ZeEUS: Bringing e-buses to the heart of Public Transport

Aida Abdulah, Senior PM, R&I UITP
“Bus Fleet Investment through the deployment of low emission vehicles”

ZeEUS and the Clean Bus Deployment
A WORLDWIDE ASSOCIATION

NORTH AMERICA
- Regional Office | New York City

LATIN AMERICA
- Regional Office | São Paulo

EUROPE
- Main Office & Centre for Training | Brussels
- Liaison Office for Turkey | Istanbul

AFRICA
- UITP - Regional Office | Abidjan
- Liaison Office for Austral Africa | Johannesburg

EURASIA
- Regional Office | Moscow
- Liaison Office for Kazakhstan | Astana

MIDDLE EAST & NORTH AFRICA
- Regional Office and Centre for Transport Excellence | Dubai
- Liaison Office for Maghreb | Casablanca
- Liaison Office for Iran | Tehran

ASIA-PACIFIC
- Regional Office | Hong Kong
- UITP ANZ - Regional Office for Australia / New Zealand | Melbourne
- Regional Office for India | Bengaluru
- Liaison Office for China | Shenzhen
- Centre for Transport Excellence | Singapore
A DIVERSE MEMBERSHIP

1,500 MEMBER COMPANIES
18,000 CONTACT MEMBERS
16 OFFICES ACROSS THE GLOBE
MEMBERS FROM 96 COUNTRIES
OUR VISION & MISSION

We are working to enhance quality of life and economic well-being by supporting and promoting sustainable transport in urban areas worldwide.

- We promote and mainstream PT.
- We inspire excellence and innovation.
- We foster exchange and partnerships.
Great Interest from Urban Mobility Actors on Clean Buses

**European Bus Fleets**

- **79%** Diesel
- **9.9%** Biodiesel
- **7%** CNG
- **0.6%** Biogas
- **1.2%** Electricity
- **2.3%** Other

**Energy Transition Operators & Authorities**

- **69.7%** More hybrids
- **33.3%** More fully electric with batteries
- **45.5%** Electricity
- **12.5%** More plug-in hybrids
- **18.9%** CNG
- **13.2%** Biogas
- **34%** Diesel
- **13.2%** Other

*Respondents distribution according to future plans to change propulsion system ratio*

Bus fleet breakdown per fuel or energy used
ZeEUS: Supporting e-bus deployment

40 Consortium Partners
20 User Group Members
2013-2018
Coordinator: UITP

1 common evaluation methodology

€22.5 million
EU funding: €13.5 million

10 demo cities
>107 electric buses

Main Output
Tools and guidelines to accompany bus stakeholders in e-bus deployment
ZeEUS Demo Cities

10 cities, +100 e-buses

High capacity buses
- 12 meters,
- articulated,
- double-deckers

Different e-type
- Plug-in Hybrid,
- Full-electric,
- Battery Trolleys

Energy supply modes
- Plug-in,
- Inductive
- Conductive (pantograph)
- Overhead (trolley)

Fast and slow charging strategies
- Overnight (depot)
- Opportunity (terminal)
- On-route (trolley)
ZeEUS: A flagship EU Project on urban e-bus systems

ZeEUS as central link between Market and Policy for the sustainable deployment of high-capacity e-bus systems
ZeEUS: A large platform of collaboration, involving more than 100 Organisations

**PTA/ PTO/ Cities**
- 10 core demos
- 20 user groups
- 90 observed
- 3 monitored

**Vehicle Manufacturers**
- 5 Project Partners + 4 Suppliers
- 8 E-SORT WG + 32 in ZeEUS Report

**800 Buses**

**8 electric charging solution providers**
ZeEUS eBus Report #2

An updated overview of electric buses in Europe

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

DOWNLOAD YOUR DIGITAL COPY AT: www.zeeus.eu
5 Main challenges

- High upfront cost
- New challenging operations
- New ways to procure
  - Vehicles & Equipments
  - Operation services
- Standardisation / Interoperability
- Reinforcing cooperation energy/bus
Phased approach for e-bus deployment

Action lines to deploy e-buses

IF
Know Decide

WHEN
Plan Regulate Finance

WHAT
Specify Procure Deploy

HOW
Operate Maintain

Joint Effort of Institutions Stakeholders Cities

Project elicted knowledge, guidelines & tools to support stakeholders
Phase 1

IF: Know & Decide

- Define a global & integrated mobility vision.
- Exchanges experiences and knowledge.
- Feasibility study with all stakeholders.
- Define own operational needs for Clean Buses.
- Solve trade offs in own scenario to ensure needed operational capability.
- Develop LCC / TCO model suitable for the operational scenario.

Start from the needs not from the solution
The Bonn Vision

• Market exploration
• Feasibility study
• Fields tests
• Technical specifications
• Charging concept
• Operational concept

→ Complete Conversion of all conventional diesel buses to full electric propulsion until 2030 by decision of SWB Executive Board
Phase 2

WHEN: Plan, Regulate, Finance

- **Ensure support** from competent Authorities.
- Assess the **impact of legislations** applicable to the specific scenario.
- Look for the **most suitable funding & financing scheme**.
- Set up **project governance**.
- Embrace **system approach**.

Don’t rush, it is all about planning
…and speak with your tram/trolley colleagues…
Paradigm shift

Operational context, costs and technical performances set the characteristics of the e-bus system elements.
Phase 3

WHAT: Specify, Procure, Deploy

• Define **risk sharing** schemes between Municipalities, Authorities and Operators according to their role.
• Open table with industry, procuring entity, regulators and financing actors – **Develop partnerships**.
• Stimulate and support procuring entities to **adapt tender process** to e-buses peculiarities.
• Follow carefully the **processes** for **infrastructure deployment**.

Expect the unexpected!
Being prepared also means…

Hidden gaspipe – not shown on any city map!

The pantograph pole has to be entirely redesigned to respect the snow clearance regulations

Run IT communication test!
Phase 4

HOW – Operate & Maintain

• Changes in the **bus depot**.
• Continuously **optimise the service**.
• **Optimisation of charging** operation (operation vs costs).
• **Training**: new skills for all category of workers.
• Evaluate operations including staff and passengers’ satisfaction.

Don’t forget the PEOPLE!

“If you compare the noise level with that of other buses, it’s an enormous difference”. Kristina Book, driver on route 55.
Before ZeEUS

Early stage of knowledge on high capacity e-buses

- Project partners started “from scratch”: “learning by doing, trial & error” approach
- Authorities were not used to consider e-bus as a system
- Very limited knowledge on how to operate e-buses
- Bus technology greatly developed since proposal phase
After ZeEUS

Gradual vehicle introduction in function of knowledge, technology chosen to ensure service operation

- Early stakeholder involvement in the planning, and development of feasibility study jointly
- Paradigm shift: from vehicle procurement to system procurement
- IT supporting fleet monitoring to optimise operation
- Developing a “local” LCC model: identification of main elements
- Integrating e-bus services into the global decarbonisation strategy
ZeEUS e-Bus Performances

ZERO EMISSION URBAN BUS SYSTEM (ZeEUS) PROJECT For the period Aug 2015 - Aug 2016

Figures coming from 10 cities across Europe

5,661,126 km
The distance travelled by ZeEUS buses running in pure electric mode¹

2,151,228 litres²
The amount of diesel fuel saved by the ZeEUS bus project¹

3,273 tons³
The amount of carbon dioxide emissions prevented by the ZeEUS bus project¹

¹ For vehicles increasing from 12 (2015) to 109 buses (84 BEV, 11 PHEV, 6 Trolley-Battery)
² Assuming 38L/100 km
³ ISO 16258 factor for Diesel and GaBi factor for EU electricity grid mix (2014)
Electric bus orders are growing fast!

![Graph showing electric bus orders in Europe per year from 2010 to 2017.](image)

**e-Bus orders in Europe per year**

- 2010: 33
- 2011: 39
- 2012: 163
- 2013: 144
- 2014: 178
- 2015: 277
- 2016: 544
- 2017: 859

Source: ADL - 2017
Urban bus market share evolution in Europe

EU Urban Bus Market Share Evolution

Source: ZeEUS/UITP(VEI) - 2017
What do we want to achieve?

But where are we?
Beyond clean fleets: towards clean cities

- Fleet Renewal towards Clean Technologies
- Modal Shift towards Clean & Multimodal Public Transport
- Shared Public Transport Charging Infrastructure

Multiplier effect on improved air quality, urban mobility, citizens’ well-being
ZeEUS useful insights into…

- ZeEUS Vision on electric bus systems
- Analysis of existing legislation and funding sources applicable to urban electric buses
- Roadmap for electric bus systems
- Urban electric bus systems deployment plan
- Tender structure for urban electric bus procurement
Thank You!
Mulțumesc!
Backup
**Recommendations for policy making**

**Phase 1: Know & Decide**
- **Stimulate research** for new e-bus system solutions, batteries, chargers (ZeEUS/ERTRAC Roadmaps)
- Facilitate the **uptake** of technology after pilot phase (including strong user validation)
- Develop opportunities for **exchange of experience** (ex. Platform, facilitate marketplaces)
- Foster e-bus inclusion in **SUMPs**
- Push inclusion of clean (electric) bus infrastructure in **Member States’ implementation** of DAFI

**Phase 2: Plan, Regulate & Fund**
- **City policies** to favor the deployment of clean buses / public transport
- **Harmonised legislations** for a deployment of clean buses (CVD, DAFI…)
- Stimulate **funding/financing schemes** that consider the **specificity** of bus procurement
- **Open standards** for ensuring interoperability of chargers and vehicles
- Review legislations to **allow** the use of PT power network for charging e-vehicles

**Phase 3: Select & Procure**
- **Set sustainable procurement targets** for bus fleet renewals towards cleaner solutions
- Focus legislations on **objectives** (clean air) more than on **means** (technologies)
- Promote the use of **standardized evaluation** rules (E-SORT, VECTO…)
- **Facilitate** the process for infrastructure development (permits, roadworks…)
- **Tender processes** that support the **deployment of innovation** (risks, duration..)

**Phase 4: Operate & Maintain**
- Support education towards **new skills** required by innovation implementation
- Support the **staff transition** towards new skills
- Promote standardization of **safety procedures for emergency** situation

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**ZeEUS Policy and Rule-Making Recommendations to support e-bus deployment**