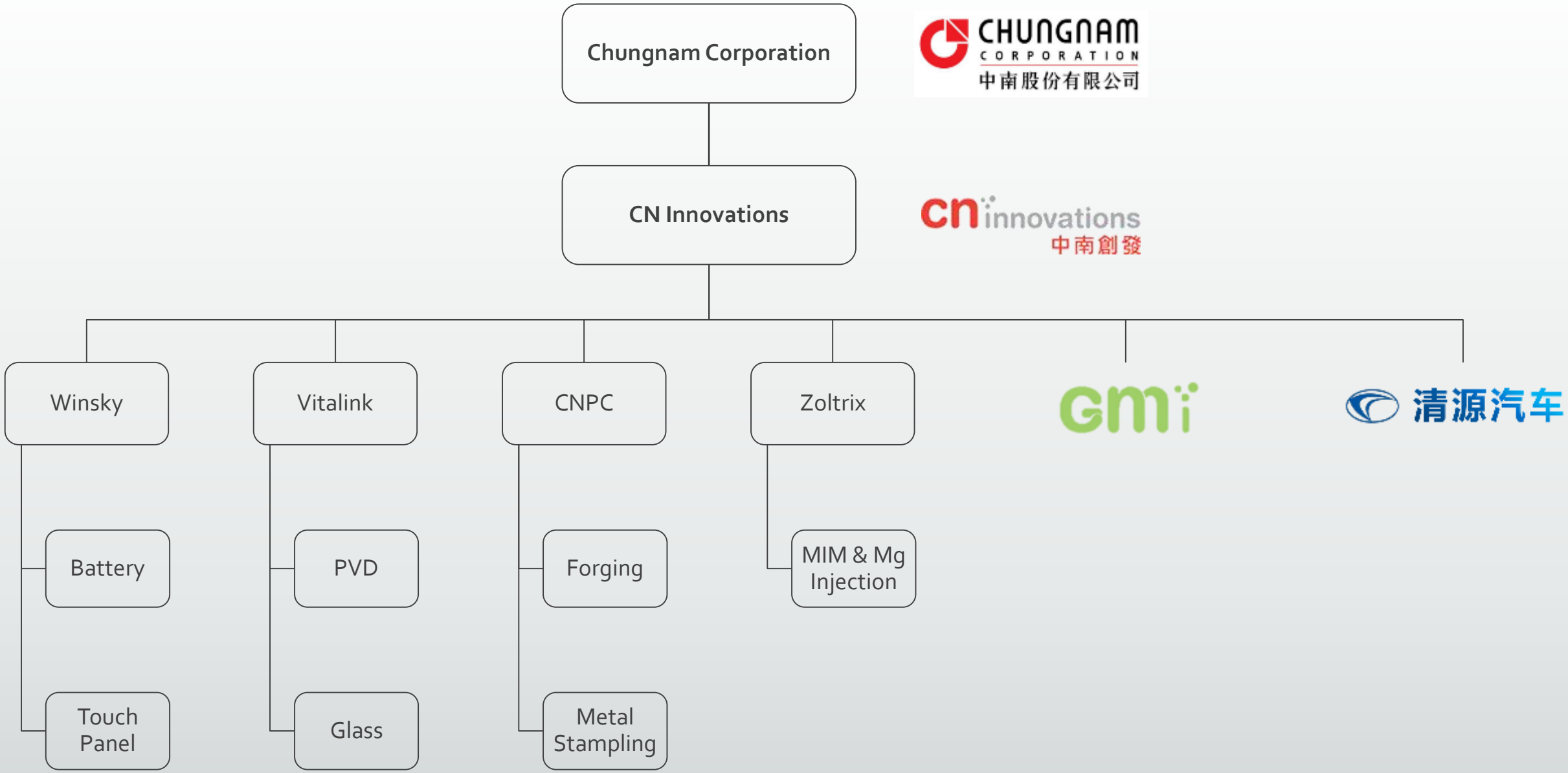
Green Mobility Innovations Limited


Chungnam Corporation
CHUNGNAM CORPORATION 中南股份有限公司
CN Innovations
cn innovations 中南創發
Winsky
Vitalink
CNPC
Zoltrix
gmi
清源汽车
Battery
PVD
Forging
MIM & Mg Injection
Touch Panel
Glass
Metal Stampling

Established in 2010

Located in San Tin N.T. with 16,000 m^2 facilities

About GMi

- The only Registered Electric Vehicle System Integrator and Manufacturer in Hong Kong
- Siemens appointed system integrator and technology partner
- Exclusive partner of Toshiba SCiB LTO battery
- Exclusive partner of OXGRIN onboard ammonia cracking technology
- Core scope of business:
  - Green transportation for commercial applications
  - Bus and special equipment manufacturing
  - Research & Development
  - Conversion and Retrofit
  - System Integration
  - Charging Infrastructure

Roadmap

- Expedite the implementation of electric buses with an EV ready concept – series hybrid design
- Enable ZERO emission vehicles progressively
- Provide quick charging infrastructure
- Charging as a service
- Mobility as a Service

On-board Generator

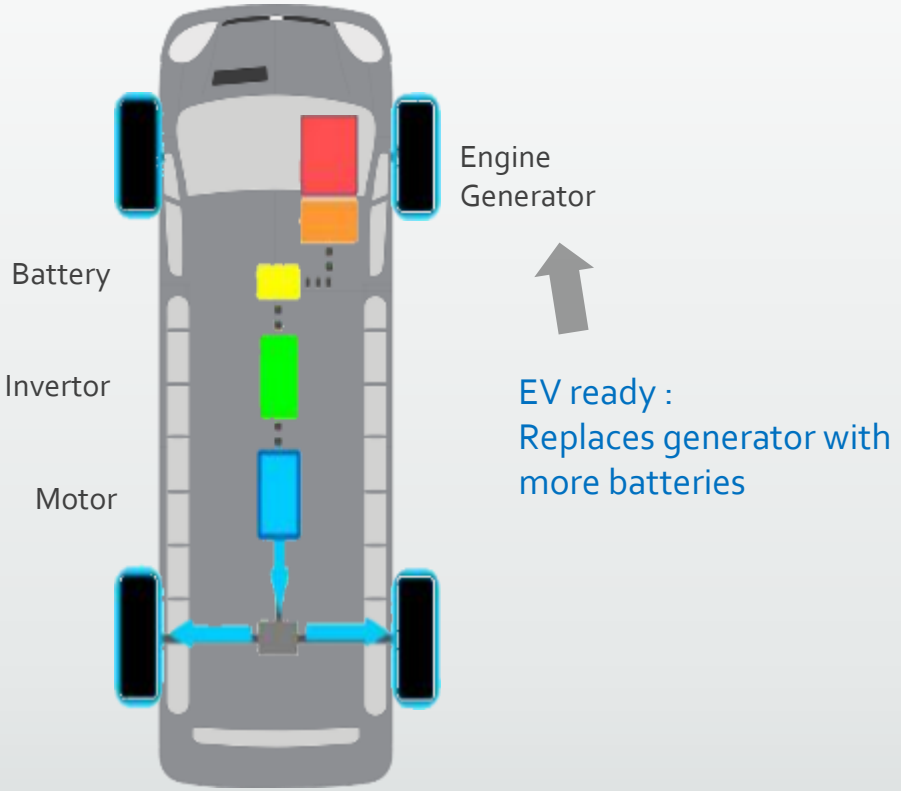
Series Hybrid design, electricity generated by diesel engine to charge up batteries

High Power Quick Charge

Top-down pantograph
3-6 mins per charge

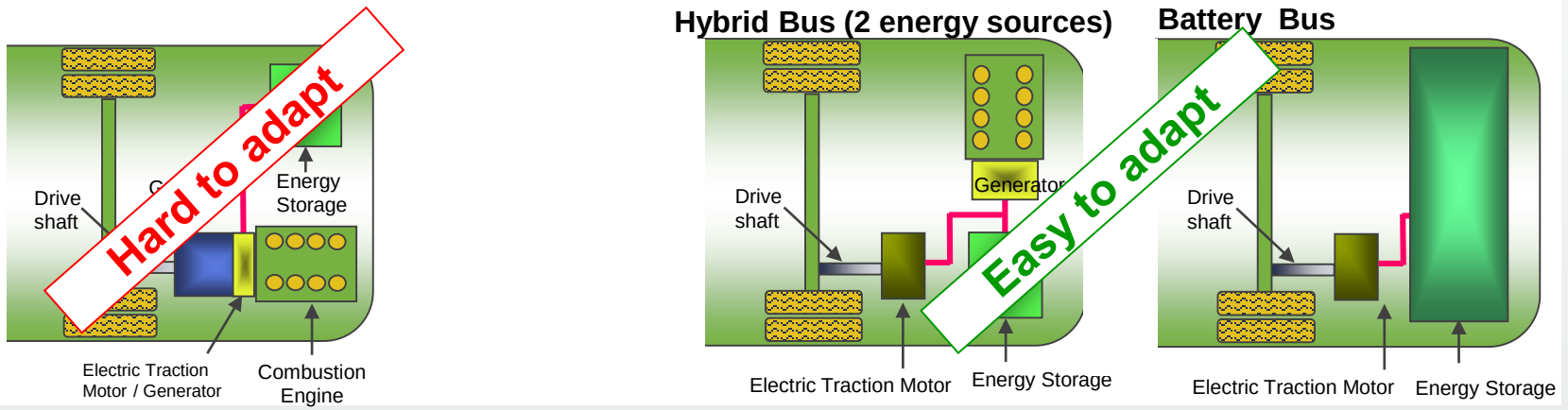
Series Hybrid Configuration

- Unique range-extender design through on-board power generation and regenerative braking
- Battery life significantly improved with carefully designed battery operating range
- Reduce carbon emission by over 70% of diesel light bus
- Fuel saving up to 50%
- Easily converted to battery electric i.e. EV ready



Hybrid concepts

There are two major types of electric hybrid systems:



Parallel Hybrid =

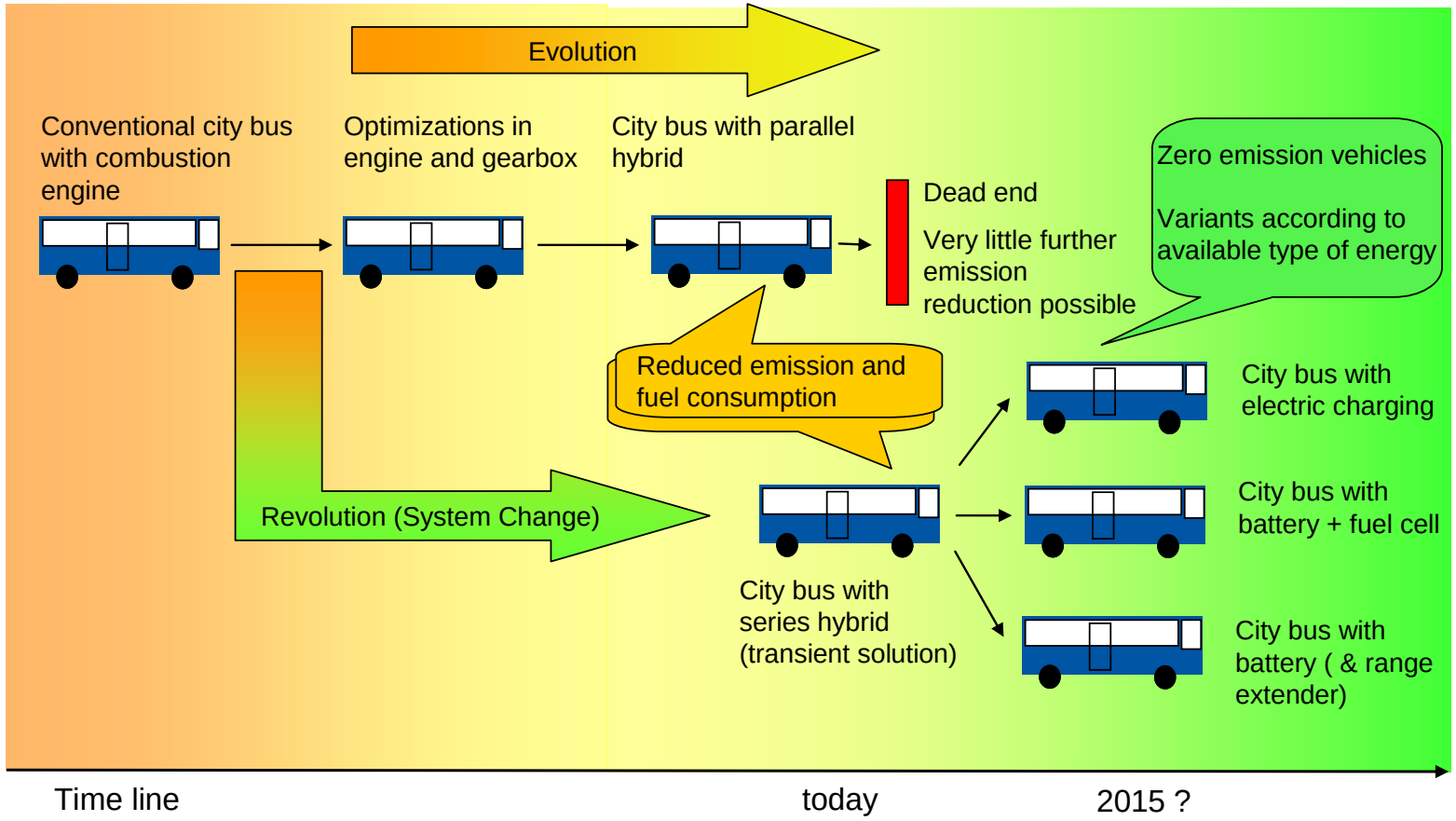
Transmission & electric boost:

- Combustion engine and electric motor are acting on the drive shaft via a common gearbox
- Electric motor acts as generator during braking
- Performance of electric motor is significantly smaller than the performance of the combustion engine
- Combustion engine must run for full power
- Conversion to battery ("zero emission") vehicle needs complete system change

Serial Hybrid = Electric Traction:

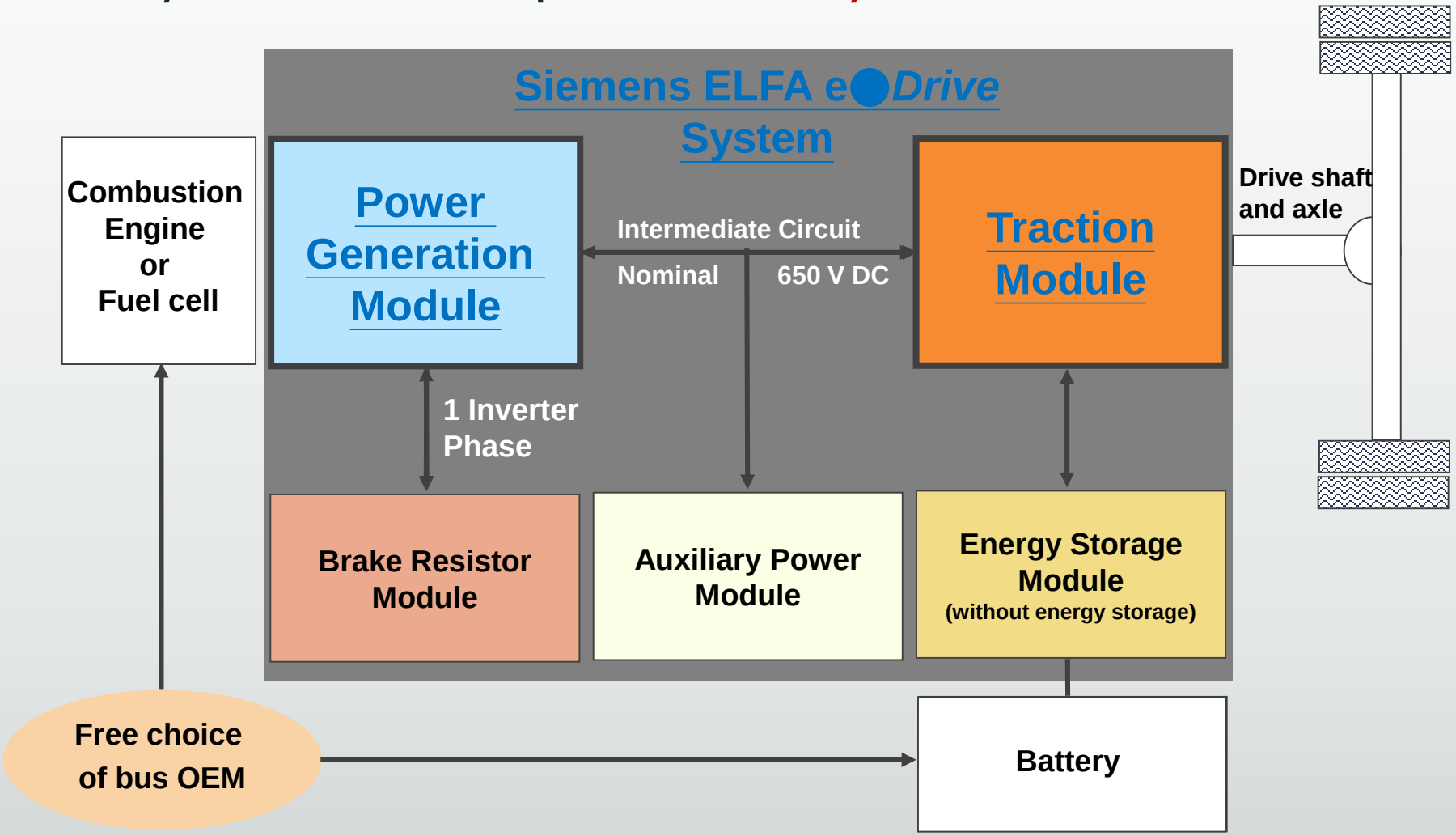
- Only the electric motor acts on the drive shaft
- Combustion engine together with generator supplies electrical energy for driving or charging the storage
- Performance of electric motor is designed for total power of vehicle
- Combustion engine can be switched off if energy is taken from the storage
- Conversion to battery ("zero emission") vehicle leaves the traction part unchanged – it's easy

Future development of city buses –
City bus of the future has an electric drive – best case as "Zero Emission" vehicle



Development roadmap depends on innovation in energy storages and fuel cells – taking into account the infrastructure.

GMi® hybrid drive modules provide Flexibility³



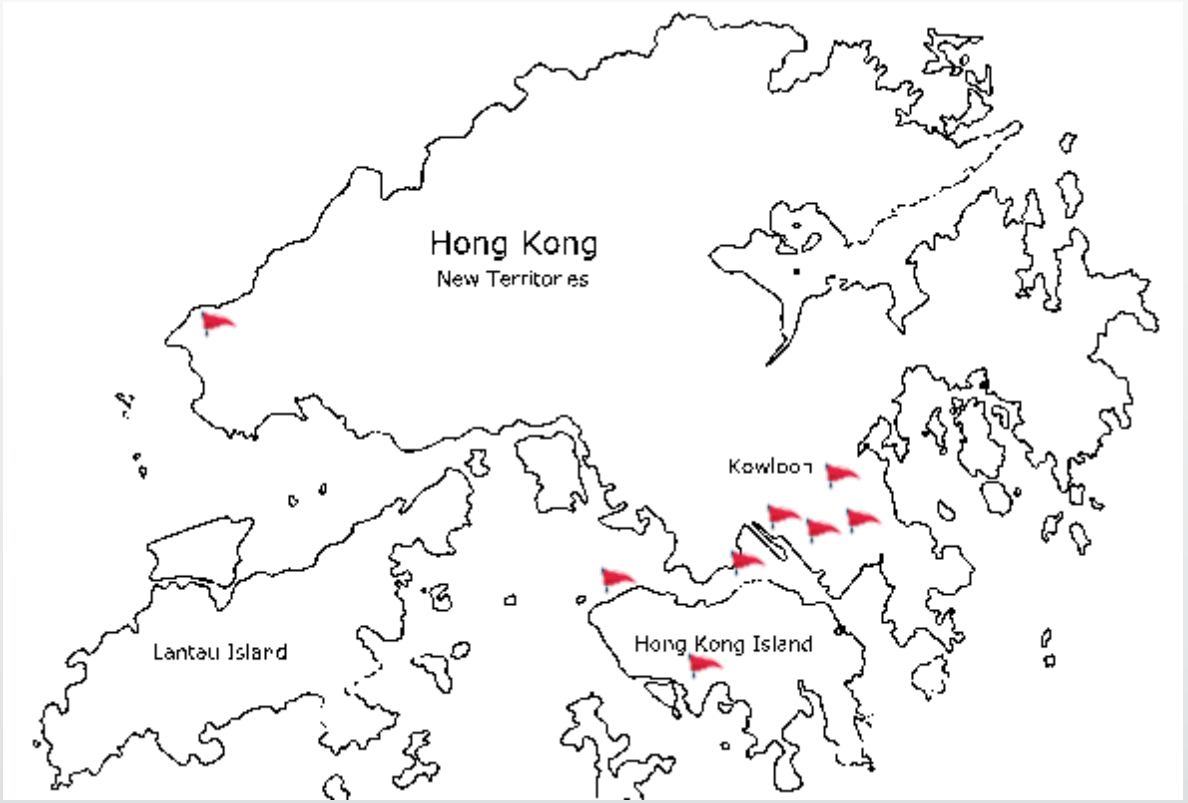
7m Range Extended Public Light Bus launched since 2015

T-Park shuttle bus

Red Minibus Route:

Kwun Tong District
Yau Tsim Mong District

Routes Operating among Hong Kong



Green Minibus Route:

39M: Tin Hau <> Lei Tung
22: Central <> Pokfulam
23: Kennedy <> Pokfulam
22M: Lok Wah <> Yue Man Sq
22A: Lok Wah <> Kwun Tong Pier
86: Kowloon Bay <> Kai Tak
43: Tuen Mun <> So Kwun Wat
2A: Whampoa <> Festival Walk
6A: Tsim Sha Tsui <> Whampoa
69X: Causeway Bay <> Cyberport

gmi

ELFA® Electric Drive Technology by SIEMENS

HK-developed "Range-extended" Hybrid Electric Minibus

Reduce fuel consumption by about 40%

Reduce emission by over 70%

gmi innovations

www.gmi-hk.com

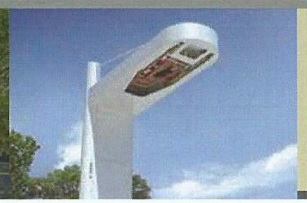
GREEN MOBILITY

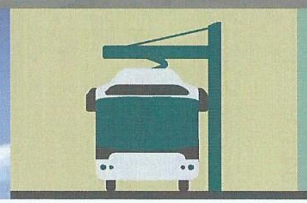
EURO 5

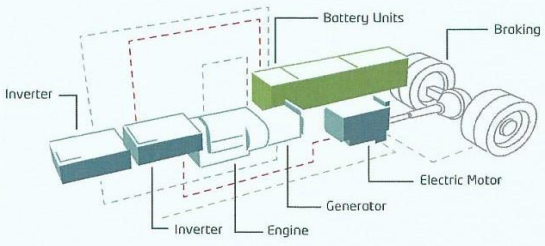
3 YEAR WARRANTY

100,000 km

Tel: 2443 6333 Fax: 2463 5773 | DD102 Lot2399, San Tin, NT, HK

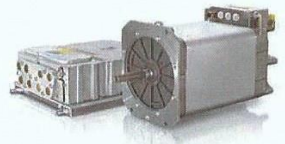






Driving range is greatly extended through on-board generation and regenerative braking

High-back seats with safety seat belt



Siemens ELFA® electric drive technology

Individual air vent and call bell

Integrated instrument panel
More visible, readable display

Facts and figures

Dimensions and weights	
Length (mm)	6 990
Width (mm)	2 040
Height (mm)	2 865
GVW (kg)	7 000
Powertrain - Plug-in Hybrid Electric	
Configuration	
Emission standard	Euro 5
Charging system	Cummins 2.8L 4-cylinder turbo charged and Charged air cooled diesel engine with Siemens 108kW generator
Electric motor	Siemens ELFA®
Power output, max (kW)	85
Torque, max (Nm)	530
Energy storage system	LiFePO4 battery
Capacity (kWh)	19.2
Voltage (V)	640
Transmission	Single speed reduction
Axles, suspension, steering and brakes	
Front loading (kg)	2 800
Rear loading (kg)	4 200
Suspension	Leaf spring type with Rigid suspension
Power steering	Electric power steering
Brakes	Vacuum boost The electric motor functions as a retarder and recovers braking energy
Tyres	215/75R 17.5
Charging system	
Plug-in charging	
Automatic fast charge using pantograph type OppCharge Standard	
Rapid charge time 3- 6 mins	
EV Range 40 km	
Additional features	
Max up to 23 passenger seats	
Front destination box	
CCTV system and reversing camera	
Rear door monitor	
Adoption of an electric folding / sliding door	

12m Range Extended Coach to be launched in Yr 2022

Mr Wong Kam-sing, GBS, JP, Secretary for the Environment visited 12M coach at ECO Expo Asia 2017

Mr Paul Chan Mo-po, GBM, GBS, MH, JP, Financial Secretary visited 12M coach HKPC's products exhibition

Quick charging

- Inverted pantograph design
- 3-6 mins per charge
- OppCharge standard compliance
- One charger serves multiple buses per hour
- Less weight; less complexity on bus
- Automatic operation; Wireless communications
- Cloud-based computation

Benefits

Low cost onboard components per vehicle

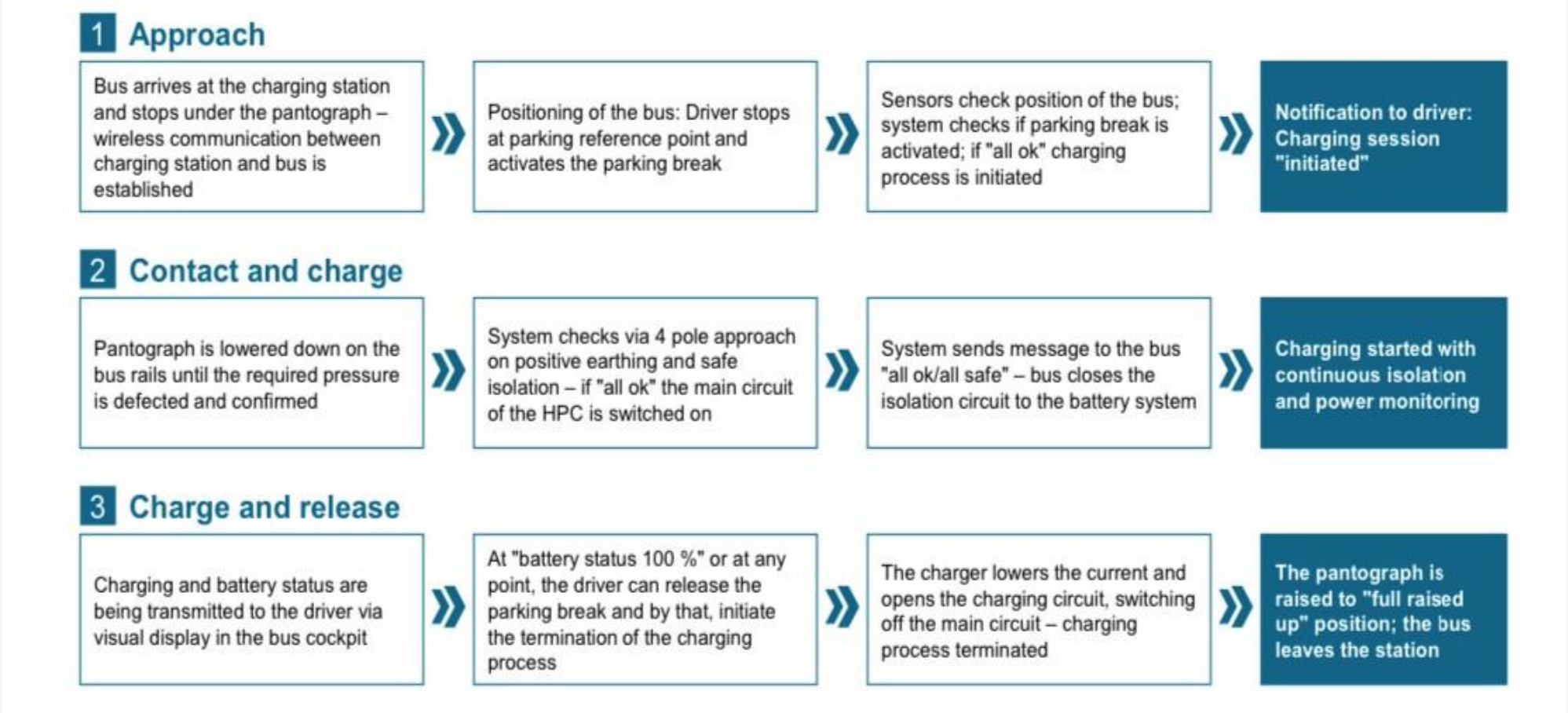
Fast, reliable, efficient

Automatic operation, highest availability

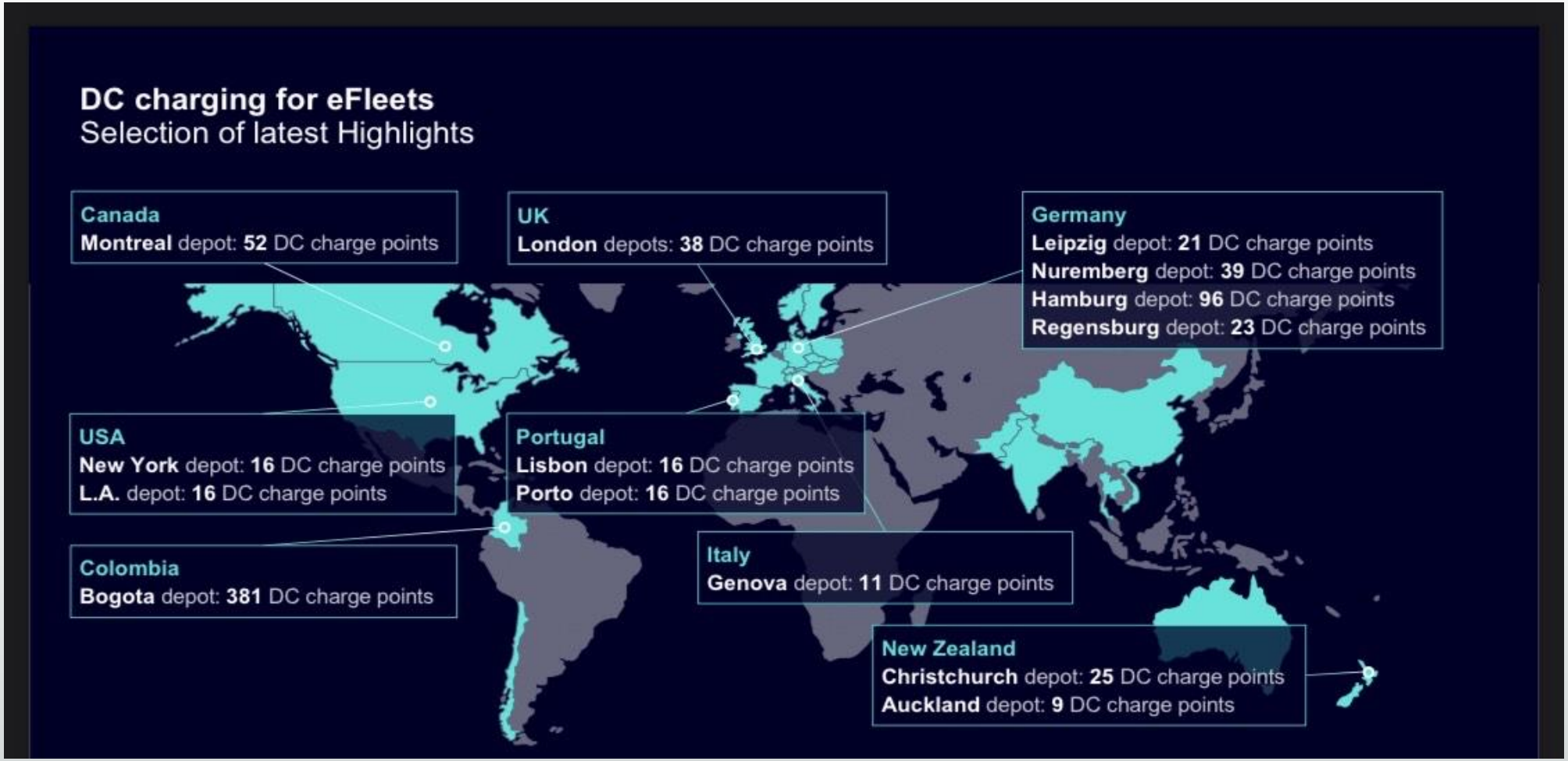
One charger – multiple buses per hour

Uses low weight onboard components	Places charging equipment off-board
Compliant with EN/SAE EV standards	IS0 15118 wireless communication
Supports multiple bus makes and types	Enables automatic charging operations

Operation


1 Approach
Bus arrives at the charging station and stops under the pantograph – wireless communication between charging station and bus is established
Positioning of the bus: Driver stops at parking reference point and activates the parking break
Sensors check position of the bus; system checks if parking break is activated; if "all ok" charging process is initiated
Notification to driver: Charging session "initiated"
2 Contact and charge
Pantograph is lowered down on the bus rails until the required pressure is defected and confirmed
System checks via 4 pole approach on positive earthing and safe isolation – if "all ok" the main circuit of the HPC is switched on
System sends message to the bus "all ok/all safe" – bus closes the isolation circuit to the battery system
Charging started with continuous isolation and power monitoring
3 Charge and release
Charging and battery status are being transmitted to the driver via visual display in the bus cockpit
At "battery status 100 %" or at any point, the driver can release the parking break and by that, initiate the termination of the charging process
The charger lowers the current and opens the charging circuit, switching off the main circuit – charging process terminated
The pantograph is raised to "full raised up" position; the bus leaves the station

Worldwide Installations



Charging systems for eFleets
Christchurch and Auckland, New Zealand

- eBus charging infrastructure for 34 buses at depots in Christchurch and Auckland
- Project demonstrates advantage of Siemens' vehicle-agnostic charging infrastructure: Integration with eBuses from 2 OEMs.
- Christchurch: **12 x SICHARGE UC 200 with Dispensers** powering 25 parking spaces
- Auckland: **5 x SICHARGE UC 200 & 2 x SICHARGE UC 100** for plug-in CCS charging

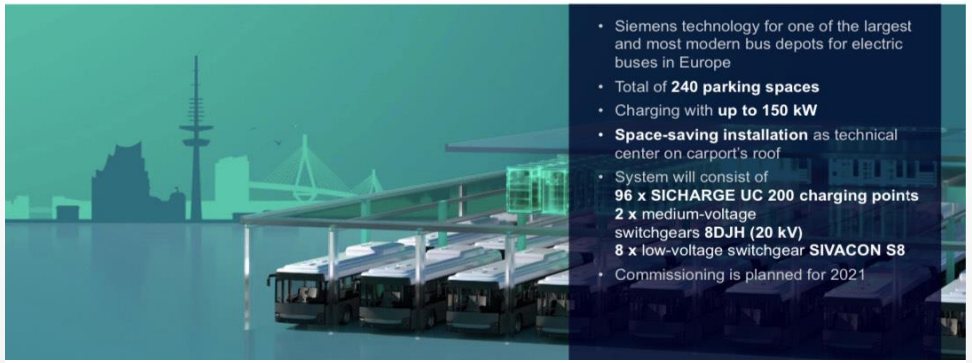
Charging systems for eFleets
Genoa, Italy

- Siemens Smart Infrastructure will provide the charging infrastructure for **10 electric buses**.
- **Compact, space-saving** design of the depot charging infrastructure makes it possible to **subsequently deploy up to 60 charging units** in the bus depot for as many electric buses – **a future-proof modular approach**
- Smart charging with **power of up to 100 kilowatts (kW) per bus**
- Electric buses equipped with **200 kWh battery pack**
- Combined with **Siemens smart charging software**, all the charging operations will be **intelligently optimized** in order to minimize the overall energy consumption and peak loads of the depot
- Commissioning: 2021

Charging systems for eFleets
Montreal, Canada

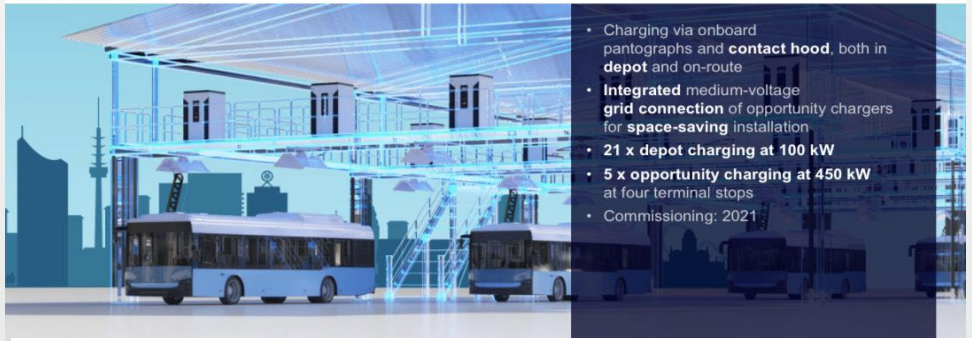
- Executed project: **Two Pantographs with each 450 kW** charging power, CSA certified
- In public operation **since May 2017**
- Project under execution: Innovative indoor depot **solution for 35 buses** with sequential **CCS and pantograph** charging
- Customer-tailored solution with **RFID authentication** and **connection to** existing **SCADA system**

Charging systems for eFleets
Hamburg, Germany



- Siemens technology for one of the largest and most modern bus depots for electric buses in Europe
- Total of **240 parking spaces**
- Charging with **up to 150 kW**
- **Space-saving installation** as technical center on carport's roof
- System will consist of
  96 x SICHARGE UC 200 charging points
  2 x medium-voltage switchgears **8DJH (20 kV)**
  8 x low-voltage switchgear **SIVACON S8**
- Commissioning is planned for 2021

Charging systems for eFleets
Leipzig, Germany



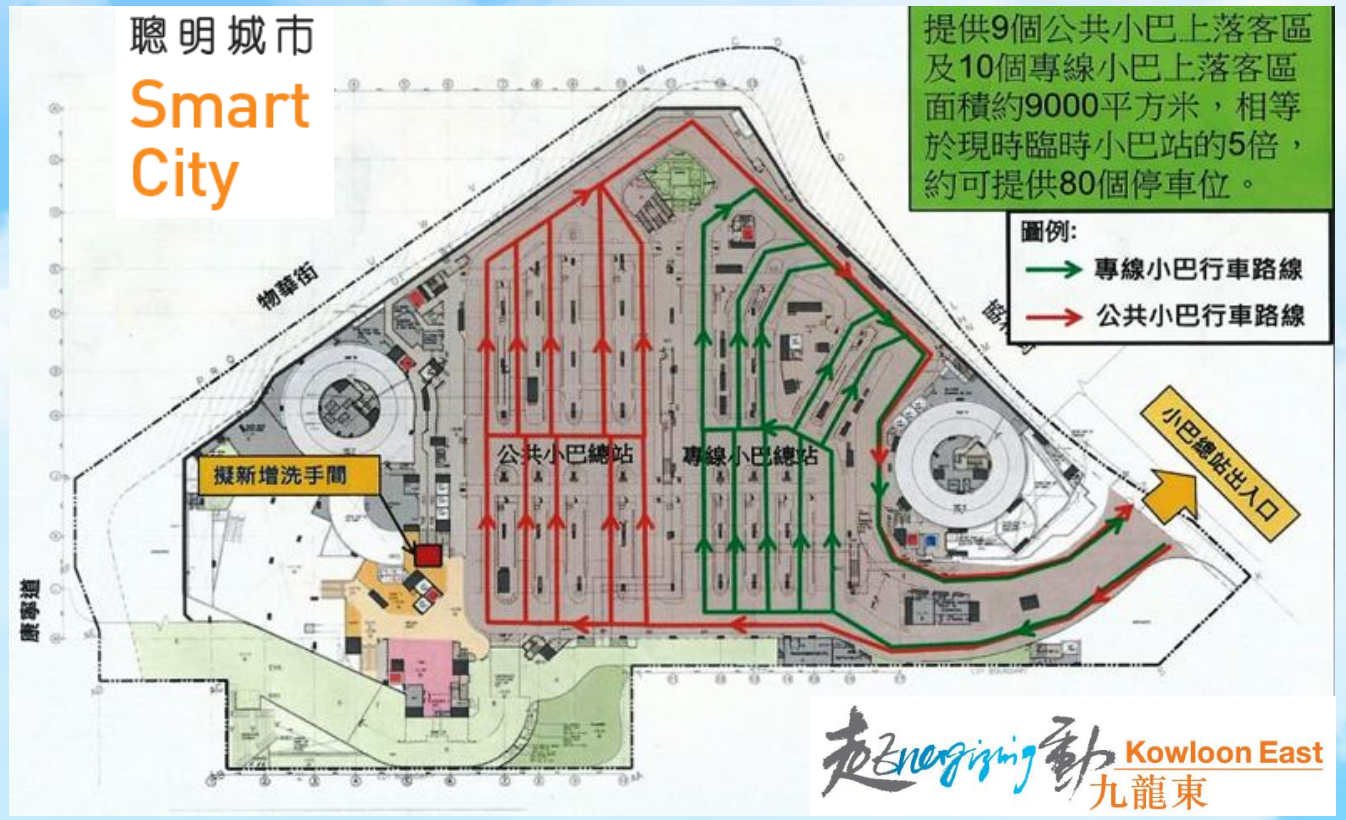
- Charging via onboard pantographs and **contact hood**, both in **depot** and on-route
- **Integrated** medium-voltage **grid connection** of opportunity chargers for **space-saving** installation
- **21 x depot charging at 100 kW**
- **5 x opportunity charging at 450 kW** at four terminal stops
- Commissioning: 2021

Charging systems for eFleets
Nuremberg, Germany

- **One of the largest electric depots** in Germany
- Siemens technology for **39 parking lots** at innovative eBus depot of VAG
- Charging with **up to 150 kW**, powering two parking spaces via sequential charging cable and connector
- System will consist of
  20 x SICHARGE UC 200 & 39 Dispensers
- **Digital solutions to optimize charging** activities, charging operations and energy consumption. The e-Depot will be equipped with **integrated dispatching system** for charging operations.
- eBus port is planned to be ready for commercial operation starting mid.2021

Proposal for Hybrid Electric Public Light Bus Fleet Operation in Kowloon East District

1. Acquisition of **100+** range-extended hybrid electric light buses with plug-in capability
2. Installation of a high power charger with the High Power **Quick Charge** technology at the PLB terminus
3. Each opportunity charging will take less than **4 minutes**



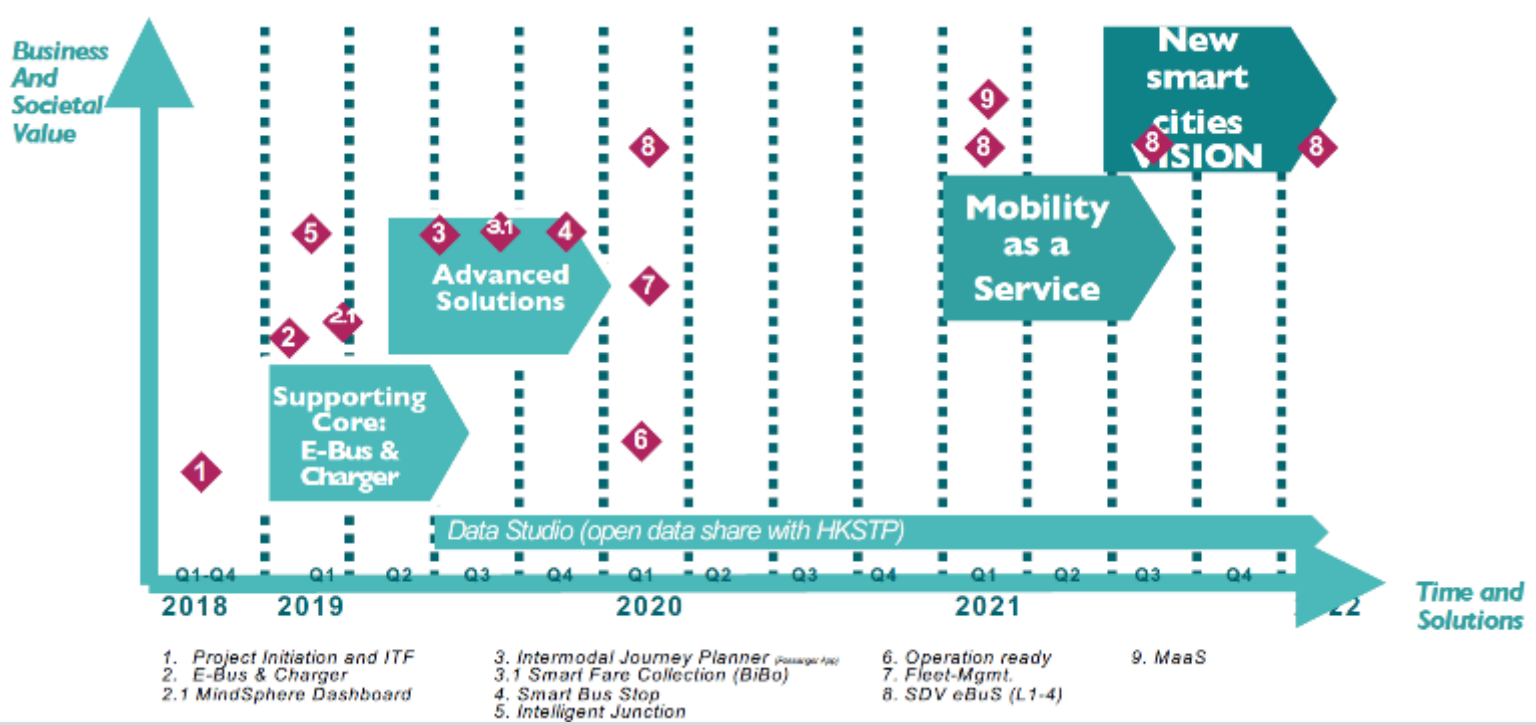
Quick Charging

- https://youtu.be/p9VTRK2SRHc

eBus solution and digital mobility concept
HPC to be installed at the Science Park

Serving at least 20+ public light buses, public transit buses and staff shuttle coaches

Showcase a smart and sustainable public transport system for HK



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