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BUS FLEET ELECTRIFICATION:

INSIGHTS FROM GLOBAL PUBLIC TRANSPORT INNOVATORS

16 - 17 **MAY** 2024

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16 May 2024

Session 01

Evolution of the Electricity Costs Made by Transjakarta, Since the Implementation of Electric Buses

Daud *Jos*eph
Transjakarta Operational and Safety Director

BUS FLEET ELECTRIFICATION:
INSIGHTS FROM GLOBAL PUBLIC TRANSPORT INNOVATORS

Transjakarta Today

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408.95 Km
Corridor Length
Non Corridor 2,326.3 Km

251 M
Ridership in 2023
(YTD November 2023)

245 Routes
14 Main Corridor

8 Types
of Services

4,632 Fleets

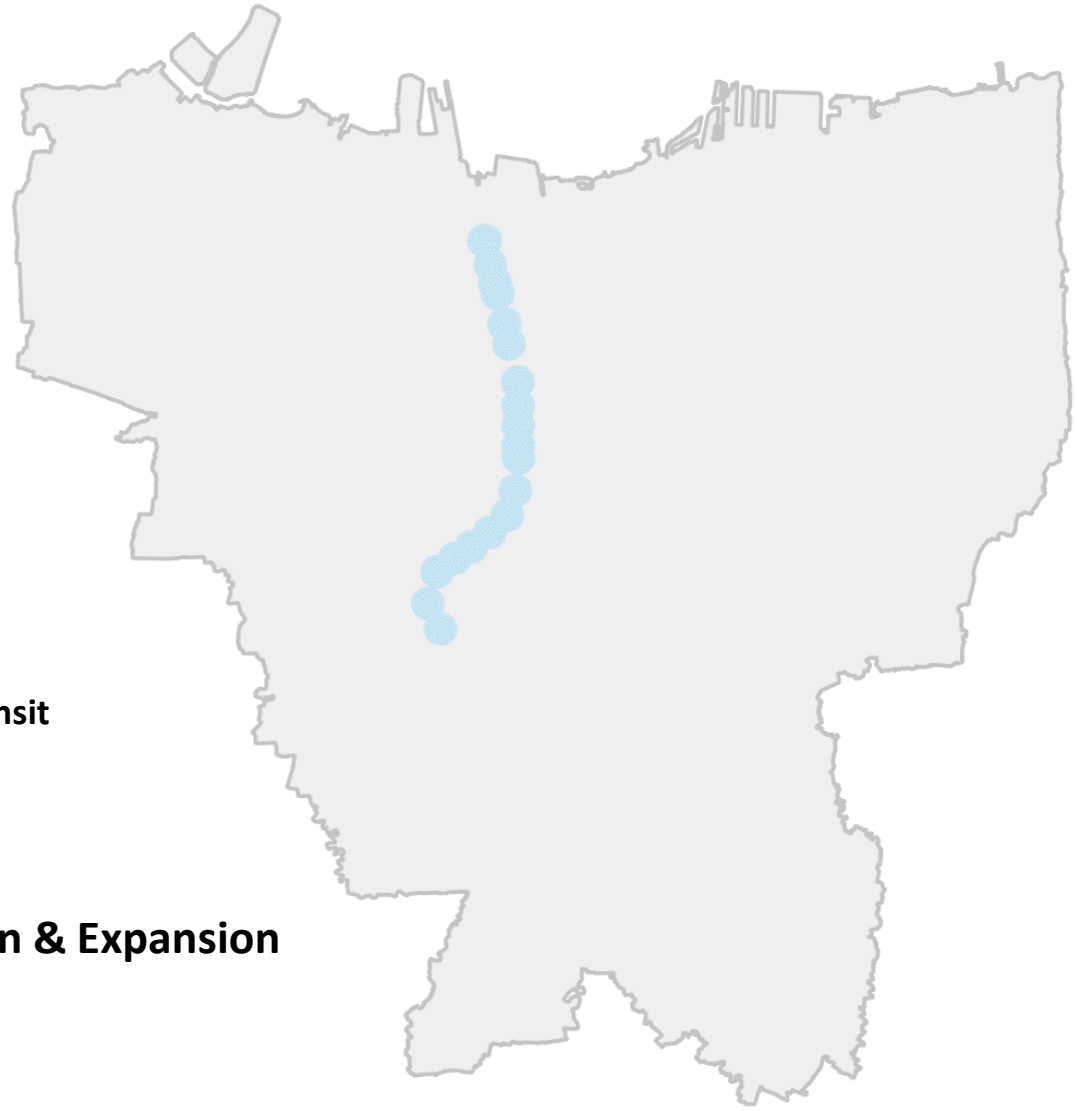
20 Operators

89% of Jakarta residents live within 500 meters from **Transjakarta bus stop**

Year	Highest Daily Customer
2015	320,000
2016	460,000
2017	489,076
2018	721,900
2019	998,658
2020	1,041,815
2021	508,698
2022	751,254
2023	1,174,098
2024	1,241.556

People Near Frequent Transit

1.8%



Results of Integration & Expansion

2004

Connecting The Life of Jakarta

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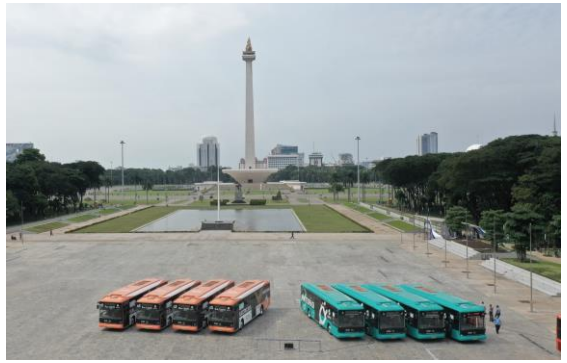
Transjakarta First 100 EV Buses



Operating since 2022
First launch 2 March 2022

3 Operators
Mayasari Bakti, PPD, Damri

3 Types of Bus Models
SAG, BYD, Skywell

10-Years Contract

Overnight Charging
at the Depo

Transjakarta Electric Fleet Progress

Electric Fleets Operation by May 2024

100 EVs

are currently operating across 9 routes:

1E Blok M - Pondok Labu
1P Senen – Blok M
4B Stasiun Manggarai – UI
4C TU Gas - Bundaran Senayan
4F Pinang Ranti – Pulo Gadung
5M Kampung Melayu – Tanah Abang
6D St. Tebet – Bundaran Senayan
7A Kampung Rambutan - Lebak Bulus
D21 Universitas Indonesia - Lebak Bulus

2019 | 2020 | 2022 | 2023

Electric Fleets Trial

*RnD & MoU with **BYD** on 2019*

3 Months, 06 July - 06 October 2020
Two types of EV, K9 & C6

Contract signing with Mayasari
7 February 2022
30 Unit

Contract signing with Mayasari
28 October 2022
28 Unit

30 Electric Fleets Operation
2 March 2022
1N Tanah Abang - Blok M
1P Senen - Blok M
6D Stasiun Tebet - Bundaran Senayan

Contract signing with PPD
28 December 2022
26 Unit

Contract signing with BMP
30 December 2022
22 Unit

22 Electric Fleets Operation
20 June 2023
D21 Universitas Indonesia - Lebak Bulus
7A Kampung Rambutan - Lebak Bulus
1E Blok M - Pondok Labu

26 Electric Fleets Operation
23 December 2023
1P Senen – Blok M
4C Pemuda Merdeka – Polda Metro Jaya
4F Pinang Rnanti – Pulo Gadung

22 Electric Fleets Operation
24 November 2023
4B Stasiun Manggarai – UI
4C TU Gas – Bundaran Senayan

Insights from 100 EVs and 2-Years Operation

The fleets have **surpassed expectations** in terms of operated kilometers, zero breakdown, and electricity efficiency.

transjakarta

Transjakarta pays the operator based on **Rp/km**

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Daily km per bus operated

Expected KM contract **196** km

Implemented realization up to **110%**

Zero breakdowns

>99% zero breakdowns from operation plan

Higher efficiency in electricity usage

Plan: **0.77 km/kWh**

Actual: **0.91 km/kWh**

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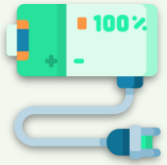
Challenges: *Transitioning to Electric Buses*

Reduce Acquisition Cost

- Decrease the initial investment required for electric buses.
- By **reducing bus prices** significantly, ideally aiming for a **35% decrease** from current prices

Justify the Benefits of Implementing EVs

- Convincing stakeholders and the public about the **advantages of electric buses** is vital.
- Operating EV buses has a **positive impact** on the environment is essential.



Reducing Electric Bus Battery Capacity

- Reducing the battery capacity by either **50% or 33%** is a challenge to make **EV bus more cost-effective**.
- Allowing the implementation of Opportunity Charging

Carbon Trading

- Maximizing the benefits of carbon trading helps gain **financial advantages** while supporting **environmental objectives**.

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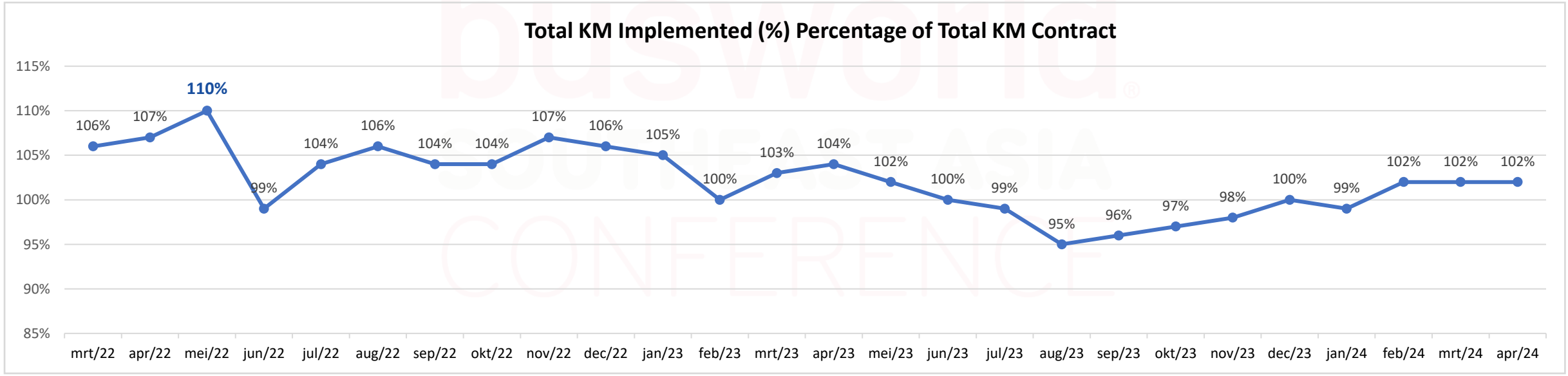
The KM Contract achieved up to 110% throughout the EV Operation



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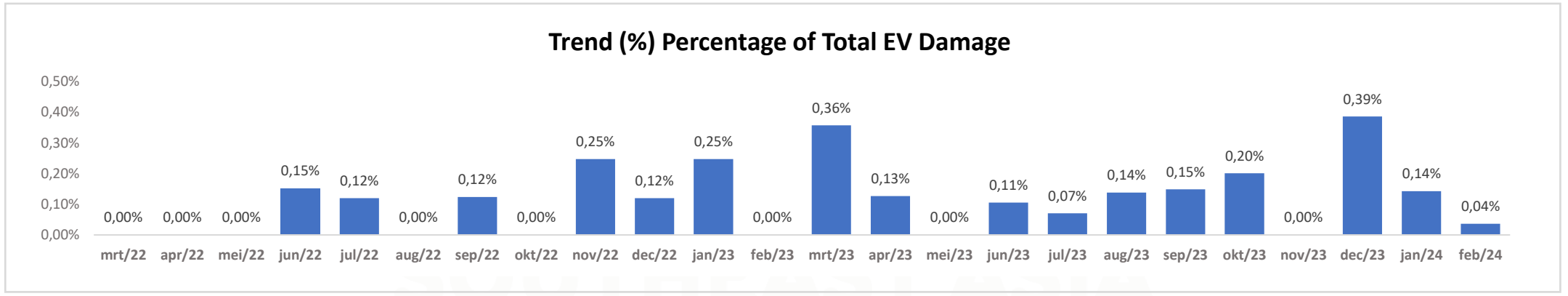
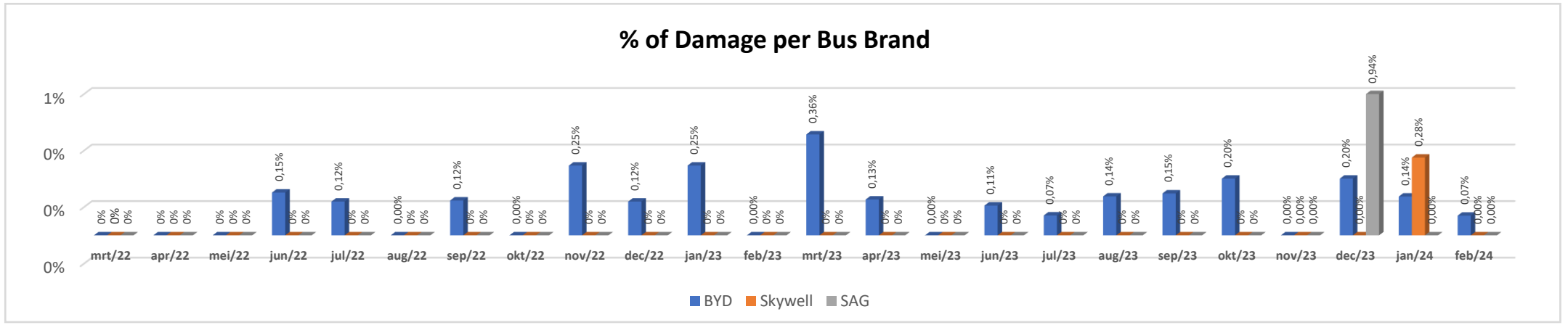
The Availability of Electric Vehicle (EV) is Better Than ICE Buses (>99%)





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Challenges:
Cost to Establish Sustainable Transportation

	EV 7-year contract	**EV** 10-year contract
ICE 7-year contract	**35%** more expensive	**15%** more expensive

The maintenance and energy costs for **electric buses** are **significantly lower** compared to **Internal Combustion Engine (ICE) buses.** However, due to the higher investment costs (bus prices and charging infrastructure), the overall Total Cost of Ownership (TCO) remains higher.

ICE	EV*	EV vs ICE
TCO remains more economical	TCO remains higher	EV TCO is 15-35% higher
Bus Investments comprises 25% of TCO	Bus Investments comprises 49% of TCO	EV bus investments is 2-2.5 times greater
Energy (fuel) accounts for 16% of TCO	Energy (electricity) accounts for 4.6% of TCO	EV energy costs are 70% more economical
Maintenance makes up 26% of TCO	Maintenance makes up 14% of TCO	EV bus maintenance costs are 46% more cost-effective

**Average ICEVs price*

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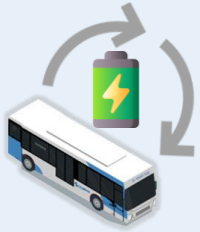
Regenerative Braking helps increase EV range by up to 22%

Source: Valladolid J., & Calle, M. (2023). Analysis of Regenerative Braking Efficiency in an Electric Vehicle Through Experimental Test. doi:10.17163/ings.n29.2023.02

Stop-and-Go Strategy

- Optimizes efficiency but also sets the stage for a windfall effect.
- Aligns well with technologies like regenerative braking that commonly found in EVs.



Regenerative Braking in EVs

- Capturing and converting kinetic energy into electrical energy during braking
- **Regenerative braking effectively recycles energy** that would otherwise be lost, allowing it to be **stored and reused.**

Windfall Effect

Additional **benefits** from stop and go strategy:

- Energy efficiency
- Financial savings
- Improved passengers experience.

Efficiency Goals

- Studies have shown, **this process can enhance an EV's range by up to 22%**
- Highlighting the significant impact of regenerative braking on maximizing efficiency and extending driving distances on a single charge.

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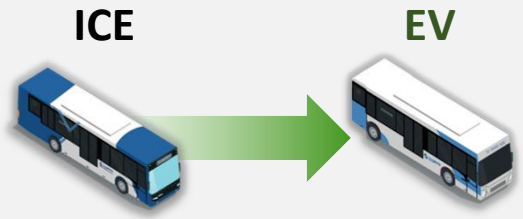
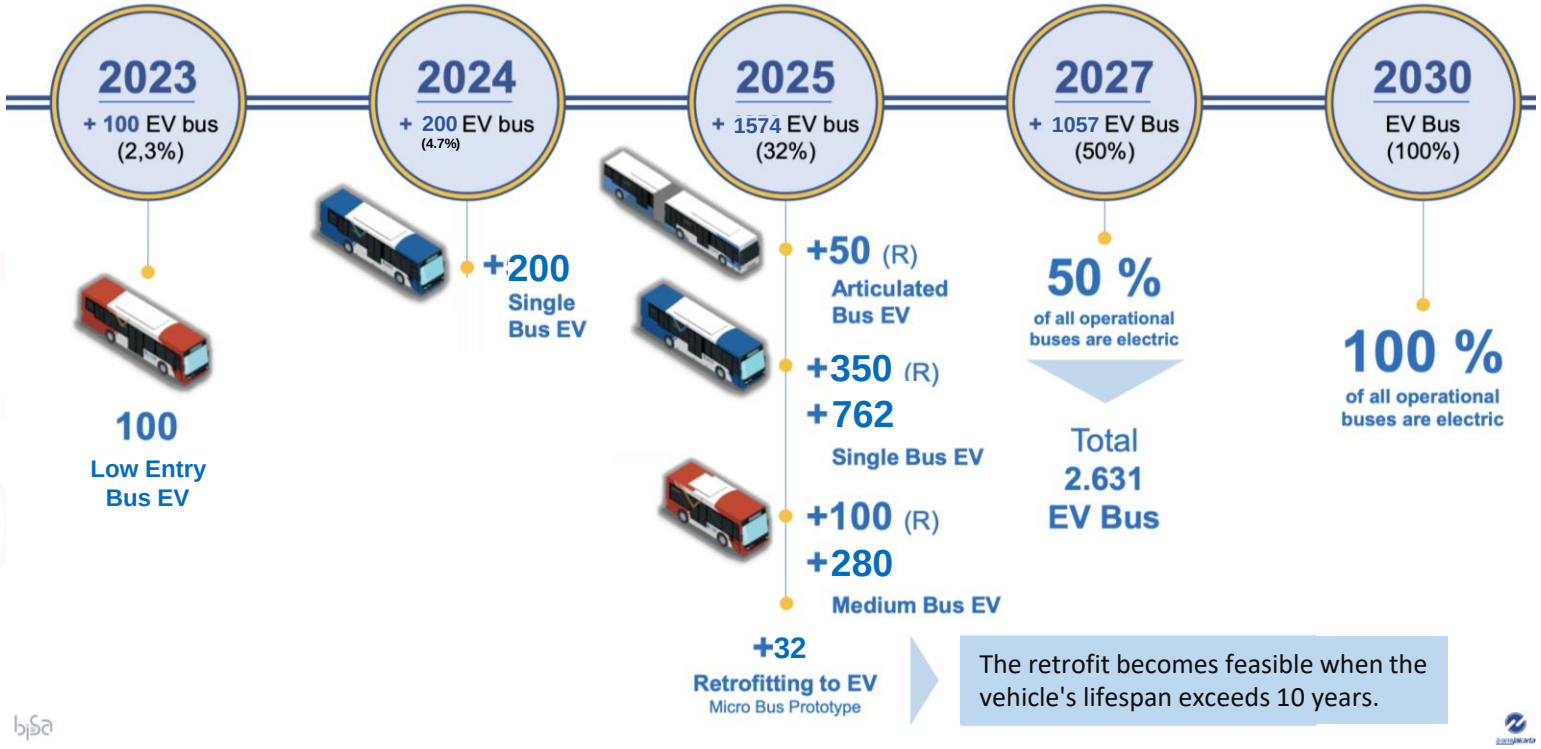
Plan for Electric Vehicles Procurement and Retrofit

	2024	2025	2027	2030
Total Fleets (units)	4,661	5,256	5,262	5,262
ICE Bus (units)	4,461	3,574	2,631	0
EVs (units)	300	1,874	2,631	5,262
% EV (units)	4.7%	32%	50%	**100%**



When **EV's TCO is lower than ICE's**, the **conversion to EV is no longer questionable** because it's not only dedicated for sustainability or environment, but also effectivity and efficiency.

Transjakarta Electrification Target



Transjakarta
+200 EV Buses
in 2024

200
***High Deck** BRT*

***TCO of EVs** is **cheaper** compared to TCO of ICE Bus*

*How to achieve **cheaper EV?***

Investment cost **20% lower** compared to the first 100 EVs

Fleet utilization is **higher** than the first 100 EVs

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Interest rate is **lower** compared to the first 100 EVs

10% higher daily KM compared to the first 100 EVs

Electricity cost is **11% lower (no VAT)**

Electricity power increase 28% compared to the first 100 EVs

Maintenance cost 5% lower compared to the first 100 EVs

EV Buses Operation contract is 3 years longer compared to ICE Buses