

# LINKKER

## Intelligent eMobility



# Mission – Quality of Life in Cities



**Environment**



**Economy**



**Experience**

City bus routes ideal for electrification – high consumption, high mileage, fixed route, energy supply available, emission reductions important, passenger attractiveness wanted, multimodal potential (rail & bus), green city image

# Linkker addresses a large market potential...

**Strong pull effect on the market - especially for eBuses - driven by the Paris Climate Convention**

## Fully electric buses respond to a growing need and presents a huge potential

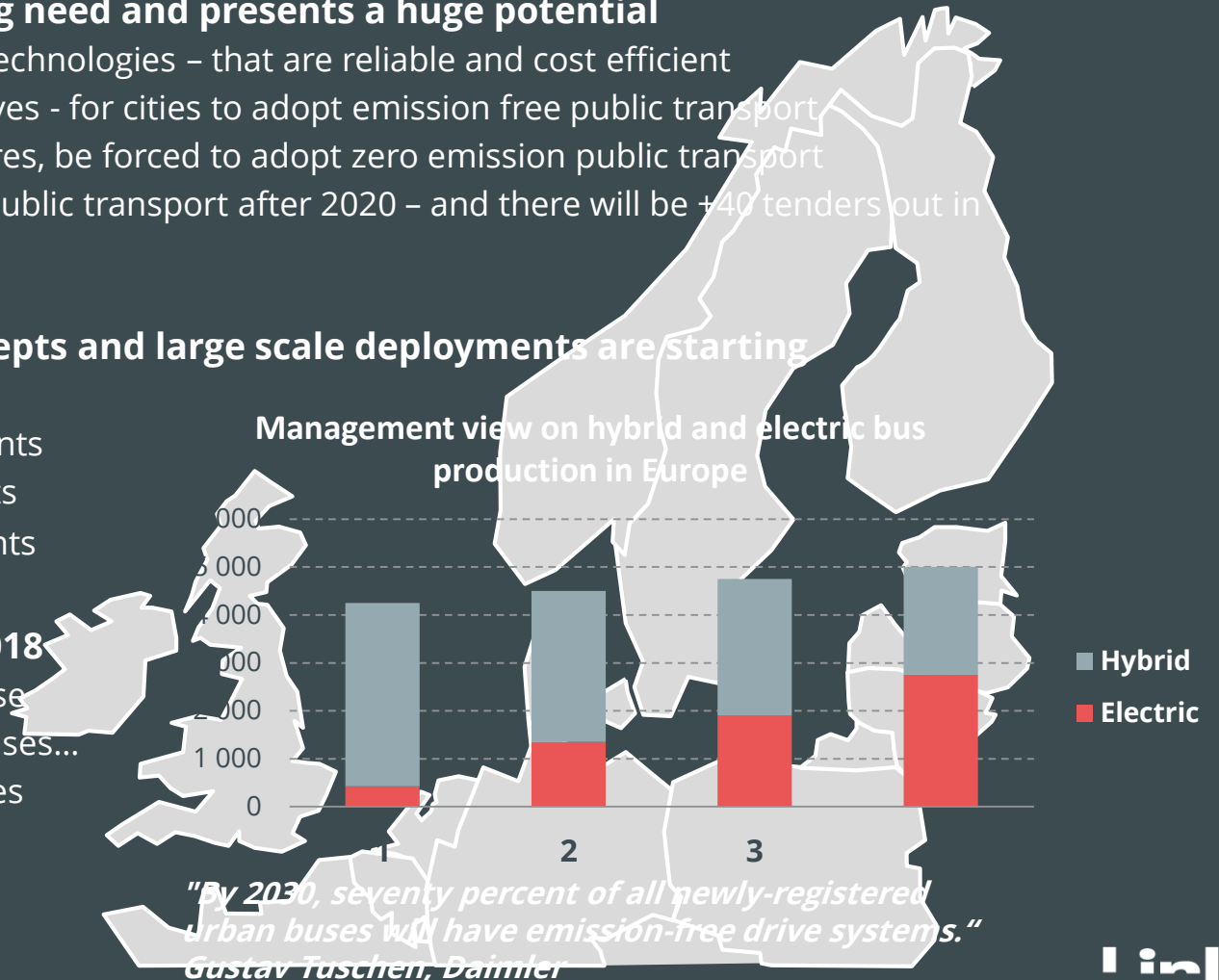
- Climate change drives transition to green technologies – that are reliable and cost efficient
- There is now strong pressure – and incentives - for cities to adopt emission free public transport
- Many cities will, through regulatory measures, be forced to adopt zero emission public transport
- France will allow only 100% emission free public transport after 2020 – and there will be +40 tenders out in 2017

## Cities in Europe are adopting eBus concepts and large scale deployments are starting

- 18 big cities with over 1 million inhabitants
- 51 urban areas with over 1 million inhabitants
- 54 cities with over 500 thousand inhabitants
- 440 cities with over 100 thousand inhabitants

## Electric buses to penetrate market in 2018

- Share of electric buses to drastically increase
- Triggered by increased performance of ebuses...
- ... matching the performance of diesel buses



# Global Potential and Challenges

## Heavy Duty Vehicle Industry

- Diesel driven
- Truck based componentry
- High inertia, slow change
- Earnings models based on engines and own assembly
- Poor utilization of data and analytics

## Quality of Life In Cities

- Mega cities
- Smog
- Growing mobility needs
- Congestion
- Global warming
- Smart & green cities

## Mobility Innovation

- High inertia, slow pace of change
- Fuel driven business models
- Fragmented service models
- Modal share private vs public
- Open data, analytics, prediction
- Concession tenders
- Risk management
- Automation

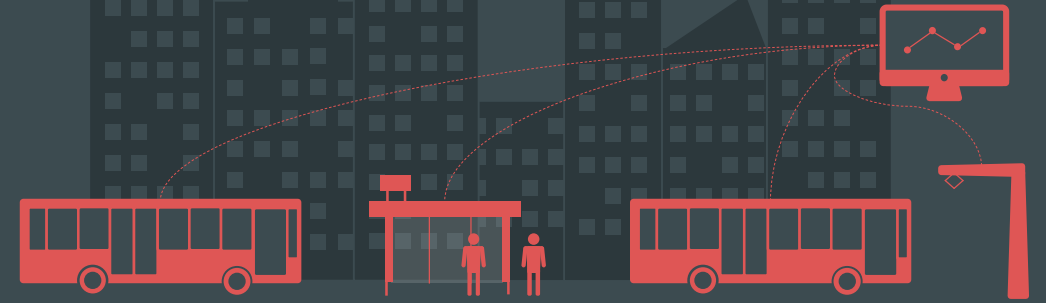
## Passenger

- Private vs public
- Private vs sharing
- Ticket vs service product
- Transport vs service vs experience
- Value choice

## Funding

- Battery
- Energy supply & Infrastructure
- Fleet
- Operation
- Contracted transport
- Life Cycle
- Asset management

# Objectives



- 1 Strong Growth & Impact by Leading & Accelerating Transition
- 2 Long Term Earning Models - Technology, Digitalization, Applications, Ecosystem
- 3 Market Access & Scale with Partners – Industrial, Financial partners & Contracted Production

# Key Challenges for Electric Bus Operation

## Planning impact

- Infrastructure
- Network coverage
- Operations
- Financial
- Technology
- Construction
- Transition

## Re-charging concepts

- Depot vs Opportunity
- Charging location
- Charging power
- Charging time vs time table
- Connectivity
- Grid connection & power supply

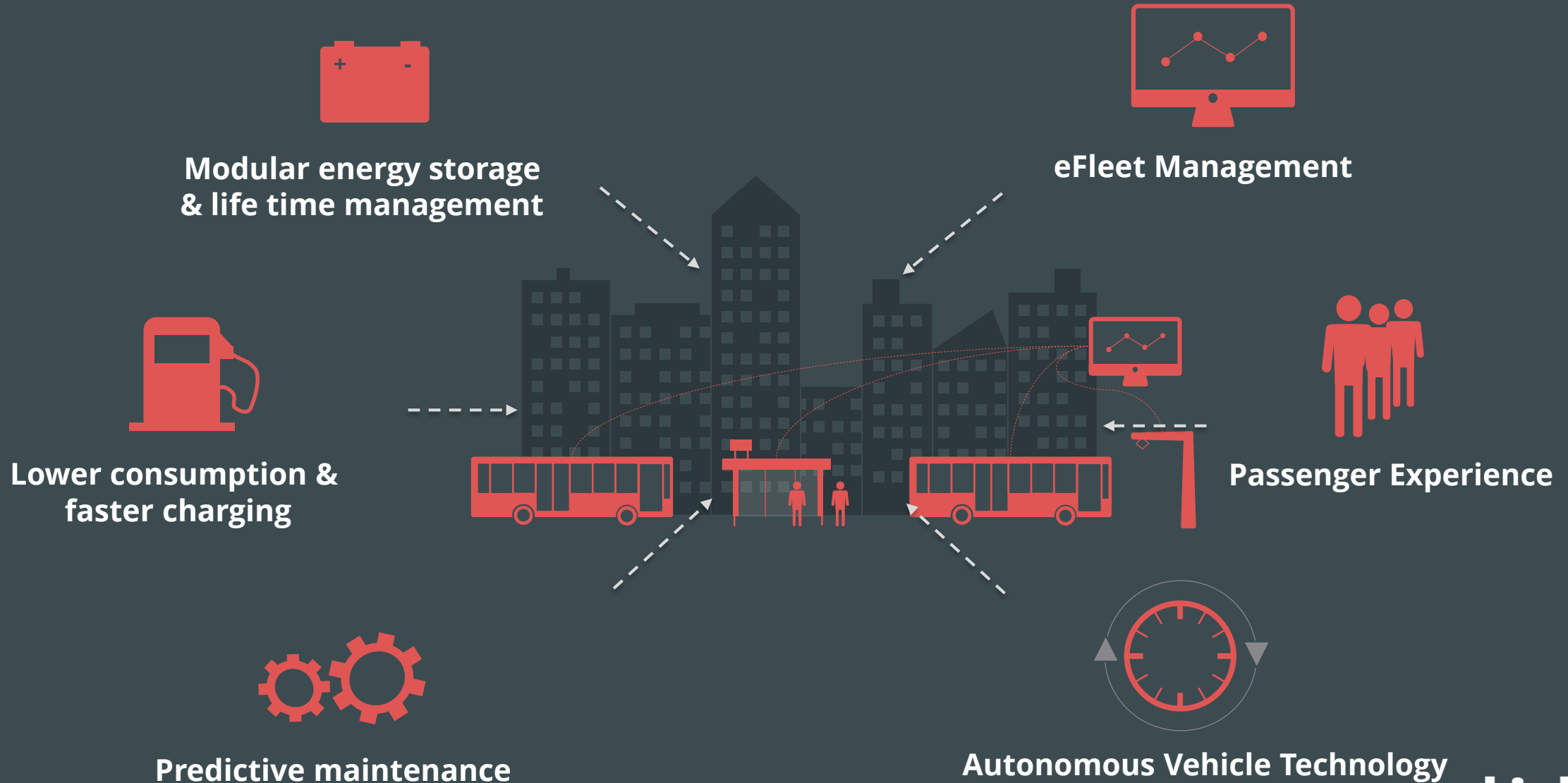
## Operational impact

- Line length
- Energy consumption
- Continuous operation
- Daily mileage
- Time table
- Depot operation

## Total Cost of Ownership

- Battery cost
- CAPEX – bus – drive line – infrastructure
- OPEX – energy – battery replacement – maintenance
- Asset management (bus – battery – depot – infrastructure)
- Technology development
- Standardization

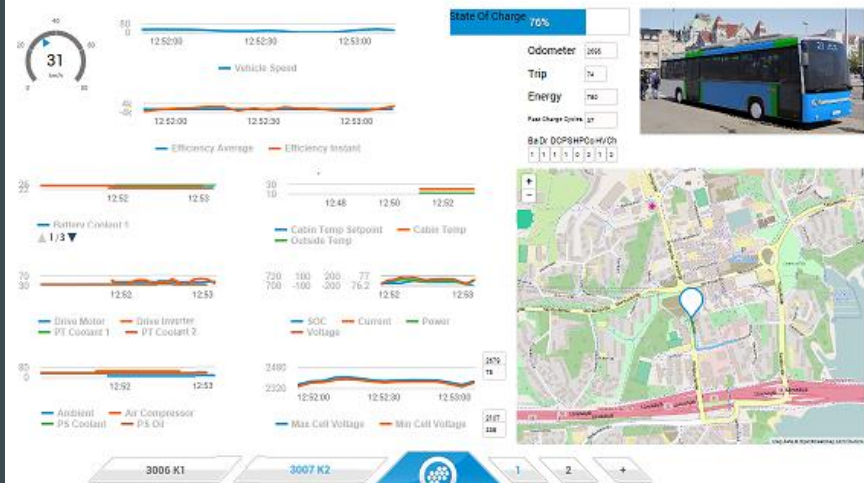
# Vision – Intelligent eMobility





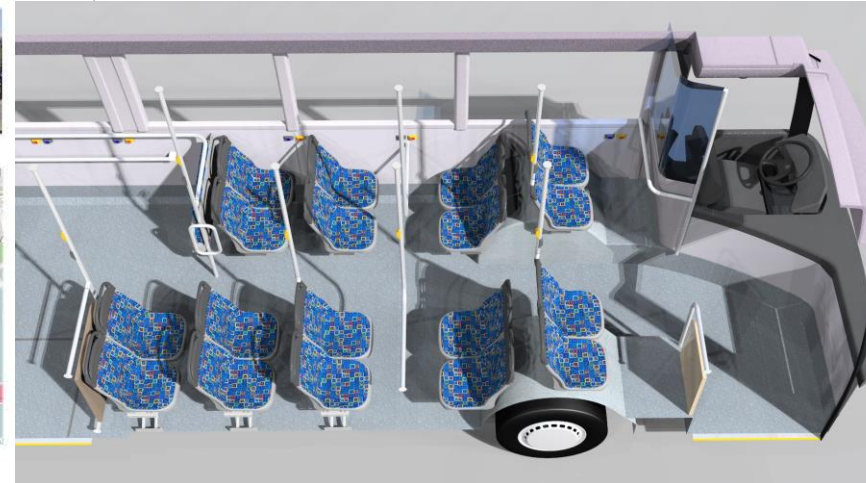
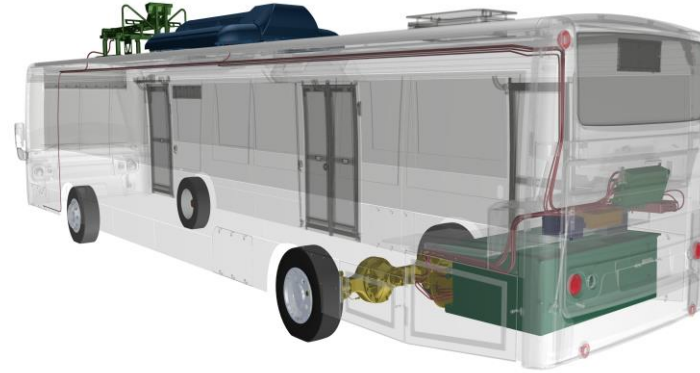
# Linkker Products

Linkker electric buses



LinkView operational SW

LinkDrive drive line & ultra fast charging



LinkLight chassis and body



# Milestones – Developing Competence



# Linkker eFleet Management

Energy reduction

Charge cycle optimization

Battery life time management

Time table performance

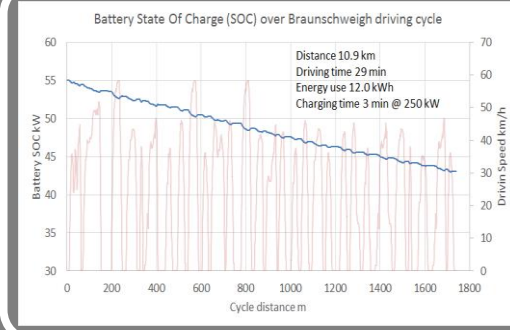
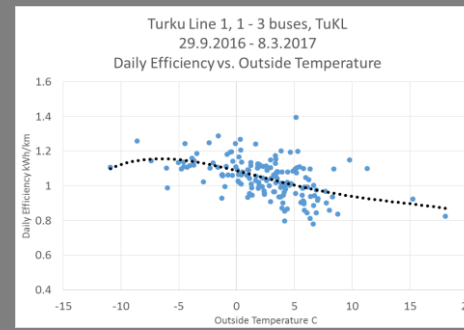
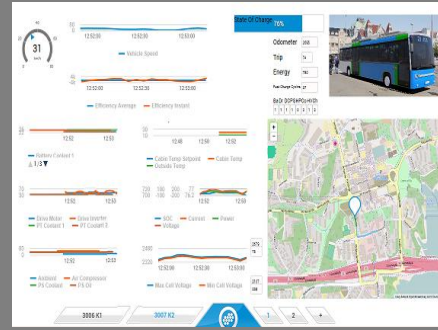
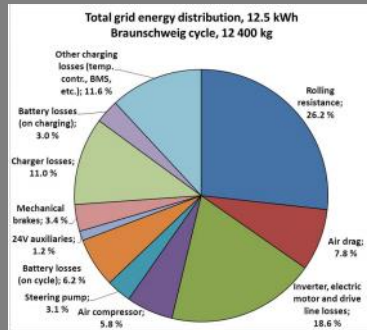


Performance monitoring

Performance management

Analytics & optimization

Active Driver Assistance



LinkView IoT platform

LinkControl

CAN

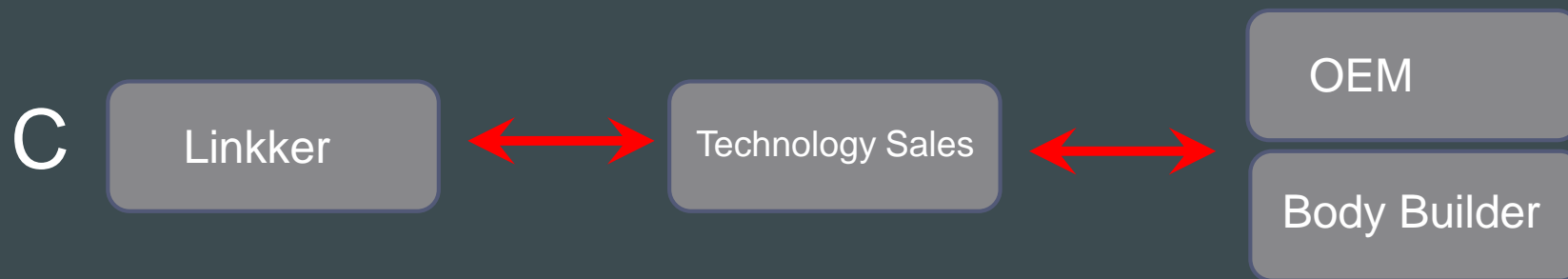
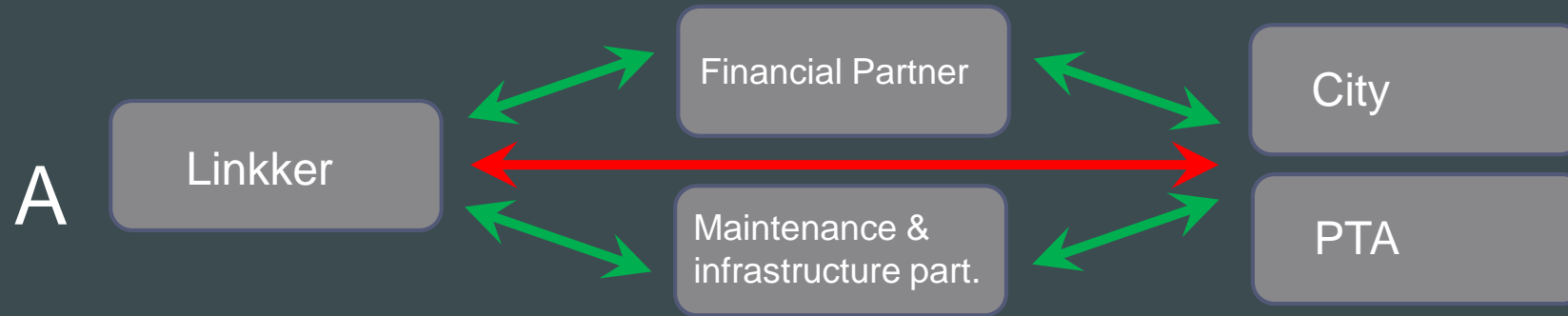
I/O GW

DataLink

Security

Autom.Vehi.

# Linkker Market Access Strategies



 Sales  
 Partners & distribution

# Linkker expansion options

- Geographical coverage
  - North America, South America, China, India
  - Sales, in-factory production, services
- Product coverage & modularity
  - Connected buses, mini buses
  - Retrofits of existing fleets
  - Digitalization & sales of data, reporting, analytics, optimization products
- Industrial partner ships
  - APAC signed
  - Russia and India in progress
  - South and Latin America discussions initiated
- Technology licensing beyond buses
  - OEMs and body builders
  - Trucks, Vans, Personal Vehicles
- Service expansion
  - PPI/PPP projects
  - Contracted transport €/km



# Transition Examples from Selected Cities

Cities with Linkker pilots...



Linkker presence (Buses/Pilot/tests)

Helsinki

Copenhagen

Moscow

Singapore

Expected roll-out

2018

10

2

1

3

2019

.

.

100

20

2020

.

75

150

30

2021

.

150

30

2022

400

40

...in addition Linkker has conducted/ is conducting tests in the following cities



Berlin

*Tender expected*



Köln

*Tender expected*



Lyon

*Tender expected*



Tübingen

*Regional cities with strong interest in electrification*



Straubing



# LINKKER

## Intelligent eMobility

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