Zero Emission Bus Rapid-deployment Accelerator (ZEBRA) Partnership in Mexico City

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*Transition to Soot-free Heavy-duty Vehicles and Fuels: Technical Workshop on Electrification of the Heavy-Duty Vehicles*

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Shift all new bus procurements in leading Latin American cities to zero-emission technologies
THE ZEBRA PARTNERSHIP

ZEBRA Summary of Approach

3,600 e-buses in core and catalytic cities, worth 1.6 bi USD of investment

Cities
Led by: C40/ICCT

- Guarantee political commitment and develop fleet-wide deployment strategies in leading Latin American cities (Medellín, Mexico City, Santiago, São Paulo).
- Support the establishment of a procurement pipeline of over 3,600 e-buses in the region.

Industry
Led by: ICCT

- Increase market competition and product availability.
- Establish ZEBRA industry guidelines.
- Monitor real world performance data.
- Engage utility sector to ensure charging infrastructure delivery.

Finance
Led by: C40

- Secure public commitments from leading investors to send clear market signal.
- Establish context-specific financial mechanisms for zero emission bus assets worth over $1.6 bi USD.
- Design streamlined process for mobilisation of project preparation funding.

Knowledg e Sharing
Led by: C40/ICCT

- Host annual showcase event.
- Facilitate knowledge transfer across cities.
- Showcase e-bus deployments in the region.
- Deliver training on best practices to utilities and financiers.

3,600 e-buses in core and catalytic cities, worth 1.6 bi USD of investment
Mexico City commitments and policy landscape

- Mexico City carbon neutrality by 2050
- Mexico City signed C40's "Clean and Healthy Streets Declaration"
  - All new buses to be zero emissions by 2025
  - Zero emission zone by 2030
- Mexico City Climate Change Strategy and Program 2021-2050
  - Ambitious targets rely on electrification of transport
  - The commitment of one fully electric BRT line by 2024 (currently 2 lines are being electrified)
- National tax import exemption for electric vehicles (~20% cost) until 2024
Announcement of a zero emissions BRT route 2019

Arrival of 18m articulated BEB for pilot in Line 3 and announcement of a new zero-emissions route (Circuito Cero) September 2020

Import tax exemption for EVs for 4 years until 2024 September 2020

Arrival of Volvo 12m BEB for pilot in Line 4 January 2021

Leasing of 9 BEB of the same characteristics as the pilot bus September 2021

Current procurement phase of 51 BEB for Line 3 and 19 for Line 4 2022

Fleet renewal of ~508 buses to BEB by 2030. It represents ~65% of the total fleet

New business model
Methodology

**Route level analysis**
- GPS data
- Operations and scheduling of routes analysis
- Drive cycle development
  - Regular operation, weight, passengers, traffic, grade, day, events

**Total cost of ownership**
- Simulation of different vehicle technologies
- Energy consumption analysis
- Route level TCO
  - Vehicle and infrastructure
  - Operations
  - Maintenance
  - Other

**Fleet emissions modeling**
- Fleet renovation and procurement plan
- Fleet emissions by vehicle technology:
  - Local pollutants
  - GHG

Fleetwide deployment strategy
- Medellín
- Mexico City
- Sao Paulo

Real-world performance and simulation

- BEB monitoring
- Route operations monitoring
- Data cleaning and data processing
- Derive drive cycle
- Simulation tool
- Energy analysis

- Calibrate simulation tool
- Validation of operation kpis
- Real consumption
- Simulation of different drive cycles and bus typologies
- Route level analysis
- Battery capacity
Metrobús fleet

Metrobús is a government-owned fleet and the only BRT system in Mexico City.

Currently has 7 lines with ~780 buses of different typologies.

Plans to renew 80% of buses in lines 3 and 4 in 2022-2023.

1.4 million pax/day
~170+ km
~780+ buses
TCO for Line 3

0.9 kWh/km, day-use electricity cost, 250 km
TCO L3 (mill mxn); 10 year contract project

Sensitivity analysis

Infrastructure cost
MX$1.6 mill
TCO L3 (mill mxn); 15-year contract
Sensitivity analysis

Infrastructure cost MX$1.6 mill
GHG reductions BEB vs Euro V/VI

L3

Conservative assumption of same fuel consumption of Euro V and Euro VI

WTT: Well to Tank
TTW: Tank to Wheel
WTW: Well to Wheel
Key Findings

• 1:1 replacement ratio is possible
• Larger project time better TCO:
  • Timeframe of contracts/projects aligned with the expected lifetime of assets
  • Line 3: -11% in 10-year contract vs. -26% in 15-year (diesel vs. electric)
  • Line 4: -21% in 10-year contract vs. -32% in 15-year (diesel vs. electric)
• Sensitivity analysis to account for uncertainty of infrastructure and electricity costs, energy consumption (kWh/km) and 2 timeframes.
  • In all cases, TCO for BEB was lower, even more when daily km travelled increases the operation requirement of 250 km.
• GHG Emissions:
  • Line 3: -88% CO$_2$
  • Line 4: -84% CO$_2$
Thank you!
Questions?
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