Developing an E-Bus Roadmap to Scale:
Jakarta’s Study on Mikrotrans Electrification

Faela Sufa, ITDP Southeast Asia Director
With its 3,573 fleets, Transjakarta has a variety of services, ranging from 18 m articulated buses operated on BRT services to 4 m fleets running on microbus routes, called “Mikrotrans”.

Source: Transjakarta, November 2021 (before pilot e-bus launched)
Transjakarta electrification plan and current progress
Around **10,000 electric bus fleet** are planned to be operated by 2030.

The procurement targets vary for every fleet type of Transjakarta.
Current Progress: Transjakarta E-Bus Pilot Project

30 low floor e-buses have been procured running 200 km daily with overnight charging facility.
Integrating Mikrotrans into the Transjakarta system
Integrating Mikrotrans into Transjakarta System: a Journey

- Intransparent tariff & operational schedule
- Board and alight passengers anywhere
- Low safety and security

Microbus cooperatives/operators are contracting with Transjakarta (gross cost contract)
- The operators will be paid cost/km based on the contract
- The operators should comply with the Service Level Agreement (SLA)

Diesel microbus fleets renewal, real-time visual information + air-conditioned

Integrated under the Jak Lingko, the integration system for Jakarta’s public transport

Semi-regulated paratransit, low performance of reliability

Fleet electrification

*Based on 2020 Transjakarta electrification plan
By improving Transjakarta services, including integrating microbuses into the system, the company managed to enhance:

- **People Near Transit (PNT)**: From 42% in 2017 to 82.1% in 2020, a 96% increase.
- **Number of Routes**: From 122 in 2017 to 248 in 2020, a 103% increase.
- **Daily Passengers**: From 489,076 in Dec 2017 to 1,006,579 in Feb 2020, a 108% increase.

In just 3 years.

Other positive impacts for the passengers:

- Improve passengers' travel experience
- Free tariff, reducing transportation expenses
Why Mikrotrans Electrification?

3309 fleets.

32% of Transjakarta e-bus fleets in 2030 will derive from the electrification of Mikrotrans, highest among other fleets types.

The electrification of Mikrotrans is momentous to scaling up Transjakarta electric bus deployment.

21% cheaper.

In 5 years, the electric microbus can provide cheaper cost/km by 21% compared to similar type of diesel bus, due to 40% reduction in O&M cost.

70 routes.

Mikrotrans has an extensive network that connects modest residential areas to important transit nodes in Jakarta.

28% of Transjakarta daily users use Mikrotrans, and 65% of them are women.

The electrification will improve accessibility & journey convenience of vulnerable groups with zero-emission and less-noise technology.

70% GHG reduction.

With the integration of renewable energy for electricity sources, such as Solar PV, GHG in 2030 can be potentially reduced to 70% from the business as usual (BaU) scheme.
Mikrotrans Operational Characteristics

- No depot available for overnight charging
- No off-peak split
  - Longer dwelling time at terminus
- Low carrying capacity
  - Operate in narrower streets
  - Stop at designated bus pole
  - Same operational hours as large bus
  - Serving dense neighborhood
Potential Charging Locations

Considering the unavailability of depots, 60 terminus points of Mikrotrans are identified and potential to be overlay locations for Mikrotrans charging.

Mikrotrans could take advantage of longer dwelling time duration at the terminus for charging purpose.

* ITDP route-level survey, 2021
Developing Roadmap for Mikrotrans Electrification
Developing Roadmap for Mikrotrans Electrification

Things to consider for developing the roadmap:
- Electrification targets and expansion plans
- Phase out plan of diesel buses based on age of fleet
- Business models and funding models
- Charging policy (own charging or public charging policy)

Implementation phasing developed based on:
- Key supporting policies needed
- Charging strategy
- Battery and charging technology
- Charging infrastructure
- Number of e-bus procured needed
- Routes selection
## Proposed Roadmap for Mikrotrans Electrification

<table>
<thead>
<tr>
<th></th>
<th>2022</th>
<th>2023</th>
<th>2024 - 2025</th>
<th>2026 - 2028</th>
<th>2028 - 2030</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Policy</strong></td>
<td>Roadmap &amp; institutional policy, demand creation policy</td>
<td>Environmental policy, infrastructure provision policy</td>
<td>Supply support policy</td>
<td>Land bank policy</td>
<td></td>
</tr>
<tr>
<td><strong>E-Bus to be procured</strong></td>
<td>50</td>
<td>507</td>
<td>974</td>
<td>928</td>
<td>850</td>
</tr>
<tr>
<td><strong>Charging infrastructure</strong></td>
<td>Existing Terminals (layover location)</td>
<td>Depots and existing terminals</td>
<td>Existing and new depots, existing and new terminals, public charging stations &amp; parking bays</td>
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</tr>
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<td><strong>Charging strategy</strong></td>
<td>Overnight + terminal charging</td>
<td>Overnight + terminal charging</td>
<td>Overnight + terminal charging</td>
<td>Overnight + terminal + staging charging (optional)</td>
<td>Overnight + terminal + staging charging (optional)</td>
</tr>
<tr>
<td><strong>Battery and charging technology</strong></td>
<td>LFP</td>
<td>LFP, NMC</td>
<td>LFP, NMC</td>
<td>LFP, NMC, or newer technologies</td>
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</tr>
<tr>
<td><strong>Energy capacity</strong></td>
<td>50 - 75 kWh</td>
<td>50 - 100 kWh, efficiency ~ 3 km/kWh</td>
<td>50 - 100 kWh, efficiency &gt; 3.5 km/kWh</td>
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</tr>
<tr>
<td><strong>Charging capacity</strong></td>
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</tr>
<tr>
<td><strong>Routes selection</strong></td>
<td>New routes + based on pilot selection</td>
<td>Based on routes ranking</td>
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</tr>
</tbody>
</table>
Important milestones on each implementation phase need to be achieved to ensure the success of Mikrotrans electrification:

- **Pilot phase**: Create a quick demonstration value.
- **Phase 1**: Subsidy, incentives, and persuasion help to reach a tipping point.
- **Phase 2**: Technology has been established, business models are in place towards large scale electrification.
- **Phase 3**: The ability to try new technologies and business models towards large scale electrification exists.
- **Phase 4**: Deployment has reached a stable phase.
There are not many cities around the world that have deployed electric micro buses for passenger service. This highlights how **pilot phase for Mikrotrans electrification is crucial**.

1. Evaluate the technical specifications
2. Conversations with microbus manufacturers & operators
3. Route selection
4. Involving OEMs on running the pilot phase, collect data on the performance
5. Perform duty cycle analysis, evaluate the findings
6. Move towards a full deployment based on the roll-out plan
Lessons Learned
Barriers and Challenges

- **Segregated visions and actions** from the National Government and Local Government.
- **Lack of supporting local policies** for large scale deployment of Transjakarta e-bus.
- Higher **complexity and social issues** on electrifying the Mikrotrans.
- Current Transjakarta **business models and financing schemes** can not cope with the electrification target, since the private operators need greater financial capacity.
- **Limited knowledge** about know-how of electric buses.
- The absence of **public charging infrastructure** that could be used for Transjakarta’s e-bus.
- Current Mikrotrans fleets’ **fuels are subsidised** (RON 90).
Thank you

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