presents :

TOSA

TROLLEYBUS OPTIMISATION SYSTEME ALIMENTATION

2013

ABB – A global leader in power and automation technologies

- 145,000 employees in about 100 countries
- $39 billion in revenue (2012)
- Formed in 1988 merger of Swiss and Swedish engineering companies
- A global leader in power and automation technologies

ABB Thomas&Betts A Member of the ABB Group BALDOR power-one®

- ABB is a world leading independent supplier of innovative and reliable technologies to vehicle manufacturers, transit operators and system integrators.
- ABB designs and supply electrical equipment and solutions from the ***"grid to the wheels"***

Industry challenges and customer needs

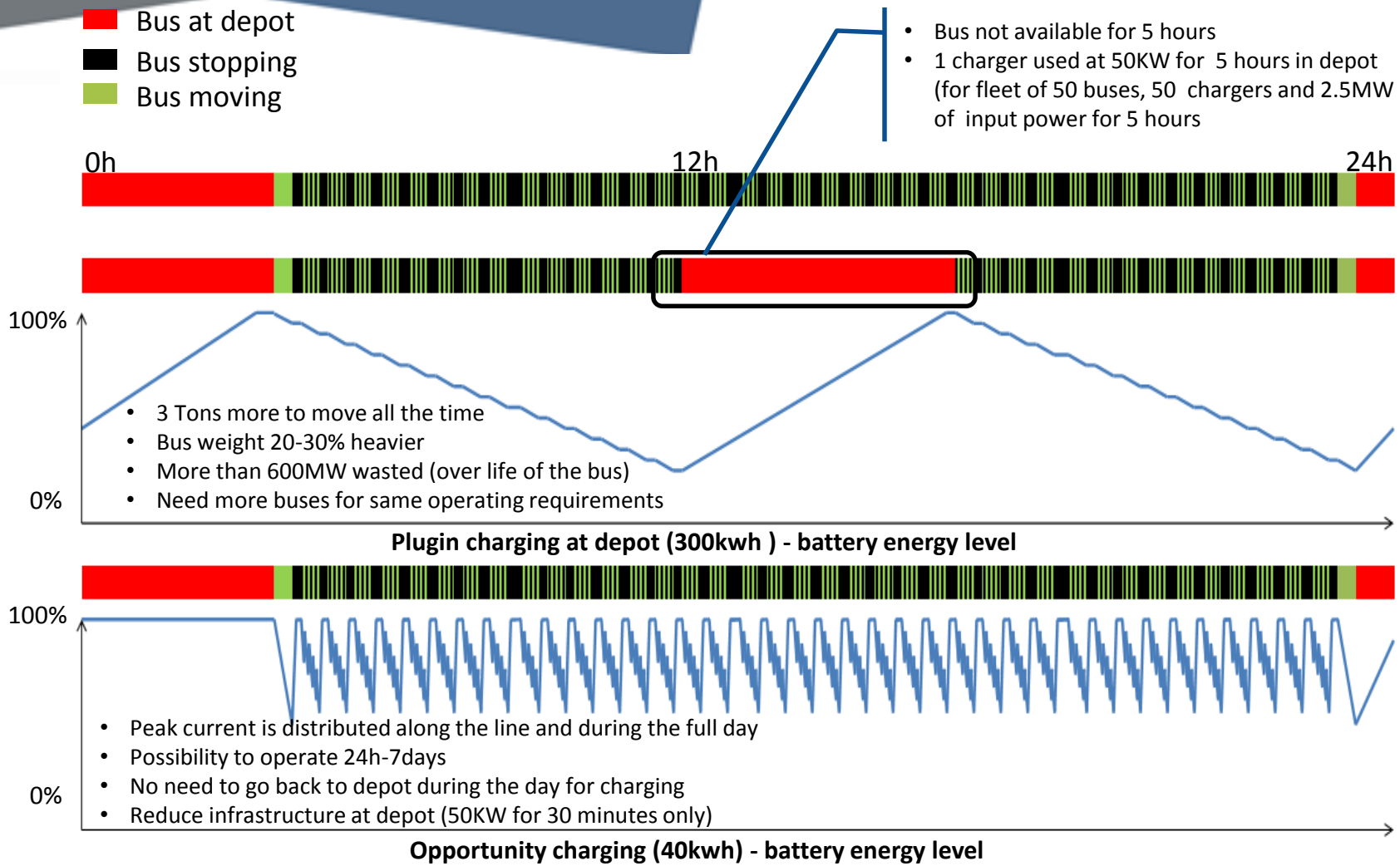
For the city

- An increase in urbanization and high mobility demands
- Traffic Congestion
- Public health:
  - CO2 and noise emissions
  - Evaporation of carcinogenic substances (OMS) coming from diesel motors Group 1 (since 2012)
- Dependence to foreign oil supply

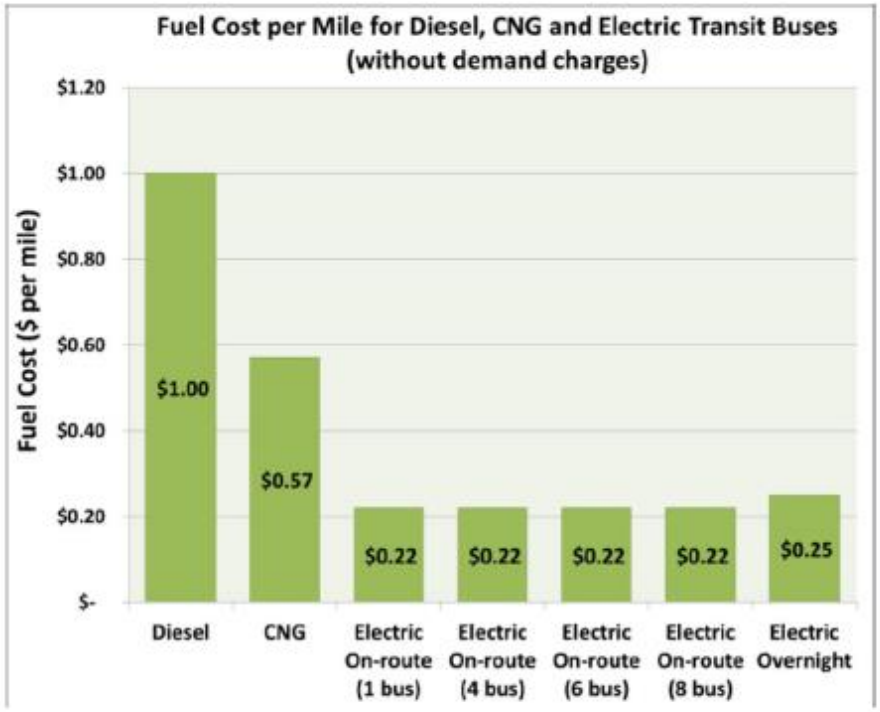
For the bus operator

- Reduction of budgets
- Capital & operating costs
- Fuel price increase
- Higher reliability and life duration of the buses and infrastructure
- Optimized fleet size to reduce
  - acquisition costs (capital)
  - maintenance costs (operation)
  - costs of logistics to manage the fleet
  - cost of infrastructure at Depot (footprint & equipment)
- Maximizing number of passengers per bus

High density lines
Autonomy vs. opp. charging



Comparison of technologies



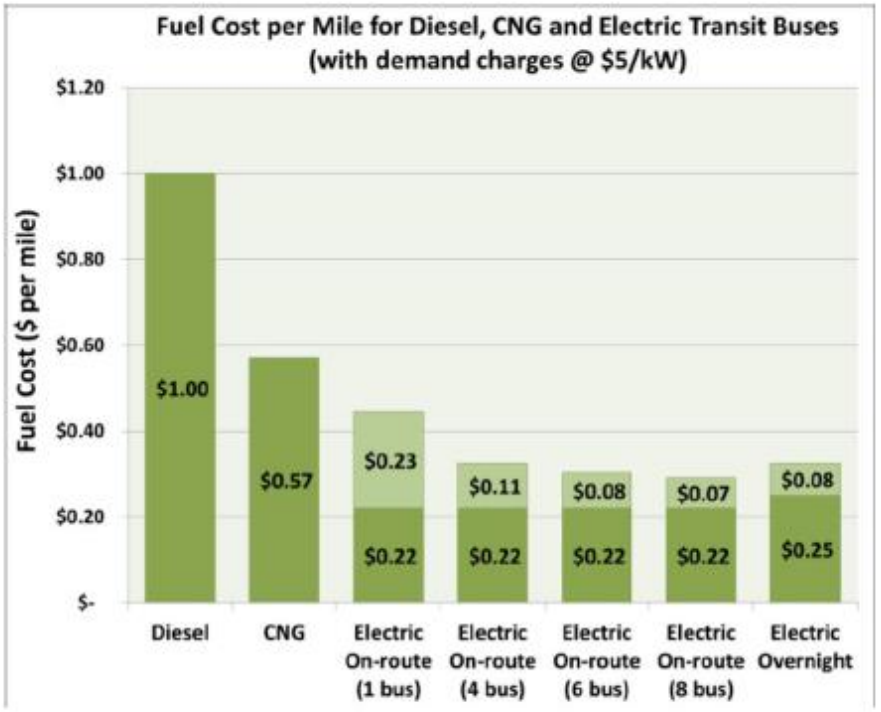


Figure ES-2: Fuel cost for diesel, CNG and electric buses with no and low demand charges

Critical factors:

- High capacity & energy efficient buses
- Energy management solutions to reduce/eliminate peak demand charges

Source: Peak demand charges and electric transit buses - Whithe paper – US Department of transportation Federal Transportation agency – prepared by Ted Bloch-Rubin, Jean-Baptiste Gallo & Jasna Tomié CALSTART – 8/14/2014

Large capacity, Flash charging electric bus
“A world premier in sustainable mobility”

Partners:

TPG: Operator

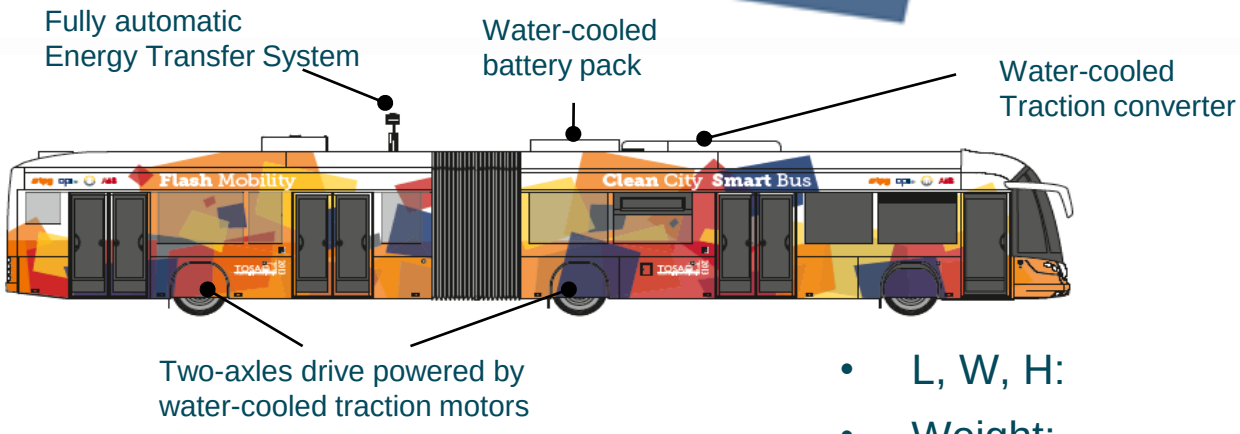
OPI: Industrial promoter

SIG: Utility

ABB: Technology provider

Support and Collaboration:

High capacity, high efficiency & ultra-fast charging bus



Goal:
Minimizing the energy storage on-board for energy and cost efficiency

- L, W, H: 18.74m, 2.55m, 3.40m
- Weight: 19.5t
- Capacity: 134 pass.
  88+44(seats)+2(wheel-chair)
- Battery pack: 10 years - Technology accepting cycling & fast charging – Autonomy based on distance to depot
- Battery charger: Integrated (regen.)
- Traction motors: Vmax = 85 km/h
- Fully automated energy transfer

Principle of operation & full line configuration

Length: 8 km (one way)

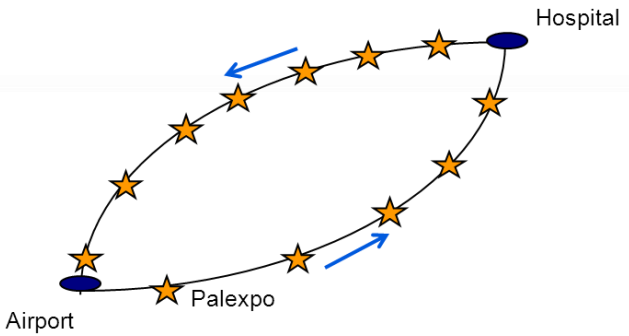
Altitudes: 380m - 460m

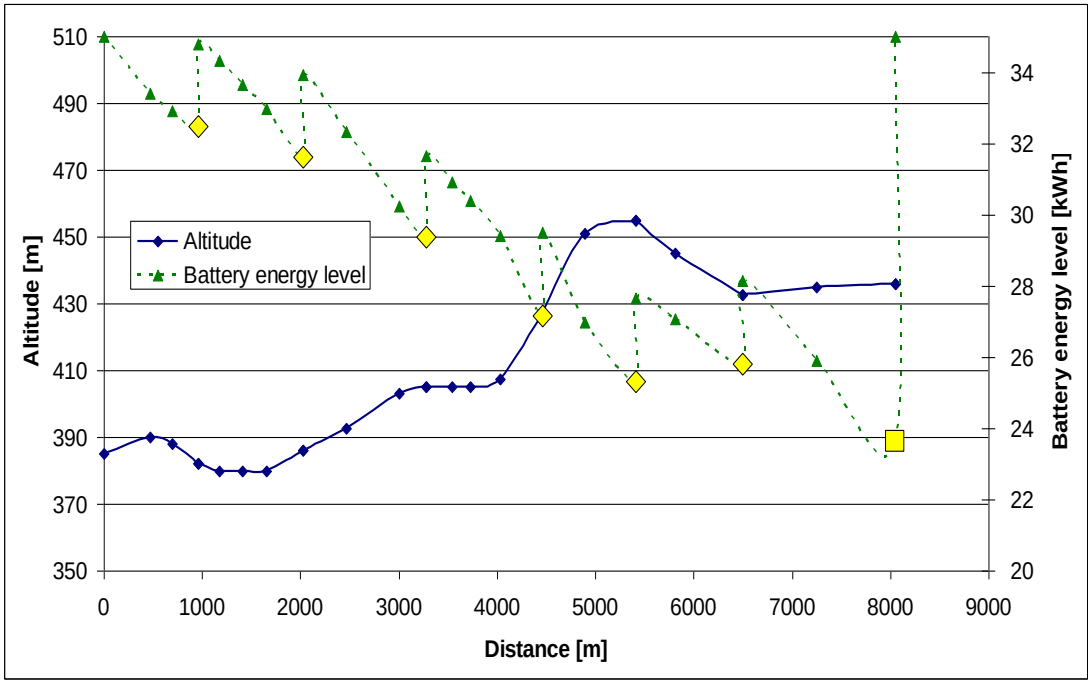
Fleet: 11 articulated buses (60 feets)
(Two motorized axles,
Battery equivalent to
2 E-cars)

Total bus stops: 42

Flash stations (15 sec.):
- 7 (uphill)
- 5 (downhill)

Terminal stations (3-4 min.):
- 2





Feeding stations - Flash/Terminal/Depot

Grid side

Flash 2’30’’

50 kVA, 400VAC

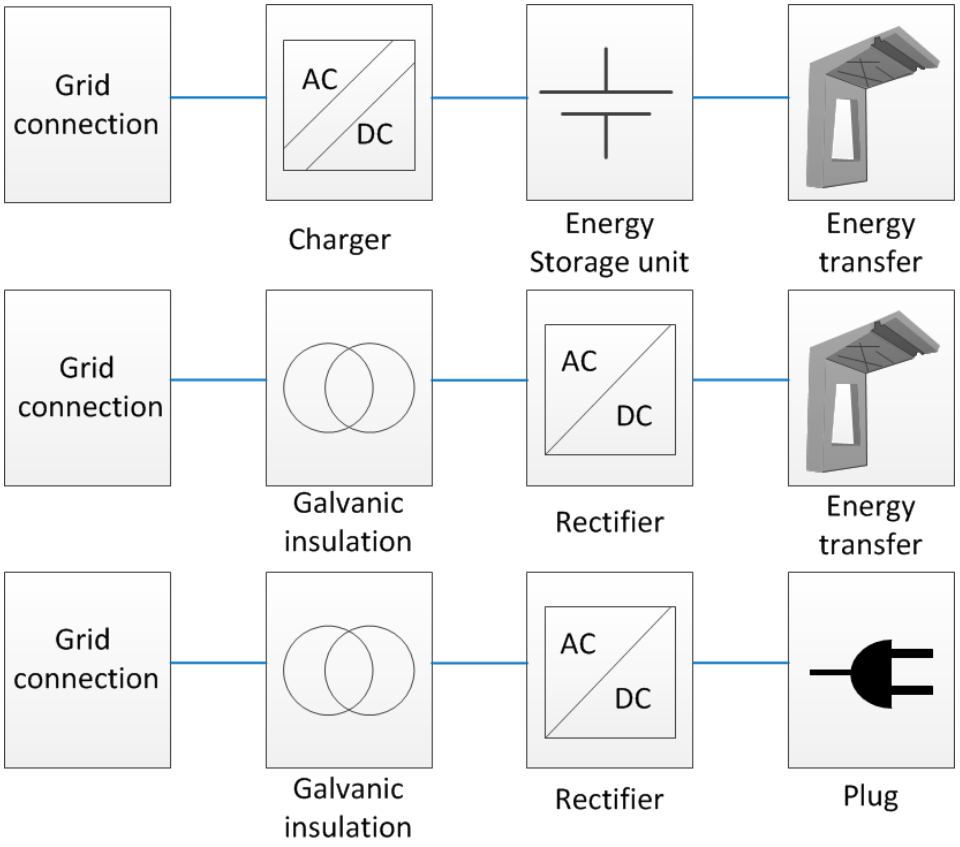
Terminal 3-4’

200kVA, 400VAC

Depot 30’

120’ (4 buses)

50kVA , 400VAC



Bus side

Flash 15’’

400kW, 500VDC

Terminal 3-4’

200kW, 500VDC

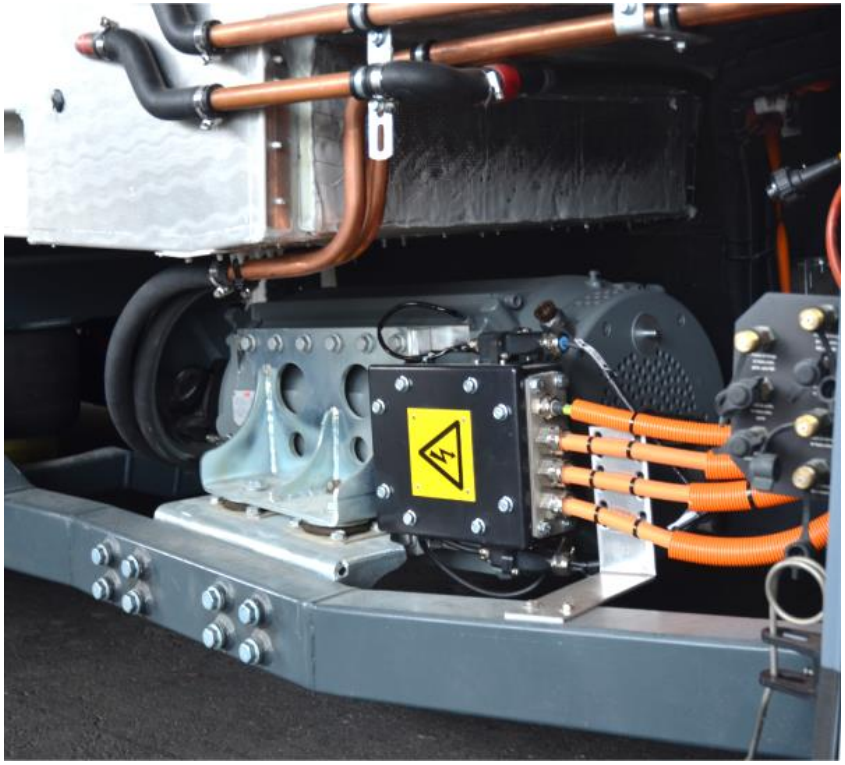
Depot 30’

50kW,500VDC

Traction equipment – traction converter and motors

The water-cooled traction and auxiliary converters. Breaking energy recovery and management of the battery charging.

2 water-cooled traction motors for high efficiency and low maintenance requirement.



Energy storage

- Water-cooled LTO battery pack:
- Small (eq. to 2 eCars bat. 38kWh)
- Safe
- Long life (10 years)
- Performances (flash charging at 10C)
- Wide temp. op. range (-40… +55C)
- Weight: 1,040 Kg

One change in the life of the bus (20 years)

Energy transfer system

Fully Automatic Energy Transfer System (no driver action)

- Makes the connection within 1 sec.
- Compensate distance to the curb: 0 to 55cm
- 3m-long connecting receptacle
- High-Power and safe: Fully compliant with most demanding EMF req.
- Efficiency: less than 1% losses

Thank you !
For more information…

Power and productivity for a better world™

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