



State of the European Battery Electric Buses

ASSURED Usg-1

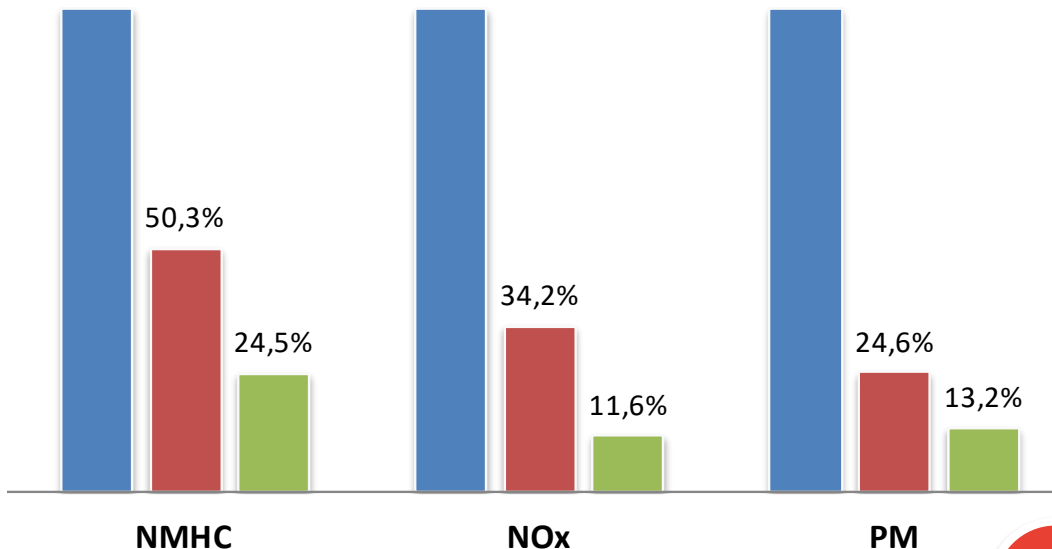
18th September 2018, Berlin

Umberto Guida
Director Research & Innovation, UITP



FLEET RENEWAL IS A PRIORITY

■ Today ■ Only > Euro III ■ Only Euro VI



Estimated emissions reduction by renewing the fleet

Source:
www.3ibs.eu



THE BUS IS CLEAN !

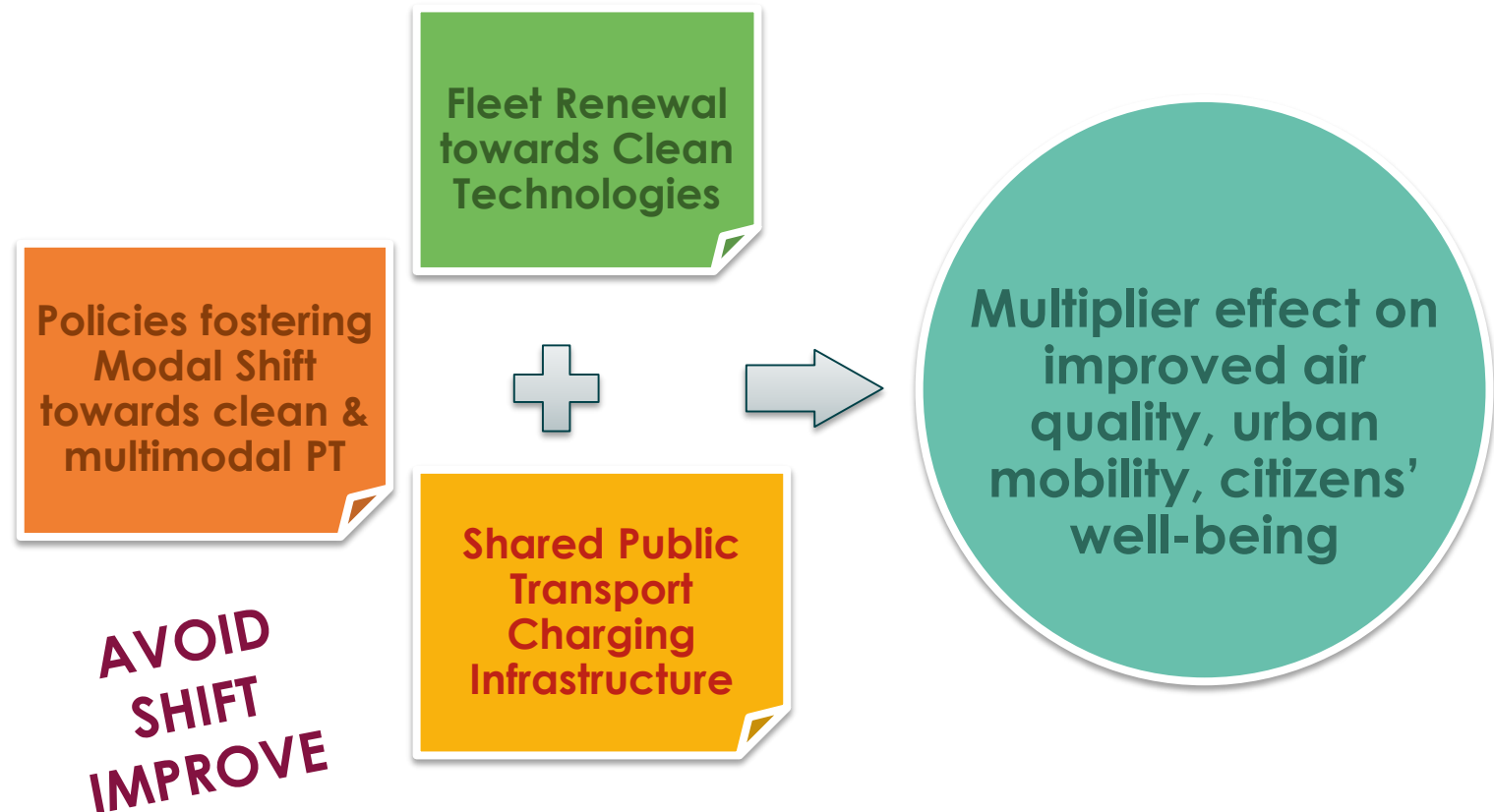
In Europe Urban Bus contribution to city transport pollution (25%) is **8%** calculated per passenger per km

In Europe, **45%** - Euro III or older

Renewal of old-bus fleets towards cleaner technologies is a priority for European Bus Stakeholders

The changes leading to a clean bus fleets shall improve and never put at risk the **quality of service** to passengers

> BEYOND CLEAN FLEETS, TOWARDS LIVEABLE CITIES





E-Bus Deployment in Europe

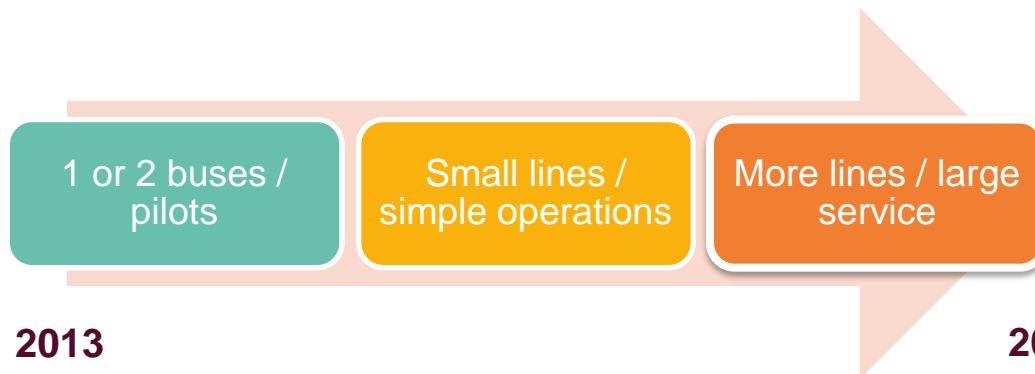
The “first steps”



➤ PILOTS: BASIC OPERATIONS

- **Short route:** daily mileage load not too high.
- **Demands** on passenger's capacity low.
- **Energy consumption** not too high (no steep climbs, av. speed not too low).
- Enough time to **charge** the batteries in depot or at the terminal.
- There is the **back up** of conventional buses.

Not always necessary a system approach, BUT more a *vehicle replacement philosophy*





BONN
6 full electric
12m Bozankaya



BARCELONA
2 full electric
12m Irizar
2 full electric
18m Solaris

High capacity buses

- 12 meters,
- articulated,
- double-deckers

Different e-type

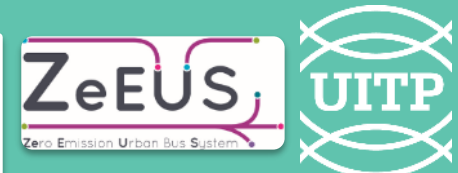
- Plug-in Hybrid,
- Full-electric,
- Battery Trolleys

Energy supply

- Plug-in,
- Inductive
- Conductive (pantograph)
- Overhead (trolley)

Fast and slow charging strategies

- Overnight (depot)
- Opportunity (terminals)
- On-route (trolley)



LONDON
3 Plug-in hybrid
(Induction)
Alexander Dennis



EINDHOVEN
43 full electric
(Opportunity)
18m VDL



CAGLIARI
12m Battery-Trolley
4 Voosloh/VanHool
2 Solaris



PARIS
23 full electric
12m Bolloré



WARSAW
10 full electric
12m Solaris



PILSEN
2 full electric
12m Skoda



MUNSTER
5 full electric
12m VDL



STOCKHOLM
8 Plug-in hybrid
12m Volvo



E-BUS SYSTEMS OPERATING IN EUROPE

ZeEUS eBus Report #2

An updated overview of
electric buses in Europe

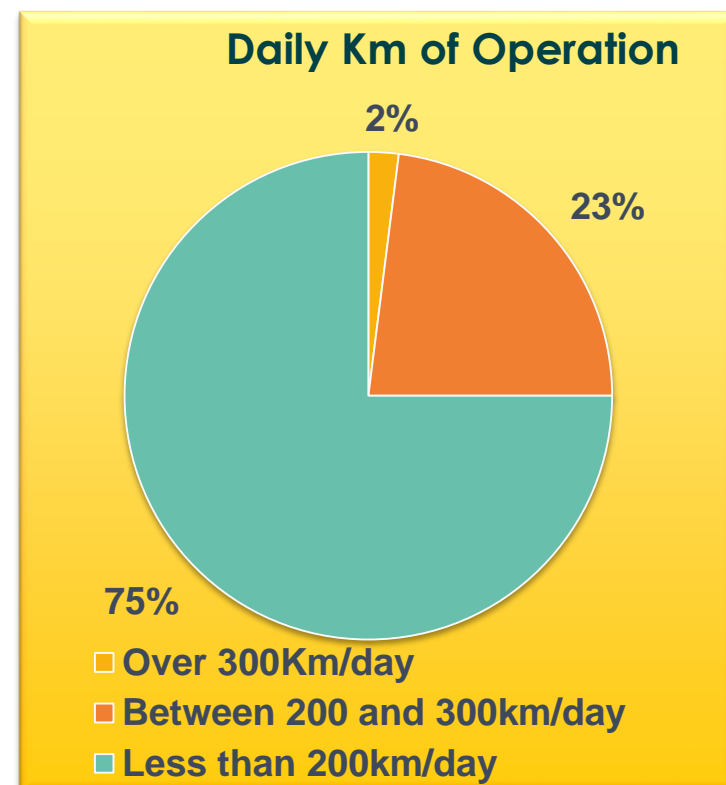
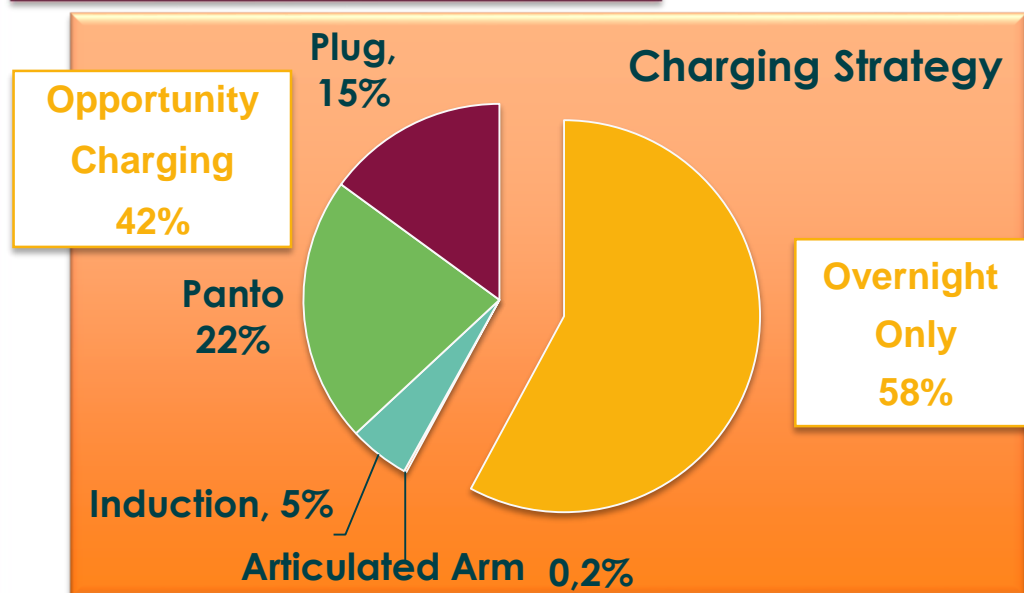
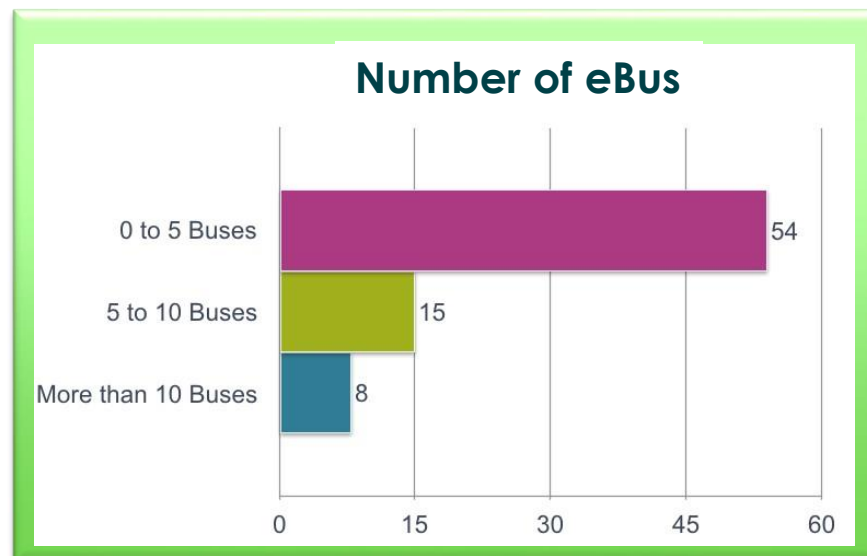
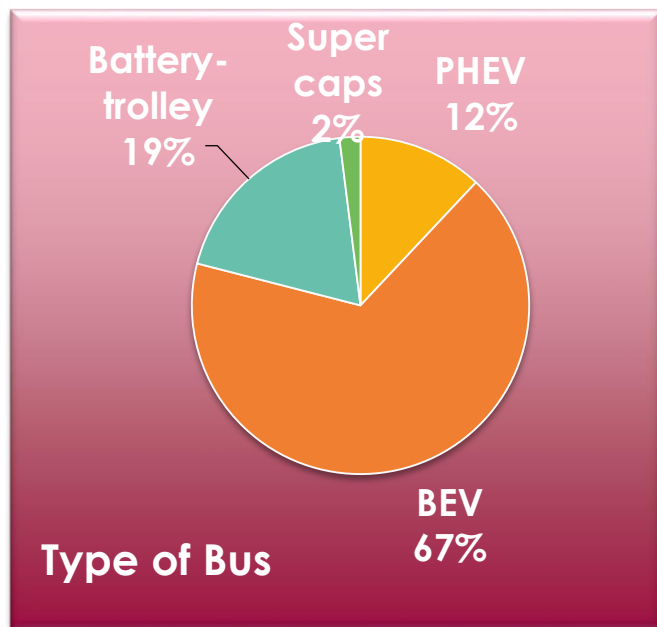
DOWNLOAD YOUR DIGITAL COPY AT:
www.zeeus.eu

- **90** cities, over **800** vehicles and over **20** million km driven in pure electric mode
- **32** manufacturers
- **8** electric system suppliers

New release in preparation (init 2019)
Battery and Fuel Cells Electric Buses
Wider International Outlook
Stay Tuned!



> ZEEUS REPORT



E-Bus Deployment in Europe

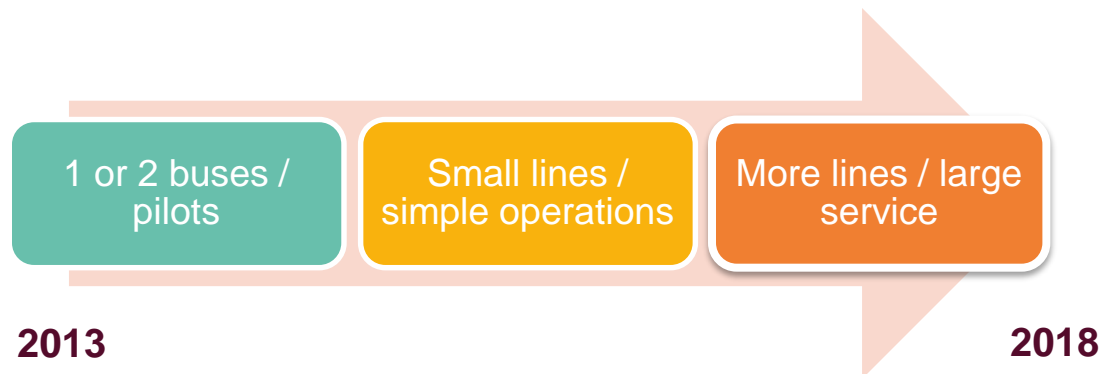
Growing “line by line”



➤ LINE(S): SIMPLE OPERATIONAL CONDITIONS

- Selection of **more suitable line(s)** according to technical capabilities and operation requirements
- Early stage of new **urban strategy** for mobility and decarbonisation
- Early involvement of stakeholders from early planning stage: **joint feasibility studies**
- IT supporting fleet monitoring to optimise operation.

Paradigm shift: from vehicle procurement to system procurement



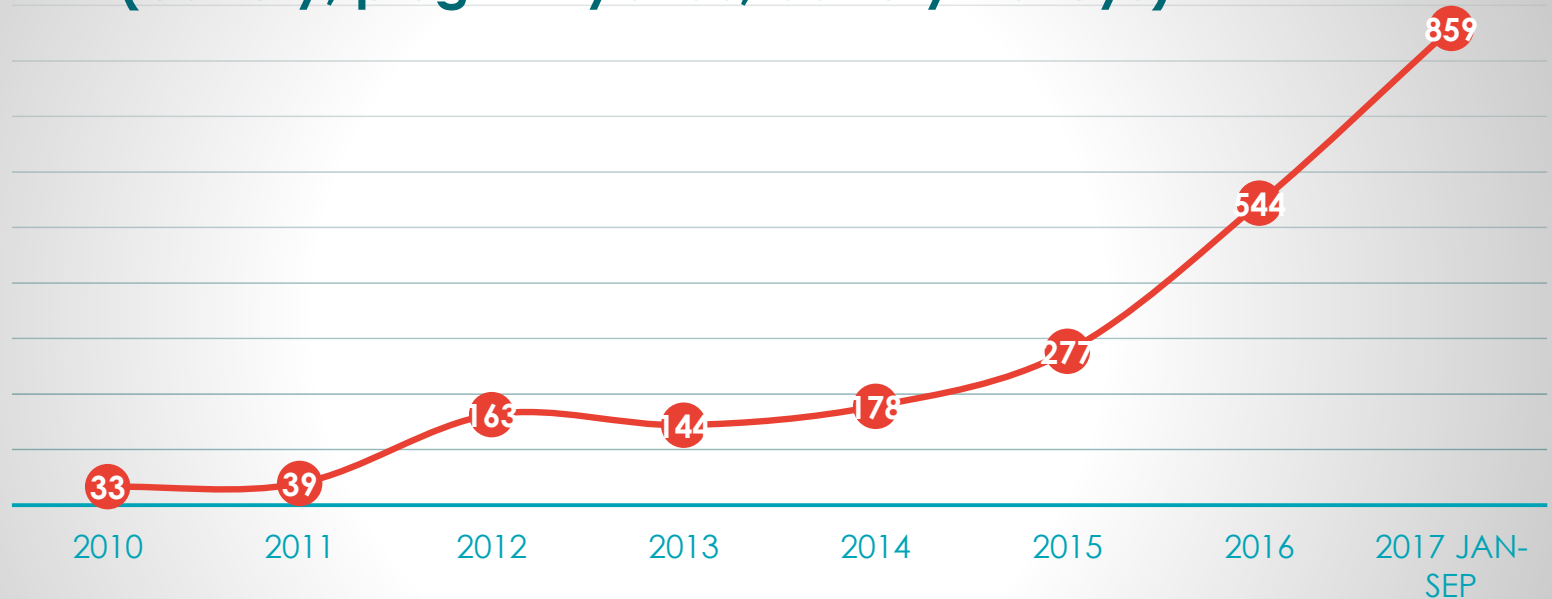
E-Bus Deployment in Europe

“BIG and Different”



> ELECTRIC BUS ORDERS GROWING FAST!

Large capacity e-Bus orders in Europe per year:
(battery, plug-in hybrids, battery trolleys)



Source: www.zeeus.eu - 2017





LARGE OPERATION AND ORDERS IN PLACE

RECENT OPERATIONS

- Schiphol (NL) 100 BEV
- London (UK) 73 BEV

ORDERS 2018

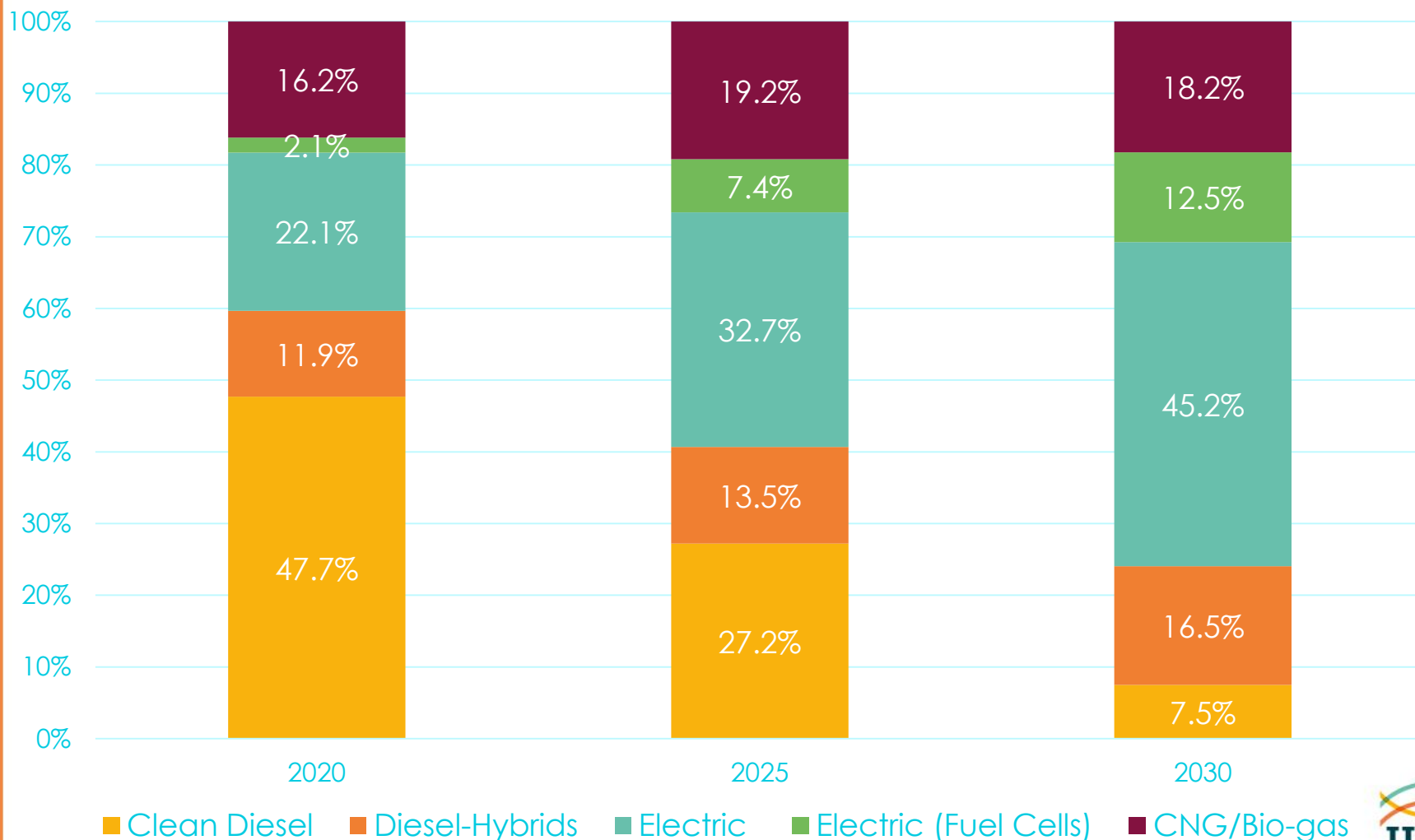
- Paris (F) 80 + 250 BEV
- London (UK) 68 DD BEV
- Manchester (UK) 105 BEV
- Milan (I) 34 BEV
- Trondheim (N) 35 BEV
- Rotterdam (NL) 55 BEV
- Messina (I) 13 BEV
- Umeå (S) 25 BEV
- Goteborg (S) 30 BEV
- Leiden (NL) 23 BEV
- Oslo (N) 57 BEV
- Berlin (D) 30 BEV
- ...



- More and more cities in Europe placing orders for **Electric Buses**
- Driven by National or Local Policies
- European legislative framework in definition for **Infrastructure** and **Procurement** (numbers)
- Financial support by Europe only for **large projects**
- Most of financement comes from **local Governments**



INDUSTRY VIEW: MARKET SHARE PROJECTIONS



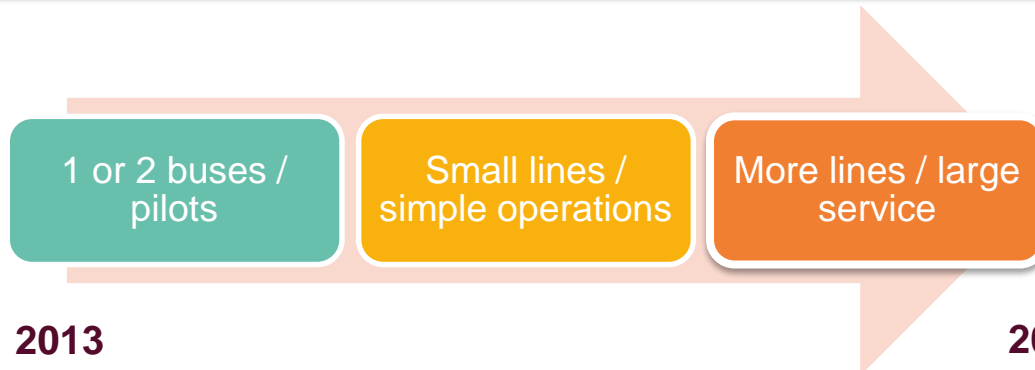
Source: www.zeeus.eu and UITP VEI Committee - 2017



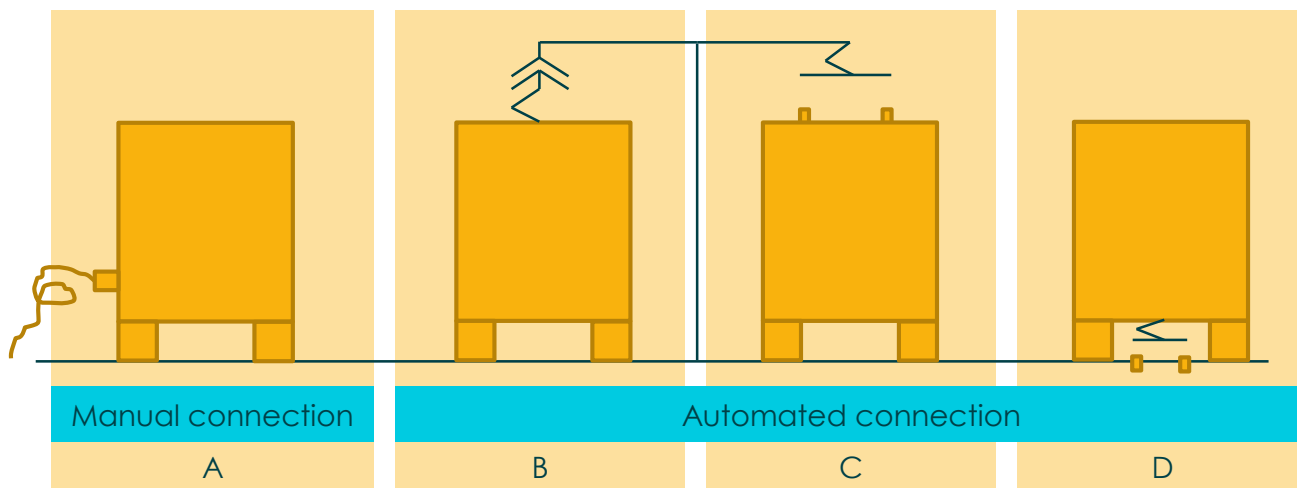
➤ LARGE SCALE OPERATION

- **Replace a fleet** of conventional buses (no back up)
- Cover a **higher mileage** load on a daily basis
- The operation time is **20 hours/day** or more (>300km)
- Need to transport a **high capacity** of passengers
- The time available for **charging** is limited.
- **Interoperability** is a must

A new transport system to be deployed.



> EUROPEAN STANDARDS FOR CHARGING



Charging options	Manual connection	Automatic connection		
	A (connector)	B (roof mounted pantograph)	C (infrastructure mounted pantograph)	D (under floor mounted ACD)
Communication	ISO 15118-2 Ed1	ISO 15118-2 Ed2		
	ISO 15118-3		ISO 15118-8	
Electrical	IEC 61851-1 IEC 61851-21-2 IEC 61851-23			
	ISO 17409 Ed1	IEC 61851-23-1 ISO 17409 Ed2		
Mechanical	IEC 62196-3 Configuration FF	prEN50696 Configuration xx	prEN50696 Configuration yy	prEN50696 Configuration zz



DEPLOYMENT SUPPORT 2



AVAILABLE
E-SORT for battery
and plug-in hybrids

COMING SOON
Measures with
Auxiliaries



Design Principles
for eBus as a new
urban object



Third edition including
tendering for e-buses
release (Oct '18)





DEPLOYMENT RECOMMENDATIONS DOCUMENT (OCTOBER 2018)



IF – Know & Decide

- Clean-buses deployment strategy
- Exchange of experiences
- Understand own operation needs

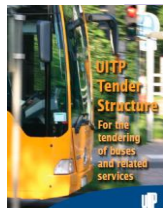
Start from the needs,
not the solution



WHEN – Plan & Regulate

- Joint collaboration
- Urban policies
- Funding & Financing mechanism
- Clear Project governance

Do the right plan!



WHAT – Select & Procure

- Standardised/ interoperable solutions
- Process for procuring innovation
- Risk sharing mechanism
- Relationship with energy providers

Expect the
unexpected!



HOW – Operate & Maintain

- Training (new competencies, processes)
- Operations (including charging operations)
- Maintenance (new garage settings)
- Decommissioning (battery after-life)

Don't forget that is for
the Passengers!



PROJECTS SUPPORTING THE UPSCALE



- **Modular high power charging systems** up to 600 kW and high transfer efficiency.
- **Charger-vehicle interoperability and standardisation** test protocols.
- **Energy storage systems & charging management strategies: smart charging** for large fleets.



- **smart management** of power distribution networks, electrified public transport networks (metro, trams...) and charging stations for EVs.





ASSURED User Group



ASSURED User Group objectives

In line with the ASSURED Innovations, the challenges of the large deployment of electric buses are **suggested** as topics for the UsG work:

- Road charging infrastructure
 - Planning, permissions, interoperability...
- Depot transformation
 - Including safety, training...
- Operational excellence
 - Energy vs operation efficiency
- IT tools for fleet management and diagnostic
 - Including data standardisation...

The objective is to look these topics from the **operational** point of view, even beyond ASSURED, and bringing **your** direct experience



THANK YOU!

QUESTIONS?

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