Electrification of Geneva bus fleet

18th Session of the Group of Experts on Cleaner Electricity Systems
Session II - Deep electrification of the energy system
Electrification of transport sector in Geneva

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Key numbers as of 2021

- 2'180 Collaborators
  - Operation: 1'547 (1'327 drivers)
  - Technical: 348
  - Administration: 285
- 476 vehicles (Trams, Trolleybuses and Buses)
- 75 lines
- 31’486’000 km annual fleet mileage
  (~86’000 km/day)
- 421 millions passenger.km/year
  (~1’150’000 passenger.km/day)
- 7/7
  - 22/24 week days
  - 23/24 week-end
Fleet overview as of 2022
Tramways, Trolleybuses, Buses and Electric Buses

124 Trams

104 Trolleybuses

12 Electric Buses

232 Diesel Buses

4 Autonomous Buses
1 Innovation

Energy transition challenge
Private public partnership

- World premiere of electric articulated bus (132 passengers)
- A very small battery: 38 kWh
- Flash charging in 20 seconds @ 600 kW

- The goal is to carry passengers, not batteries
- Inauguration during the UITP World Congress 2013 in Geneva
2 Industrialization
Full-line Deployment
Full-line Deployment
Line 23 – Energy transition of a diesel line

- After the prototype, the line
- Flagship project supported by the Swiss Confederation
- 12 articulated buses (18m75)
- 2 terminus (400 kW, < 5 min)
- 12 flash s/s (600kW, 20 seconds)
  - Peak shaving (40kVA grid connection)
- 2.5 Mkm travelled since March ’18
- ~50’000’000 passengers.km since March ’18
- Availability >98.7%
Full-line Deployment – L23

Sustainable development aspects – Capacity/Operation/Battery

- Very large capacity for passengers
  (all the technology is on the roof)
- No additional driving cost
  (dwell time identical to diesel buses)
- 10 years battery lifetime
  (500’000 km/ebus → ~10’000’000 passenger.km/ebus)
  So, before recycling, each kWh of the battery pack (72 kWh)
  will have enabled > 140’000 passenger.km
- 20 years Ebus lifetime (as for trolleybuses)
Full-line Deployment – Line 23
Sustainable development aspects – Efficiency/Infra./Renewable

- High energy efficiency
  - thanks to synchronous motor and low bus weight

- Light and secure infrastructure at depots.
  - Quick (2-5 min) recharge at the entrance to the depot before parking.
  - No charging at the bus storage location at the depot
  - Fire safety concept facilitated by the battery size, its LTO technology and non-charging at parking.

- Distributed grid connection and direct use of renewable energies
  - Recharging takes place during the day during operation. Thus, solar energy can be directly used.
  - tpg as a 100% renewable electricity contract with SIG
- Rapid and positive adoption of ebus by drivers
- It's a system! Importance of relations between teams in charge of infrastructure and vehicles.
- A large bus (18m75, 132 passengers) with a small battery (72 kWh) can operate a demanding commercial line
- Communicating vehicles and infrastructure helps optimization
3 CAP2030
The Electrical Roadmap
Large scale projet
CAP2030 1st step: Projet of 6 lines

After the prototype and the line, now the network in 2025

- A network approach
- 6 lines, 50 articulated buses and 54 double-articulated buses
- An optimized concept based on our line 23 experience and technological developments
Urban Public Transportation Network
Geneva Electric Bus Network by 2030