability: Tailored to the local context - a hybrid between international models and local models
SWAPPING OR CHARGING	Swapping is suitable for 2- and 3-W, charging infrastructure seems to be more beneficial for 4-W (mostly personal use)
POLICY	In absence of clear regulatory instruments, lack of traditional 2-W and 3-W based business models
STANDARDISATION	Standardisation of EV technology (e.g. battery system) has the potential to result in platform agnostic specialised battery swapping businesses

AFTER SALES	Retraining is required from conventional vehicles to EVs
BATTERY RECYCLING	For ease of swapping, Li-ion batteries are suitable for 3-wheelers vs. Lead acid batteries are easily recyclable in Bangladesh
FINANCING ISSUES	3–W in Bangladesh are different from international version with different risks requiring a tailored financing tools
ECOSYSTEM	Entire ecosystem needs to be strengthened (pricing, warranty, availability of spare parts etc)

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Thank you!

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Transjakarta electric bus roadmap

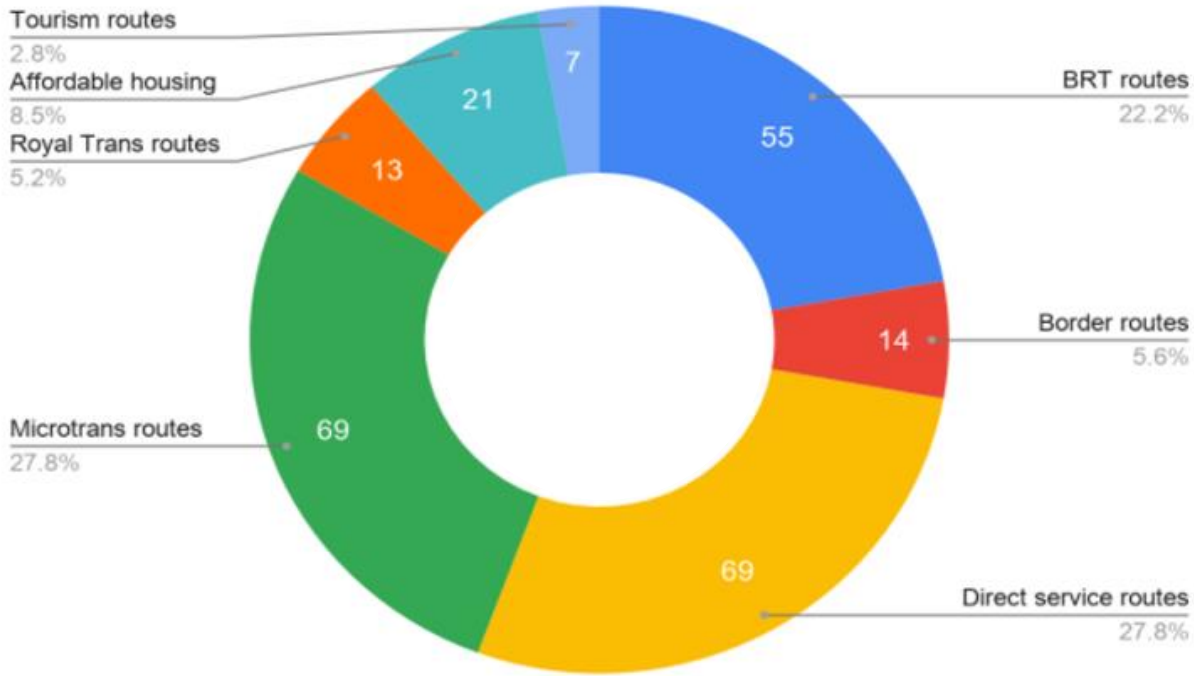
Faela Sufa of ITDP Indonesia

Outline

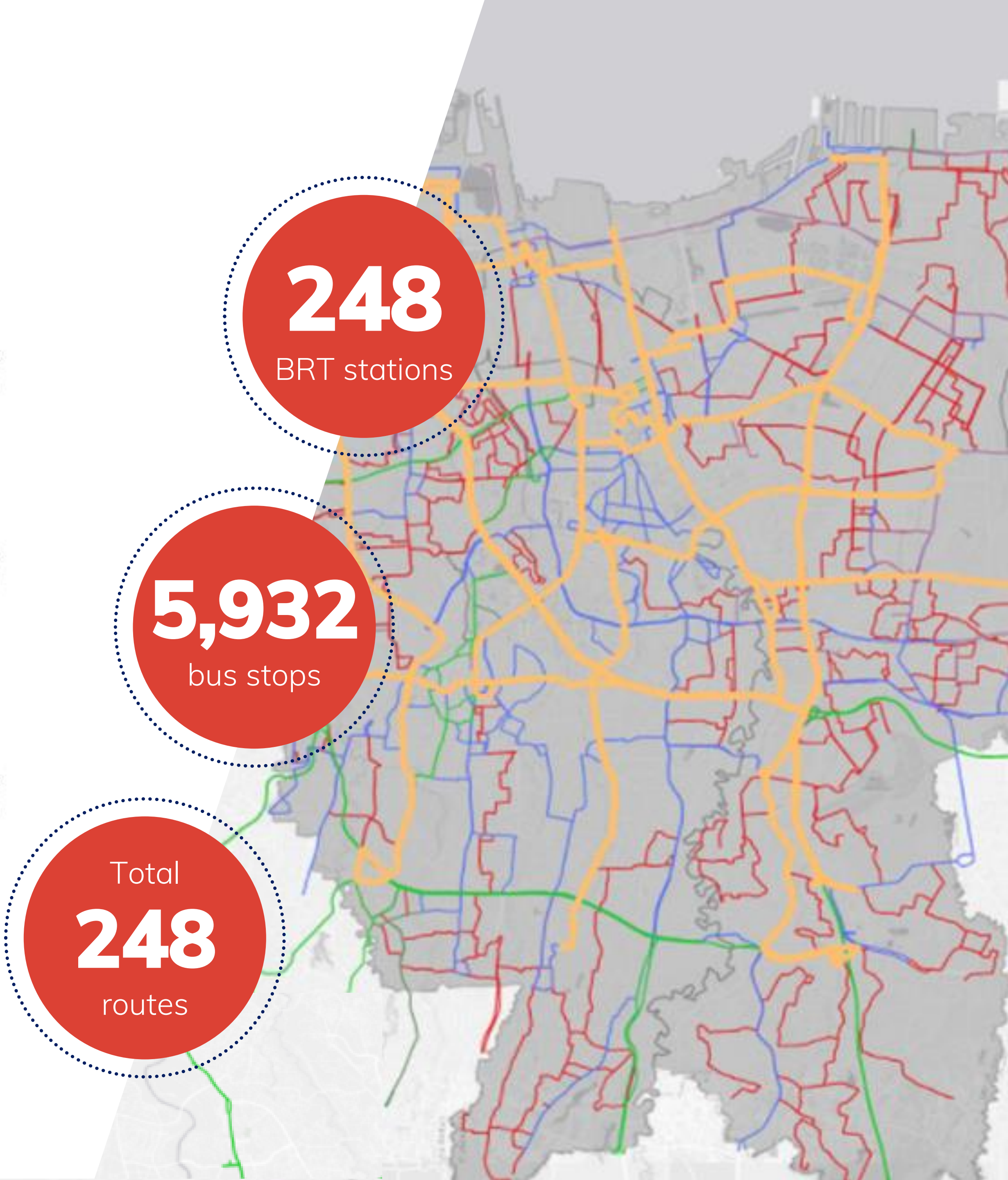
- Transjakarta electrification program
- BRT and non-BRT system
- Microbus system

Transjakarta electrification program

Overview of transjakarta

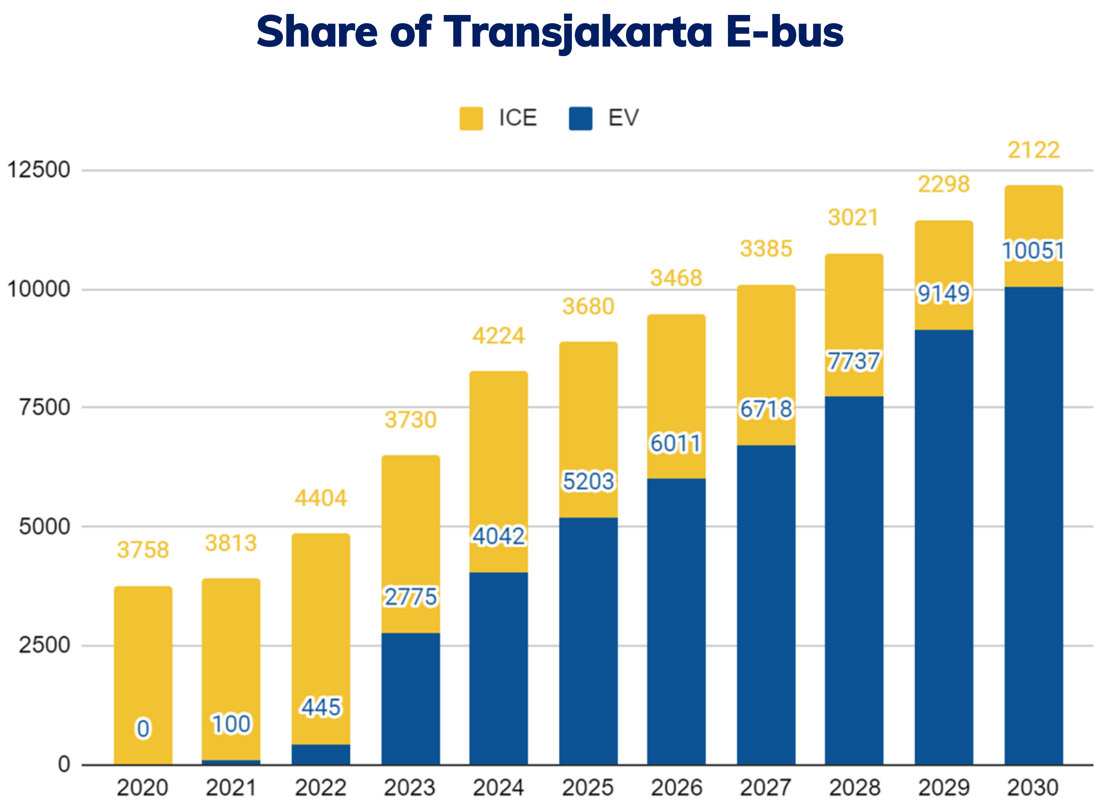


Source: Transjakarta (2020)



Transjakarta's electrification plan

Around 10,000 electric bus fleets are planned to be operated by 2030.



Source: Transjakarta

The procurement targets varies for every fleets type of Transjakarta.

Transjakarta e-Bus implementation phase based on bus typology

	Single & Low Entry Bus	Medium Bus	Articulated Bus	Microbus
Trial & Pilot	E-Bus trial has been started.	E-Bus trial has been started.	Targeted to be started in 2022.	Targeted to be started in 2022.
Phasing Consideration	Charging technology availability (opportunity charging and ultra-fast charging).	Prepared for opportunity charging due to the maximum limit of Gross Vehicle Weight (GVW).	Waiting for more economical battery prices & battery efficiency.	E-Microbus operational needs depo for charging facilities.

Transjakarta e-bus trial

Transjakarta has started to run E-Bus trial from different manufacturers since 2019. The last was Higer E-Bus, starting since the mid September, 2021.

BYD E-Bus Trial in Jakarta, 2019 and 2020

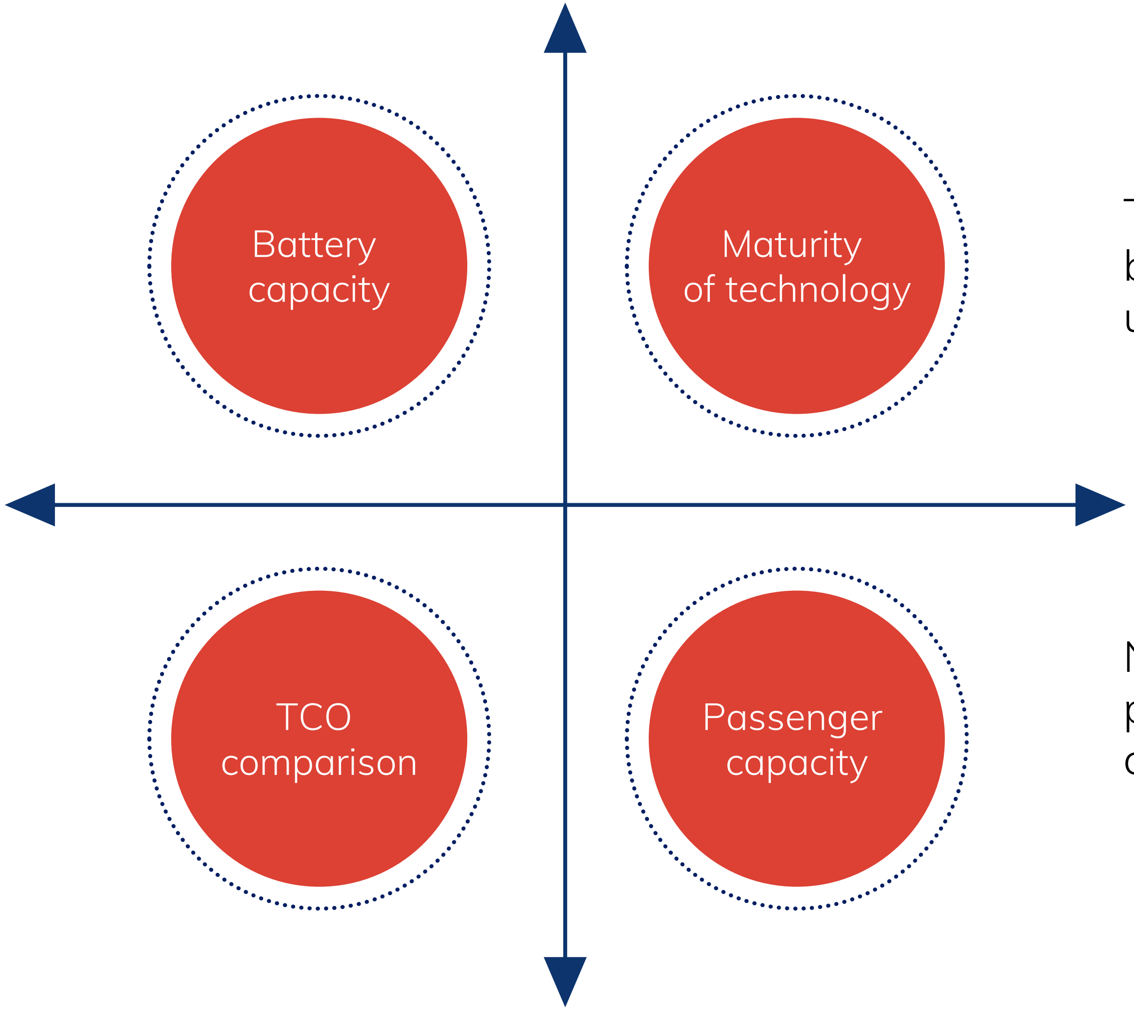
Higer E-Bus Trial in Jakarta, 2021

Source: Transjakarta

TransJakarta goals on electrification

Battery capacity that can cover daily distance travelled requirements

Technology that has been proven and well used in other cities



Small differences between Diesel Bus TCO and E-Bus TCO

No reduced in passengers capacity compared to ICE bus

Source: Transjakarta

Transjakarta
BRT and non-BRT system electrification

E-bus typology

The typologies classify electric bus technology options to avoid customization of Transjakarta E-Bus to reduce capital costs.

1.

Service type
of Transjakarta → BRT and non-BRT routes

2.

Fleet type

- Articulated bus (18 m)
- Single bus (12 m)
- Single bus low entry (12 m)
- Medium bus (8 m)

3.

Battery Size
Based on market availability* and bus type

Based on those parameters, Transjakarta E-Bus will be divided into 8 typology.

* Market availability: The combination of bus type and its battery size for the typologies has considered fleet model availability in the market

Recommendation on charging strategy selection

Starting with medium battery size, with overnight charging at depot

A. No additional infrastructure needed
B. Lower TCO and lighter battery

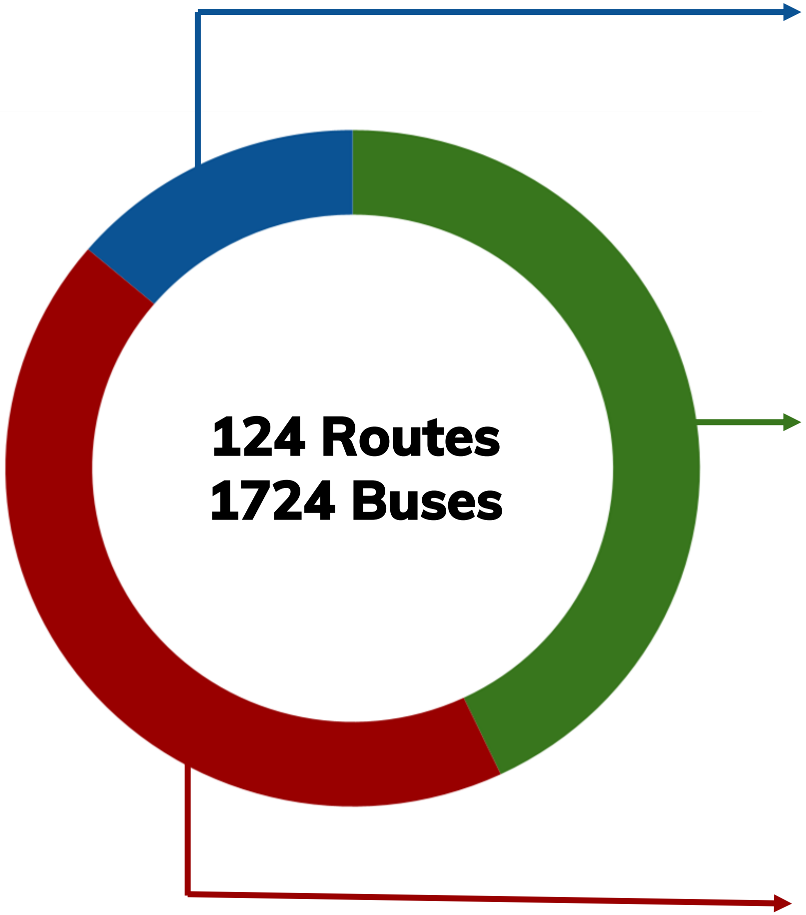
Opportunity charging with installed fast charging facility at terminal points

A. Charging occasion at the end of routes
B. Charging duration will be in line with existing operational

Provide staging facility at off peak hours

A. To cover energy requirements for the routes which can not be covered by overnight and terminal charging
B. The e-bus will be charged during off peak hours (split period)

Summary on Transjakarta e-bus charging strategy



Overnight charging 14% (150 kW charger power)

Need additional power 43% (Overnight + Opportunity + Additional off-peak charging strategy)

Overnight + Opportunity charging at terminal 43%

Opportunity charging analysis parameters:

- Space availability at terminus (dedicated land or mixed traffic)
- Available dwelling time vs charging time (based on the power output of the chargers)

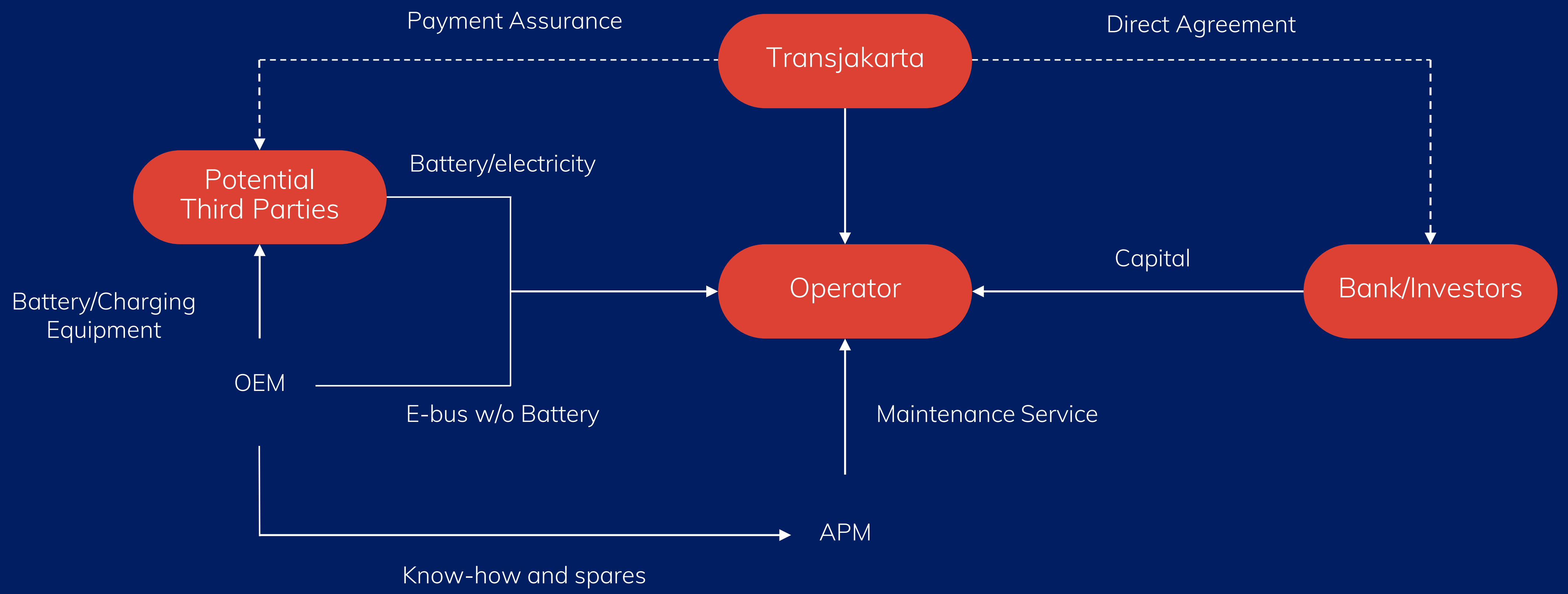
**It is assumed that fast charging facilities can be installed at Kampung Melayu and Lebak Bulus, although future traffic improvement are required in these locations*

Recommendation on e-bus implementation phase

ITDP recommended 5 Phases of Implementation of Transjakarta E-Bus deployment, starting from 2021 to 2030.

2021 - 2024		2024 - 2027		2027 - 2030
Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
• Single Bus	• Single Bus • Medium Bus	• Single Bus • Medium Bus	• Single Bus • Medium Bus • Articulated Bus	• Single Bus • Medium Bus • Articulated Bus
Overnight + Staging Facilities + Terminal Charging	Overnight + Terminal Charging	Overnight + Staging Facilities + Terminal Charging	Overnight + Staging Facilities + Terminal Charging	Overnight + Staging Facilities + Terminal Charging

Jakarta - proposed e-bus business models



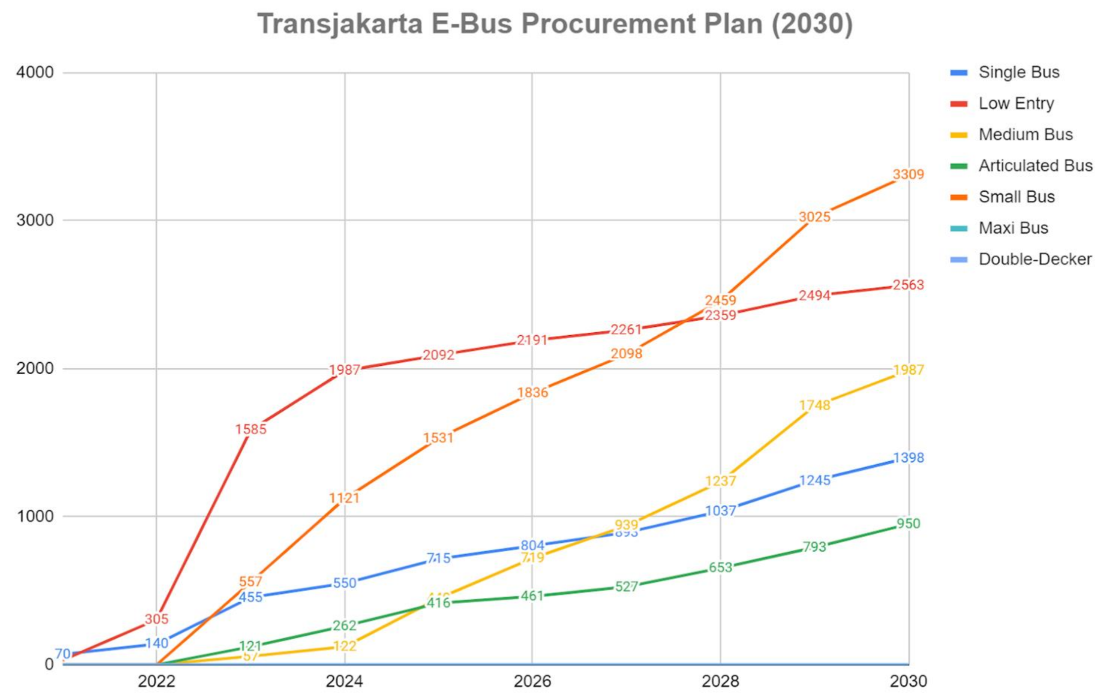
- Transjakarta could establish an agreement with Bank or Investor to support the capital capabilities of operators.
- The operators will cooperate with PLN/or other potential third parties for the provision of battery/ electricity.

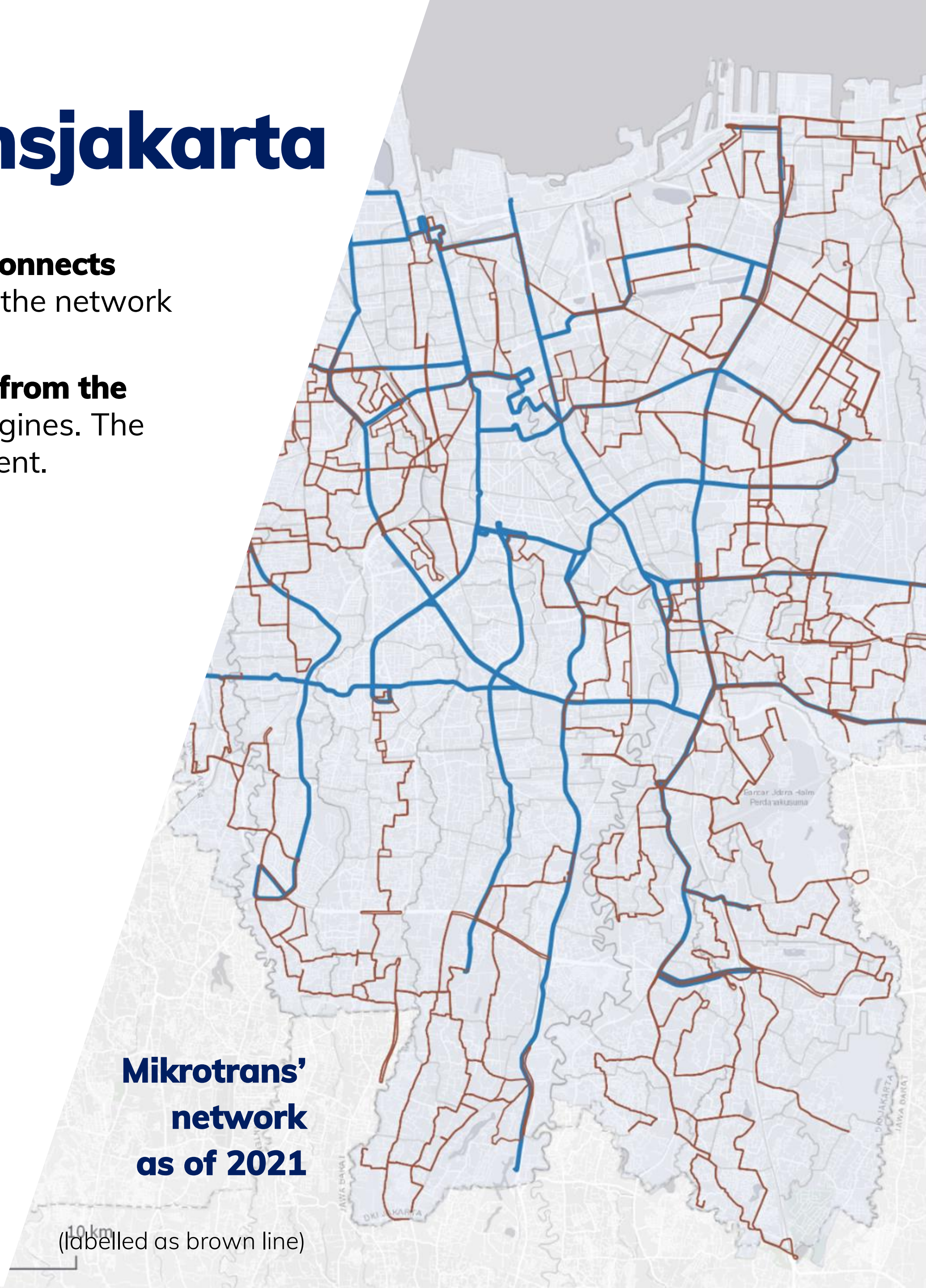
- OEMs will provide E-Bus without battery to the operators.
- APM will do maintenance services of E-Bus.

Microbus system electrification

Overview microbus system of Transjakarta

- Microbus system of Transjakarta, called Mikrotrans, has an extensive network that **connects residential areas to important transit nodes** in Jakarta. Started operating in 2018, the network now has **72 routes.**
- Based on the Transjakarta electric bus procurement target by 2030, **32% will come from the electrification of Mikrotrans**. But as of now, all of Mikrotrans' fleets still uses ICE engines. The electrification of Mikrotrans is very crucial to scaling up Transjakarta E-Bus deployment.



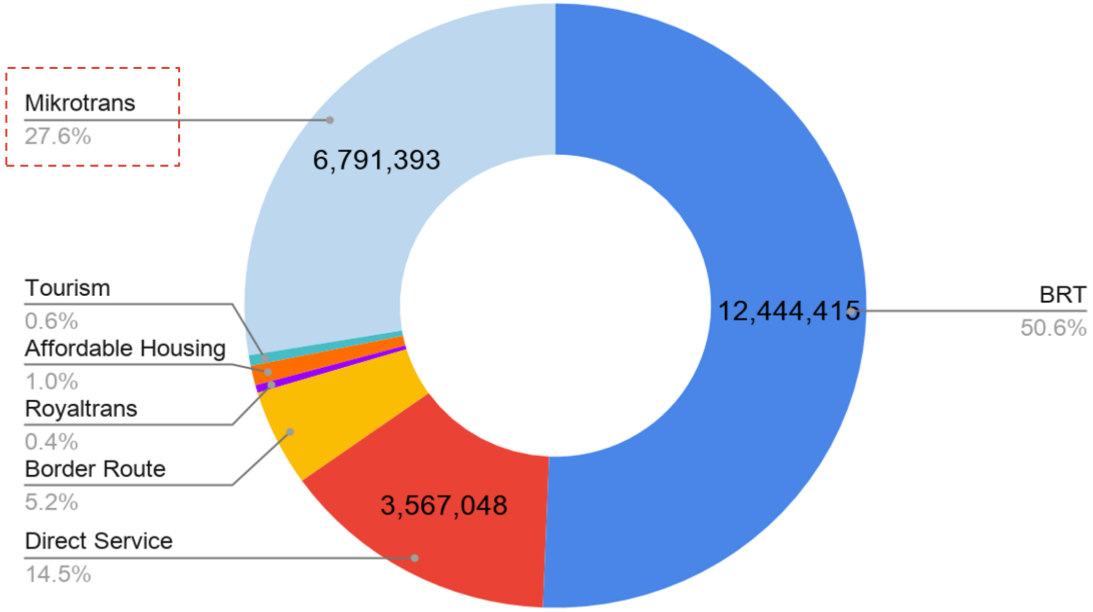


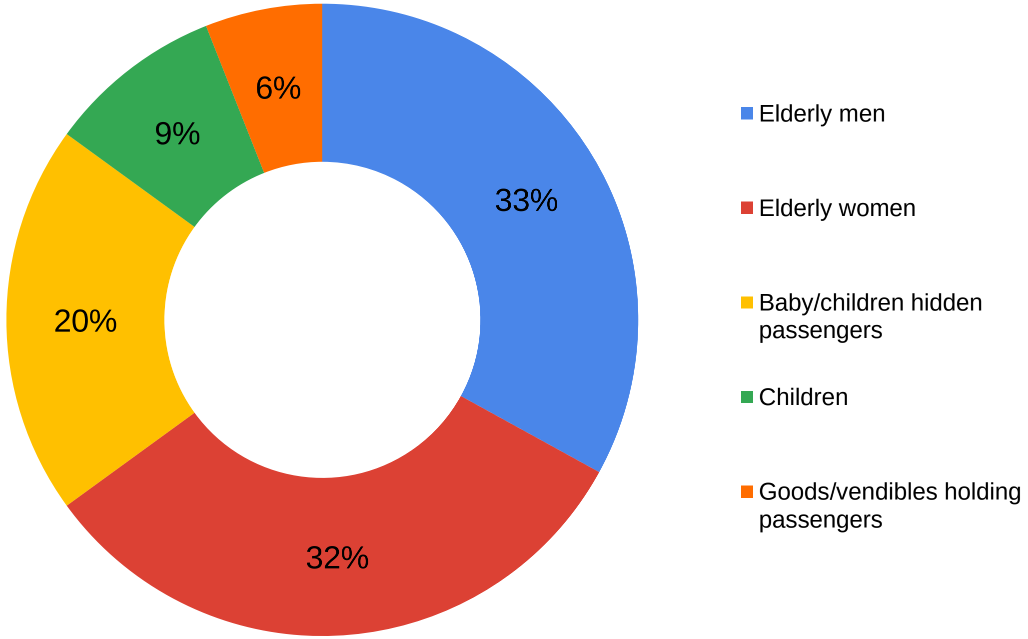
Mikrotrans' network as of 2021

(labelled as brown line)

Vulnerable users of Mikrotrans

- As of February 2020, Mikrotrans made up to **28% of Transjakarta users**.
- **Women** made up to **65% of Mikrotrans' users***.
- **Various vulnerable groups** are captured as Mikrotrans' users. **The majority** of vulnerable users comes from **elderly men**; followed by elderly women; children/ babies holding passengers; children; and goods/ vendibles holding passengers.*





*based on Boarding-Alighting surveys of 49 Mikrotrans Routes, 2021

Opportunities and barriers to electrifying Mikrotrans

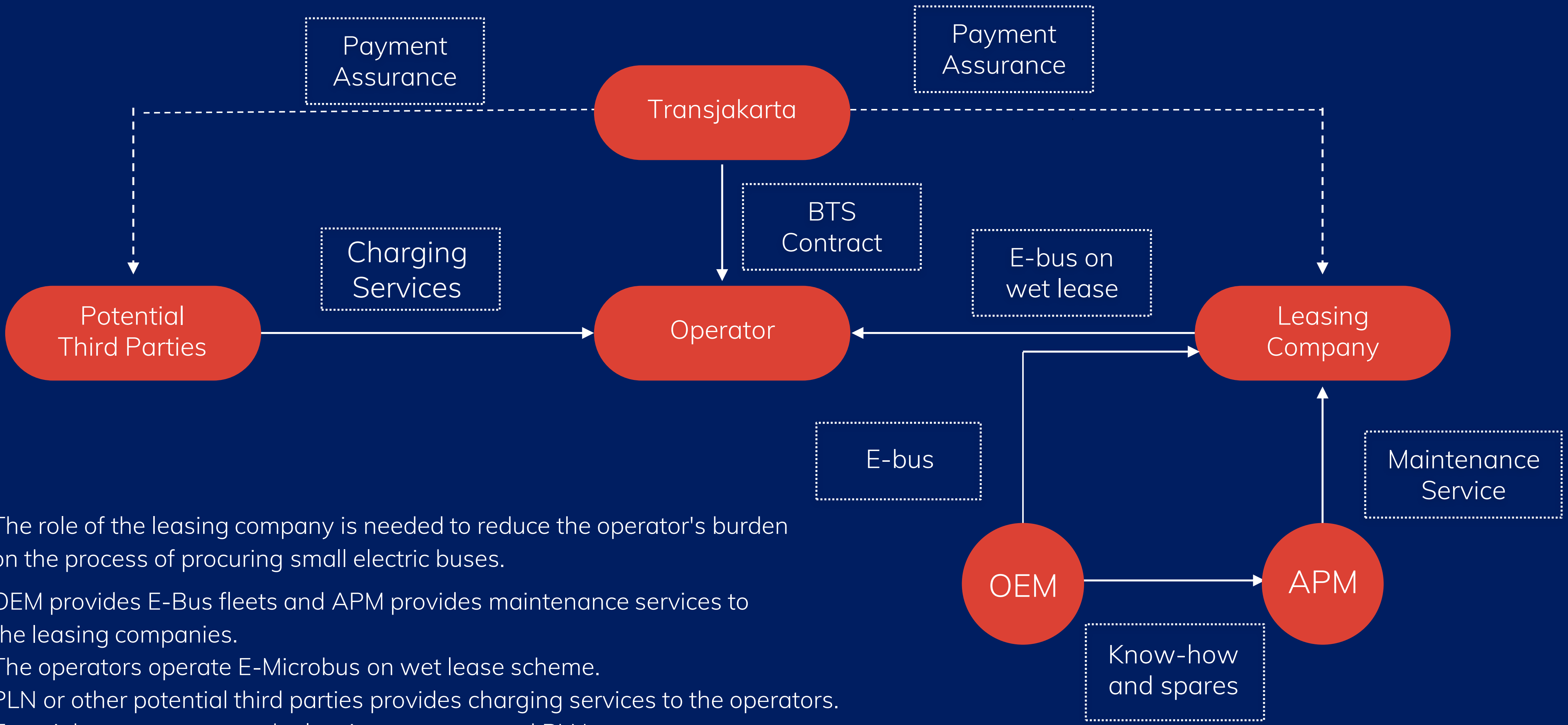
Opportunities

- Mikrotrans has **lower kWh/km battery consumption** than large buses.
- **Suitable models** for Mikrotrans has already been **available** on the market.
- Even though Electric Mikrotrans as of now has slightly higher CAPEX cost, it potentially has **20% lower TCO** compared to ICE Mikrotrans due to lower OPEX.

Barriers

- Has more **complex** involved **stakeholders** and **societal burdens** than BRT/non-BRT.
- Mikrotrans' operational **does not have depots**. Charging is only possible to be done at Mikrotrans layover areas.
- **Need leasing companies** to reduce the operator's burden to procure E-Bus.

Jakarta - proposed e-microbus business models



- The role of the leasing company is needed to reduce the operator's burden on the process of procuring small electric buses.
- OEM provides E-Bus fleets and APM provides maintenance services to the leasing companies.
- The operators operate E-Microbus on wet lease scheme.
- PLN or other potential third parties provides charging services to the operators.
- Transjakarta guarantees the leasing company and PLN a payment assurance.

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Thank you!

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City of Johannesburg EV readiness programme

Zanie Cilliers of Sustainable Energy Africa

Project overview

Aim: Build city of Johannesburg capacity on and readiness for the inevitable uptake of EVs across the metro.

Focus **1**

Response options to managing the impact of private EV charging on the grid.

- Localised grid impacts (capacity / cost), based on EV uptake model
- Private EV charging management options
- Tariff proposal (private charging)

Focus **2**

City role in public charging, in particular minibus taxis.

- Public charging infrastructure needs, based on EV uptake model
- Tariff proposal (public charging)
- Feasibility study on City-owned / managed public charging infrastructure, including linking to renewables
- Feasibility study for electrification of minibus taxis (business case)

Reasoning behind focus areas

Focus 1

Response options to managing the impact of private EV charging on the grid

80%

of EV charging will happen at home

(International experience)

Household EV installation occur mostly on low voltage networks

–reaching capacity limits in some areas and may require expensive infrastructure upgrades

Grid functionality needs safeguarding

– infrastructure used for social protection / wealth transfer (Free Basic Electricity for low-income households)

35%

of emissions are on-road transportation

(most from private vehicle)

Reasoning behind focus areas

Focus
2

City role in public charging,
in particular minibus taxis

70%
of commuting public in South Africa use minibus taxis

Public chargers usually installed on medium/ high voltage networks
with more capacity available

60%
of households spent more than 10% of income on public transport (2019)

Equity: not everyone will be able to afford or have the amenities
(off-street parking) to install EV chargers – hence need for public chargers

City mandate / authority

Cities and city developments can provide:

Adequate **public infrastructure**

- This may include EV chargers.
- Cities can either develop and own EV charging infrastructure or coordinate this development.

Promote health, financial and **environmental sustainability**

- Reduce public transport costs (from decreased vehicle maintenance).
- Decrease tailpipe greenhouse gas and pollutant emissions.

Provide affordable or subsidised EV tariffs

- To certain underserved sectors / households
- Provided the tariffs are transparent, approved, and do not contradict requirements for a fair and competitive regulatory framework.

Promote **equity & inclusion** in **transitions**
(such as the transition from conventional to electric vehicles)

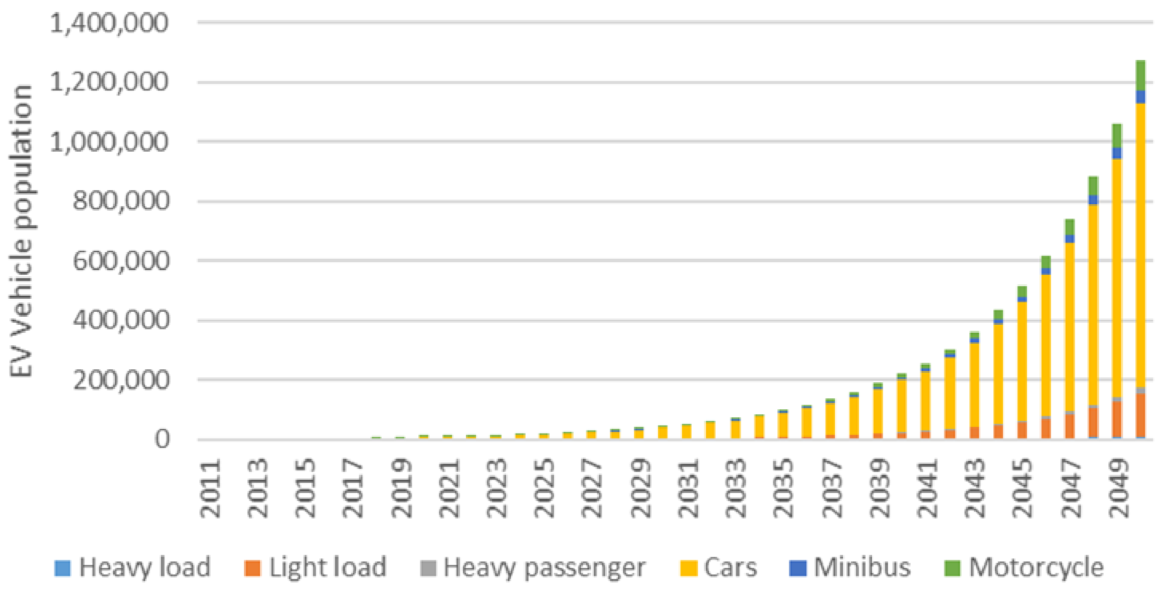
- The City’s focus could be on public charging infrastructure for underserved suburbs and/or public transport.
- Ensure safeguarding of grid for all (that upgrade costs linked to EV use by wealthy do not fall onto all (including low-income households)

EV uptake forecast

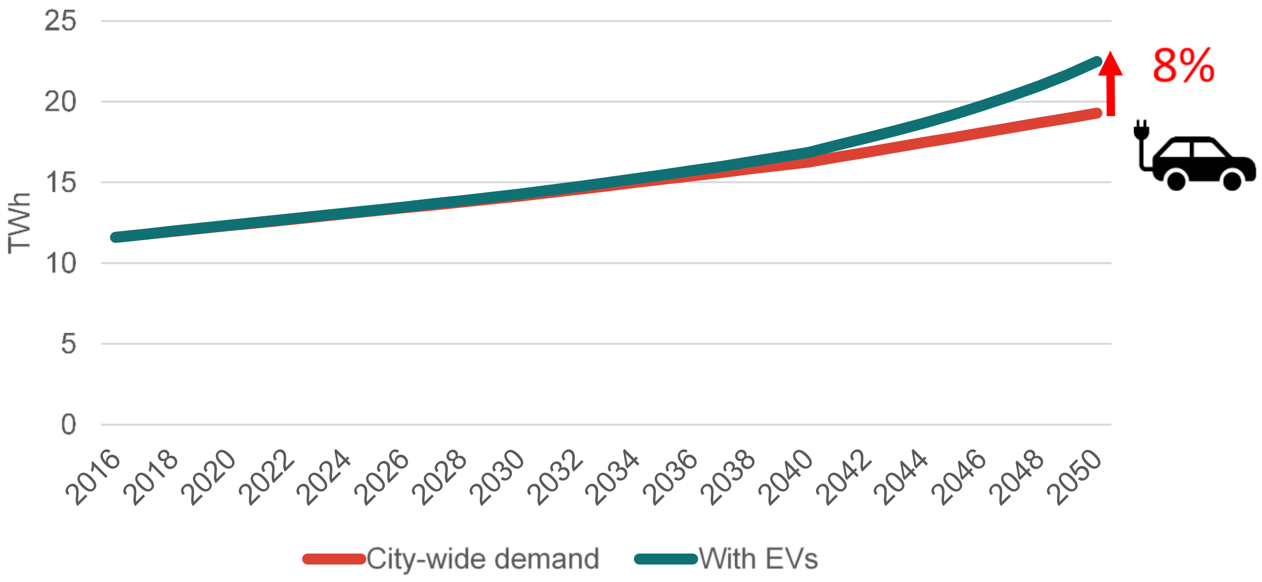
Vehicle numbers & electricity demand

- Based on EV uptake and mode shift targets from the City of Johannesburg's **Climate Action Plan**.
- **40-50 thousands EVs by 2030**, most of them private passenger vehicles
- EVs **increase** total metro area electricity **demand** by **8% by 2050**.
- Electricity demand increase seems manageable, but **impacts will be local.**

EV Vehicle population by type



Electricity demand



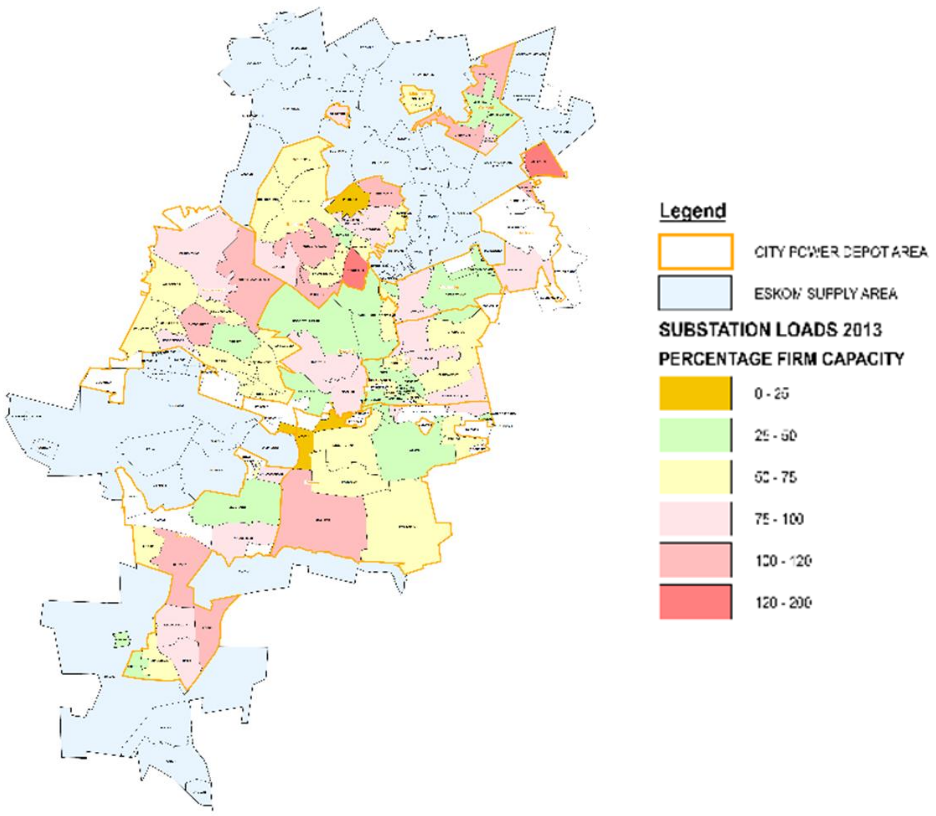
EV uptake forecast

Regional demand impact

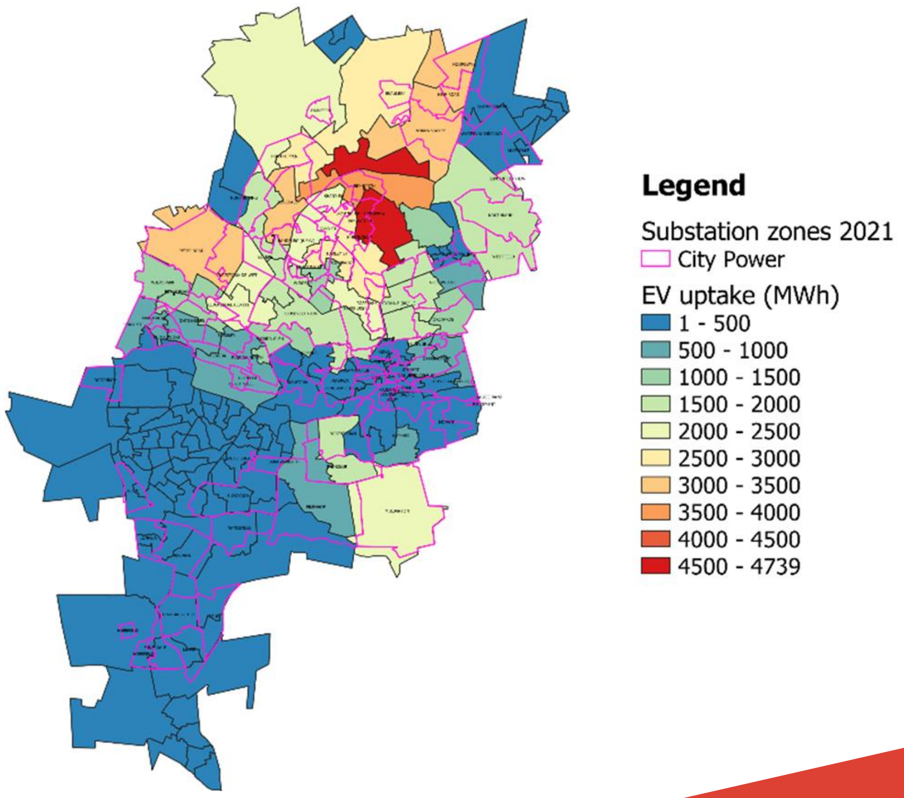
- Increased demand (caused by high-income households) occurring in areas where substations are already constrained (some areas already over 100% capacity)
- Can result in requirement for expensive infrastructure upgrades – will increase electricity service delivery costs and impact utility business model (and therefore ability to deliver services)

City Power JHB (PTY)LTD

Substation Loads (2013 Winter Load Readings)



EV Uptake (2030)

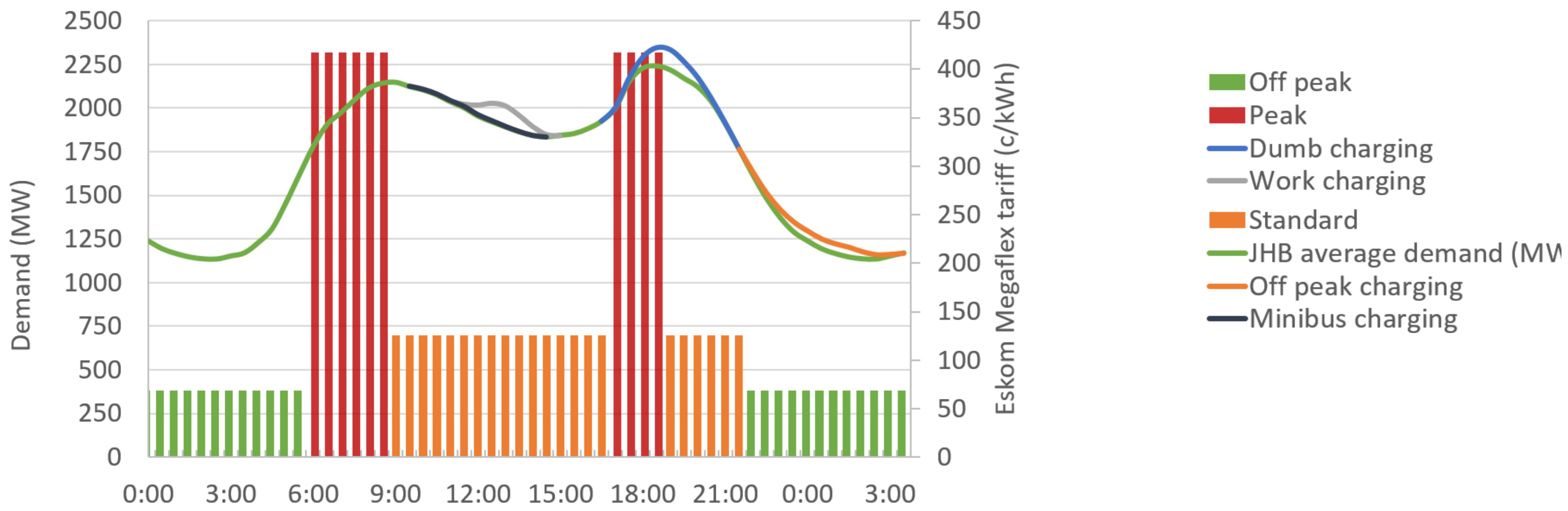


EV uptake forecast

Utility business model impact

- **Minibus taxis have negligible impact on grid by 2030** – more efficient mode of transport
- **“Dumb” charging** by private vehicles will **increase the utility’s costs** (energy and grid upgrades) – impact utility business model (ability for service delivery)
- If private vehicles **charge at night** – when capacity is available – **cost impact is reduced**. May increase utility revenue (one of few opportunities for load growth).

Impact of EV Charging on typical winter day (2030)



Managing impact of private EV charging on grid

City response options

Tariffs and City infrastructure

Planning and management of EV installations and tariffs to decrease EV charging impact on the grid, and related upgrade costs.

- Unmanaged EV charging by high-income households (the early EV adopters) could cause the need for extensive grid upgrades, the cost of which will be spread across all citizens, which is regressive.
- The grid is currently used as one of the biggest mechanisms of redistributive social protection, through Free Basic Electricity (which is cross-subsidies by high-income users).
- Planning for its maintenance / protection is therefore essential.
- EV tariffs that encourage charging in off-peak times will limit the cost linked to grid upgrades.

Staffing

Upskilling youth and female engineers and ICT specialists employed by the City:

- Employed on infrastructure and software related to grid management.
- The rapidly evolving space of new technologies (EV and SSEG), smart grids and the internet of things will require new skills to manage.
- The City can aim to grow these skills internally, through training programmes, becoming a centre of excellence and source of skilled technicians.

Procurement processes

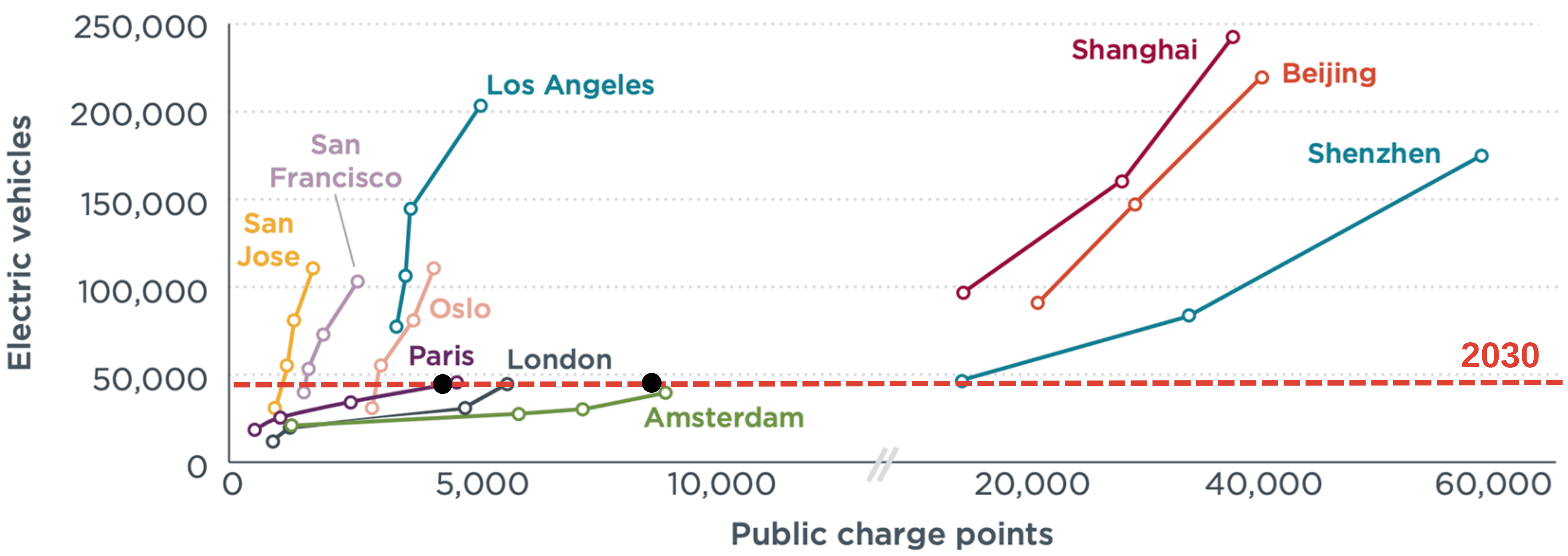
Business opportunity creation:

- Through the City's procurement policies, the City can ensure that priority is given to enterprises that are majority black and/or female-owned for contractual work required in managing the city's assets (grid) and fleet (both current and future electric-based fleet).

Public charging infrastructure & minibus electrification

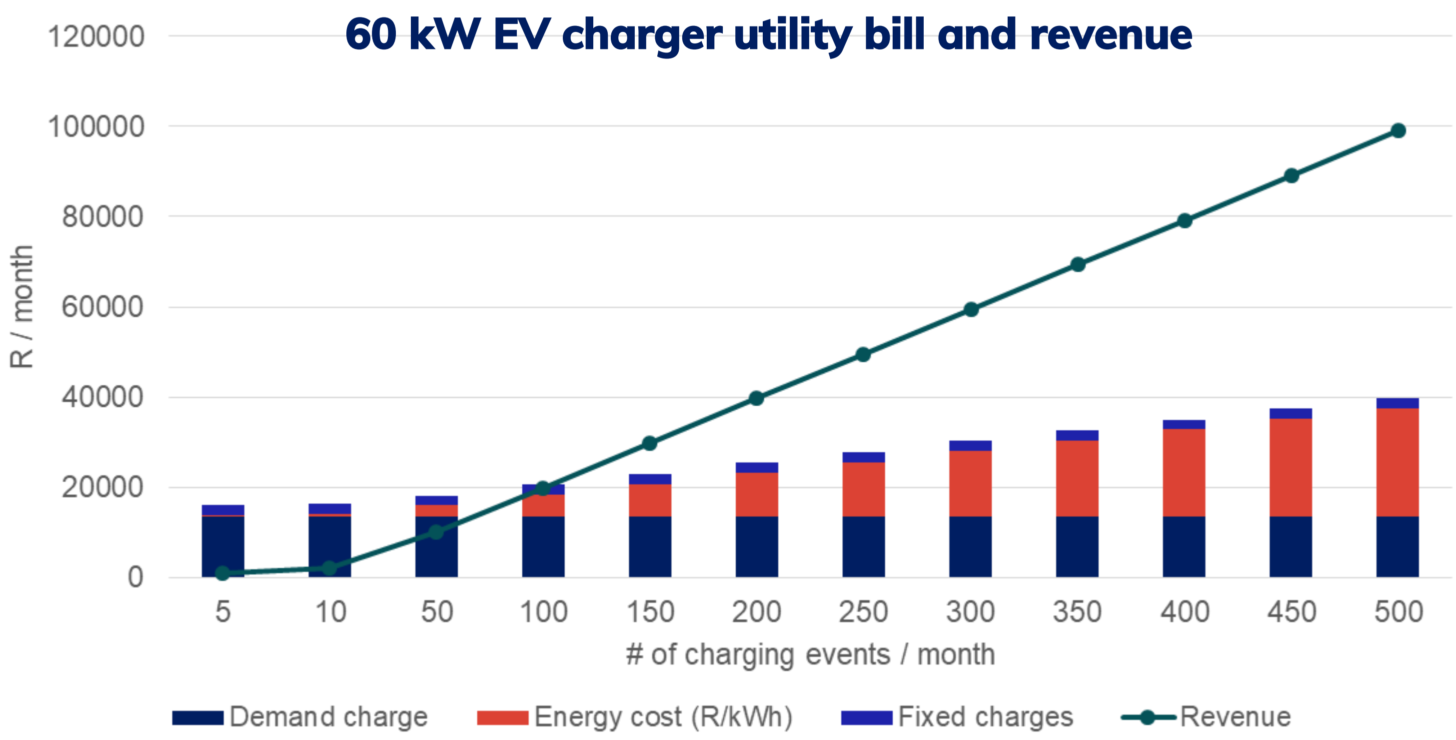
Infrastructure requirements

4000-8000 public chargers required by 2030, based on international no. of EVs per charger.



Public charging infrastructure & minibus electrification

Public charger feasibility



Customers per month (no.)	Payback period (years)
116	39.3
122	24.9
128	18.3
13	14.4
140	11.9
146	10.1
150	9.2

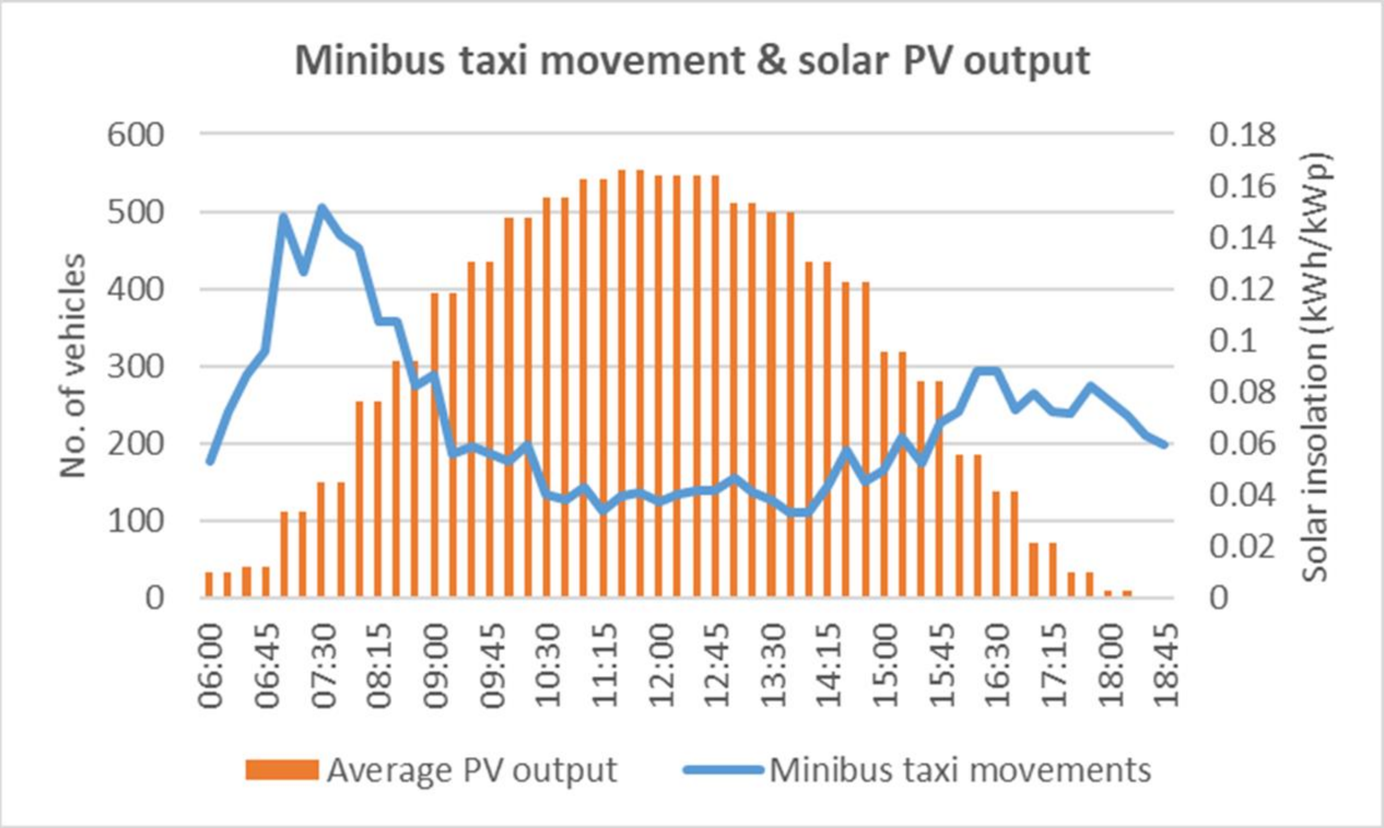
- **>100 EVs charging events per month required to break even with utility bill**
- **Payback decreases with increasing numbers of customers**
- **Only reason public charger business case is viable is because chargers are on a tariff linked to an existing building / user**
- **EV charger not as viable in early market stage**

Public charging infrastructure & minibus electrification

Feasibility of renewables and minibus electrification

Inter-city trips by minibuses usually during peak hours

An opportunity for charging with renewables during middle of day



Public charging infrastructure & minibus electrification

Feasibility of renewables and minibus electrification

Renewables

- Small-scale on-site (of charger) expensive (payback 10-15 years) and produce less power than charger rating – although good for awareness
- Power generation may not align with use (increases payback under current tariff environment)
- Best to align with nearby building load (e.g. mall, existing fuel station, etc.) – increase utilisation

Further research still to be done on business model

Comparing ICE vs EV costs

Concerns:

- No minibus EV models locally available (and international model prices are at least triple)
- Ad valorem (EV luxury tax)
- High EV import duties (protect local ICE manufacturing)
- Battery replacement costs
- Informal industry – advocacy needed

Public charging infrastructure & minibus electrification

City response options

Partnerships / agreements

Leasing municipal owned land/property to private installers at favourable rates in underserved areas, to enable public access and fulfil the social developmental objective and service delivery mandate of the city to all its communities.

- Alternatively, consideration of possible public-private partnership with a private installer, which would entail reduced service charges, an EV charger tariff that is progressive, and provision of land through a lease agreement.

Tariffs and city infrastructure

Developing progressive EV tariffs and/or consider rolling out city owned infrastructure for underserved
or key customers / sectors, such as minibus taxis.

- A charger at a major minibus taxi rank may experience high enough utilisation to cover operational costs.
- Favourable EV charging tariffs may take the form of a limited monthly allocation of lower-cost EV charging electricity units, similar to Free Basic Electricity, but linked to one vehicle.
- Broadly favourable EV charging tariffs, in particular during the early phases of EV uptake, will increase charger utilisation, which in turn improves the charger business case, resulting in lower tariffs – essentially solving the “chicken and egg issues” (EV chargers need many customers to be viable, but customers only buy EVs if chargers are available) and driving rapid uptake into a future where the number of EVs are high enough to allow for lower EV charging tariffs.

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Thank you!

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