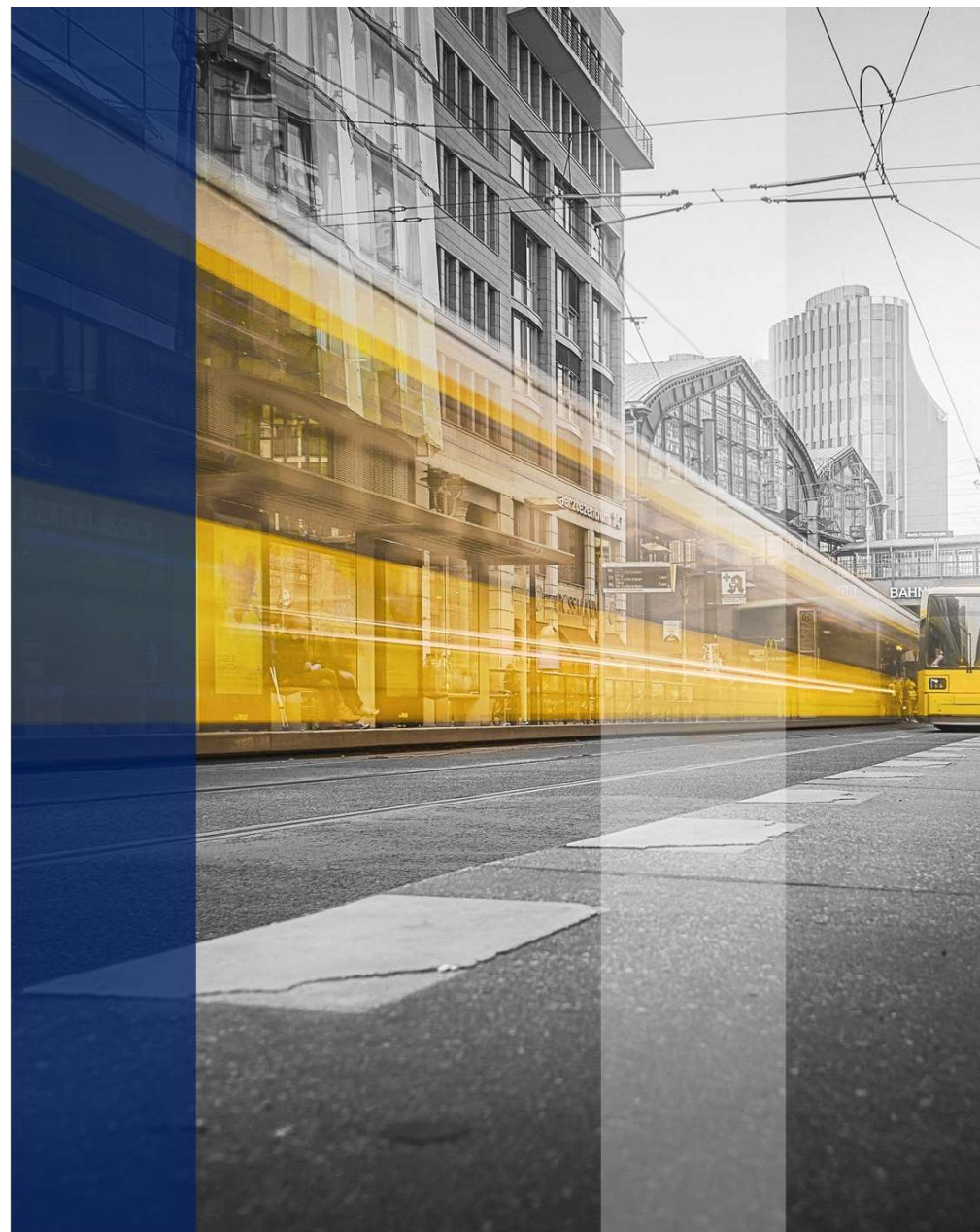


# DECARBONISATION AND AIR QUALITY. Towards zero emission (public) transport:

Achievements to date and important  
issues yet to overcome

Lluís Alegre  
EMTA Board member  
Mobility Director



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# Background and road travelled

Preliminary remarks

Timeline



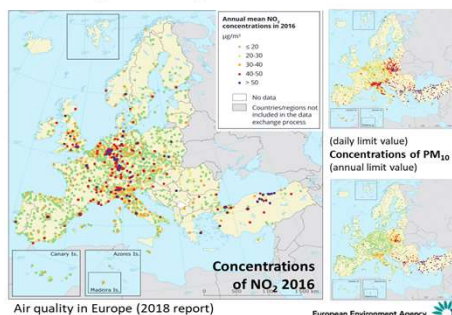


## Preliminary remarks of Decarbonisation and Air Quality

### Why is it useful to view these topics combined, Climate Change and Air Pollution?

- ✓ Both stem from our current energy model
- ✓ Both will exacerbate greatly in the years to come (1), if no or insufficient countermeasures are taken
- ✓ The tactical measures required in the short-term, such as emission standards and restrictions, awareness building and education, are to a large degree common to both matters
- ✓ Decarbonisation is the key lever in the long-term solution to both problems
- ✗ Different scale level and impact, location dependence and target specificity

#### ① Air quality



Air quality in Europe (2018 report)

“4.2 million deaths every year as a result of exposure to ambient (outdoor) air pollution”

World Health Organization

#### Climate change



“Between 2030 and 2050 climate change is expected to cause 250.000 ADDITIONAL DEATHS PER YEAR due to malaria, malnutrition, diarrhea and heat stress”

World Health Organization



## Preliminary remarks of Decarbonisation and Air Quality

### Why do PTAs have a stake in this? What has EMTA made as an association?

- EMTA Declaration of Intent (June 2018), for the promotion of a scaled transition to zero emission buses  
*'Realizing that public transport, particularly in urban areas, should be exemplary to drive forward the energy transition of road transport in Europe'*, committed themselves to *'support the acceleration of "clean vehicles" and to remove local obstacles that could impede the transformation to low and zero-vehicle strategies by procurement of clean vehicles in terms of striving towards 100% of zero- and low-emission bus fleets, as soon as and wherever possible.*
- Air Quality Survey (November 2018), answered by most EMTA members concluded that a working group was required to approach DAQ in a collaborative action.

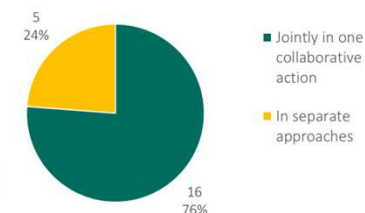


**EMTA's DAQ Working group was created**

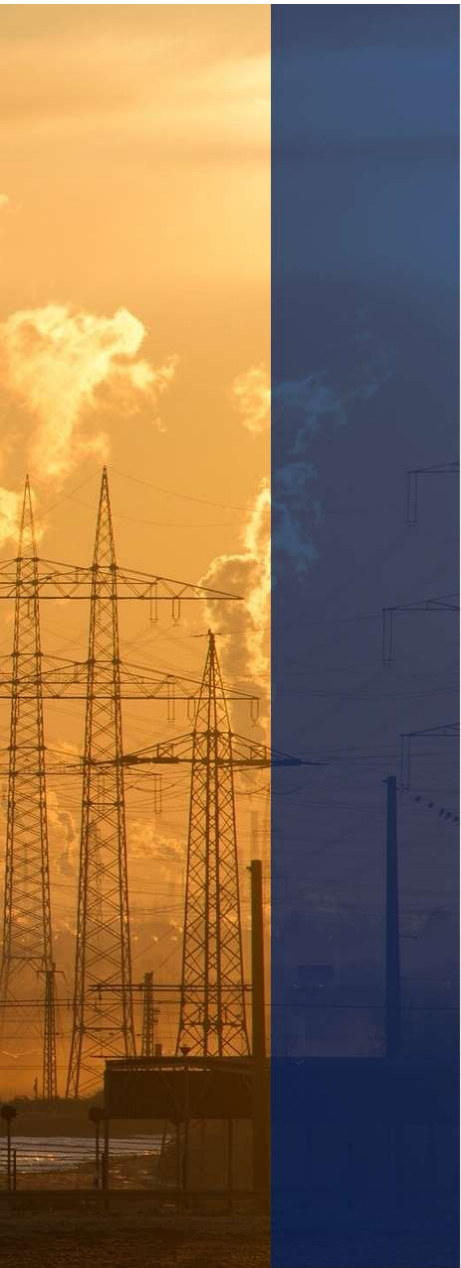
### Air quality survey



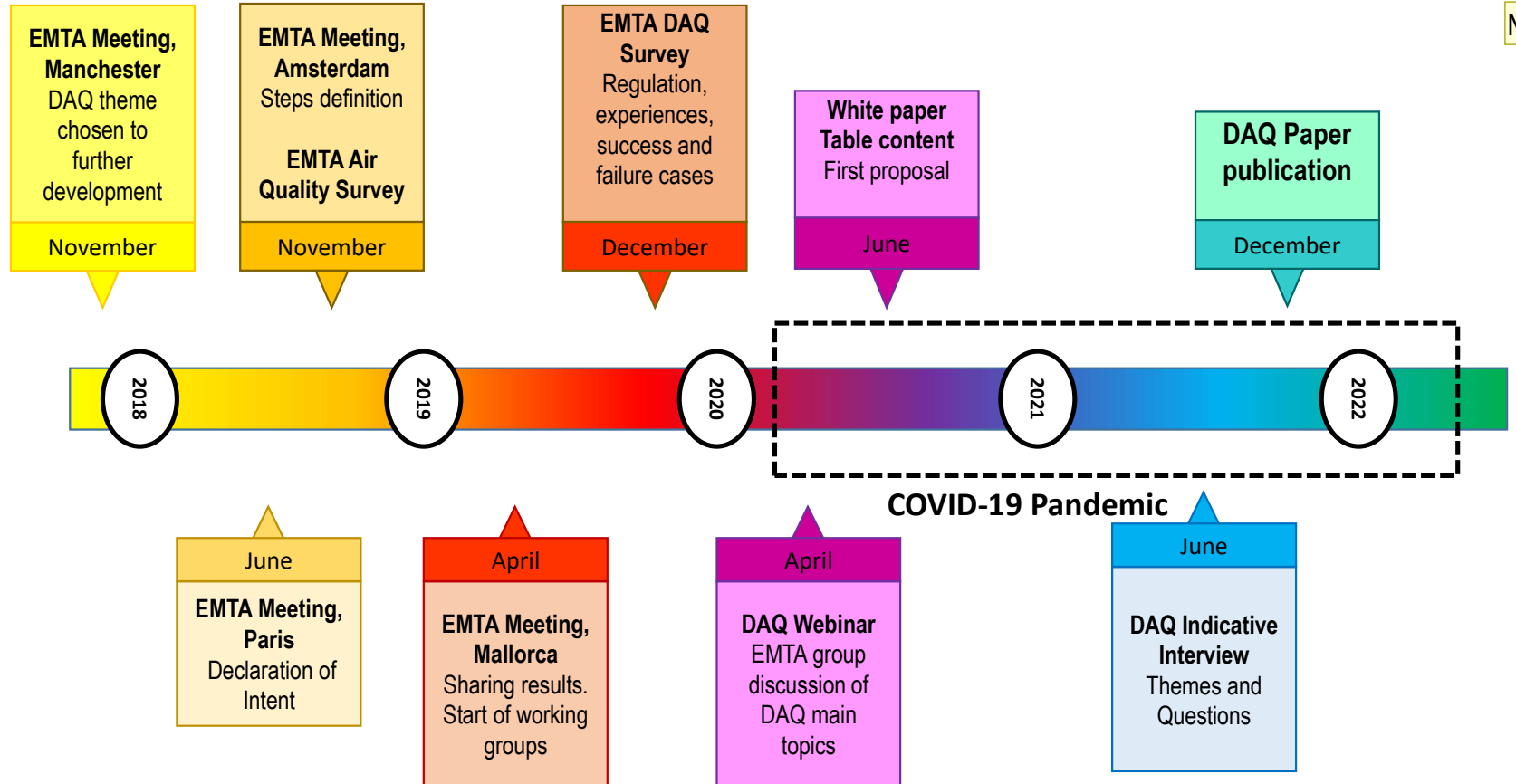
In your opinion  
Should the work topics of air quality and decarbonization  
of public transport fleets be pursued jointly or separately?



**"76% prefers work jointly in only collaborative action"**



# Timeline



MGN

## Diapositiva 5

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**MGM0**

Aquestes són les fites més importants que he trobat, no sé si me'n falta alguna i potser n'hi ha intermèdies que sobren

Marc Guede March; 2022-04-27T21:56:18.794

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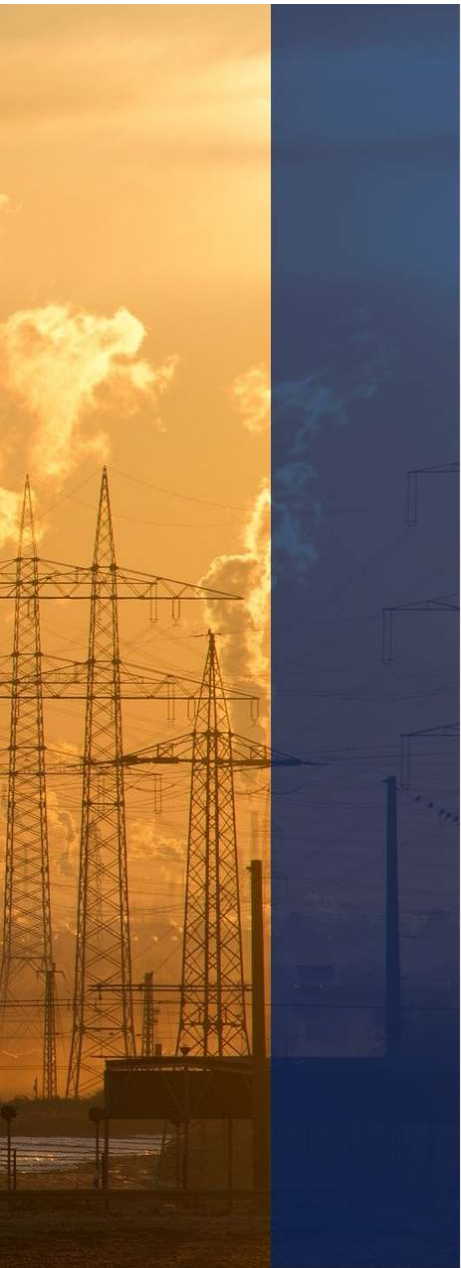


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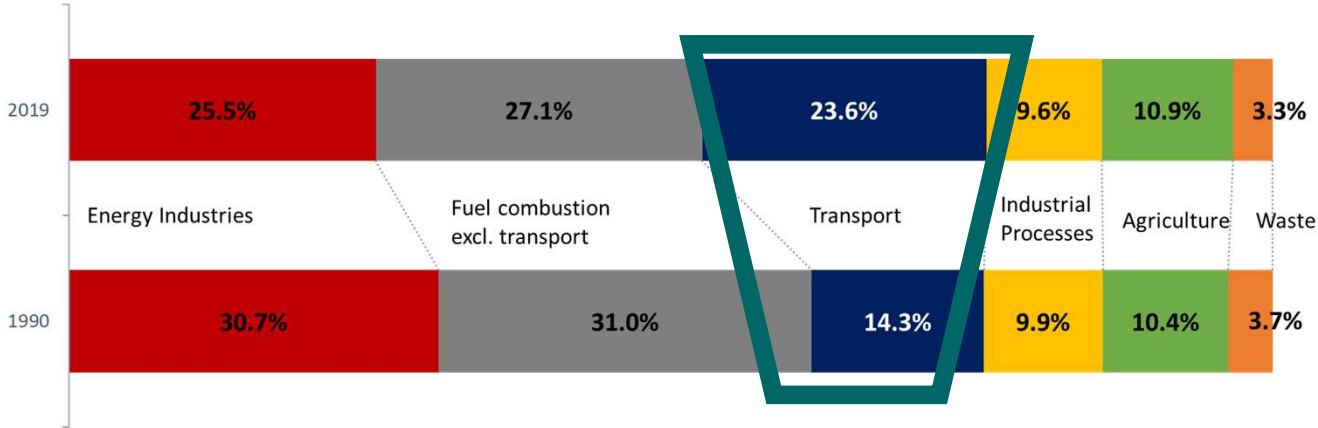


# The Relevance of Transport Decarbonisation





# The Relevance of Transport Emissions

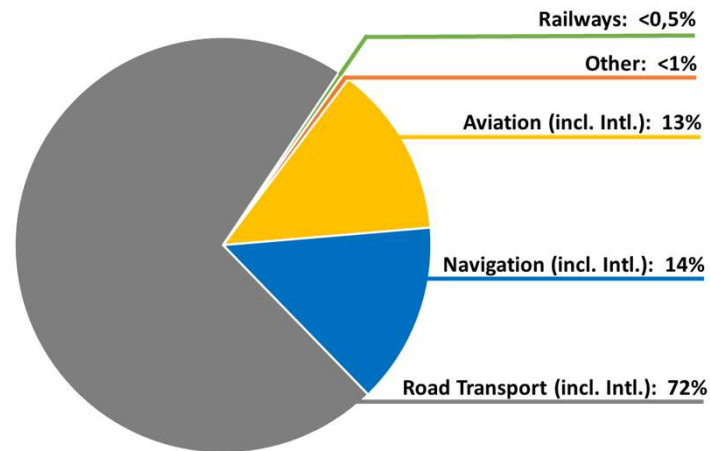


Share of GHG Emissions per sector in the EU in 1990 and 2019.

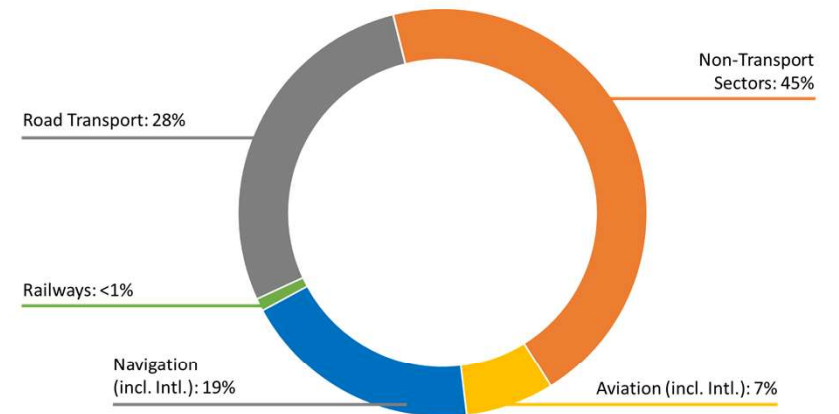




## The Relevance of Road Transport Emissions



GHG per transport mode, 2019



NOx per transport mode, 2019

Exhaust emissions from road vehicles with internal combustion engine, mainly private automobile and goods vehicle fleets, account for

72% of transport's GHG emissions,  
50% of transport's NOx emissions,  
25% of transport's PM2.5 emissions.

# Why Move to Cleaner Buses?





## Why Cleaner Buses?

Public transport only accounts for a minor fraction of transport related emissions.

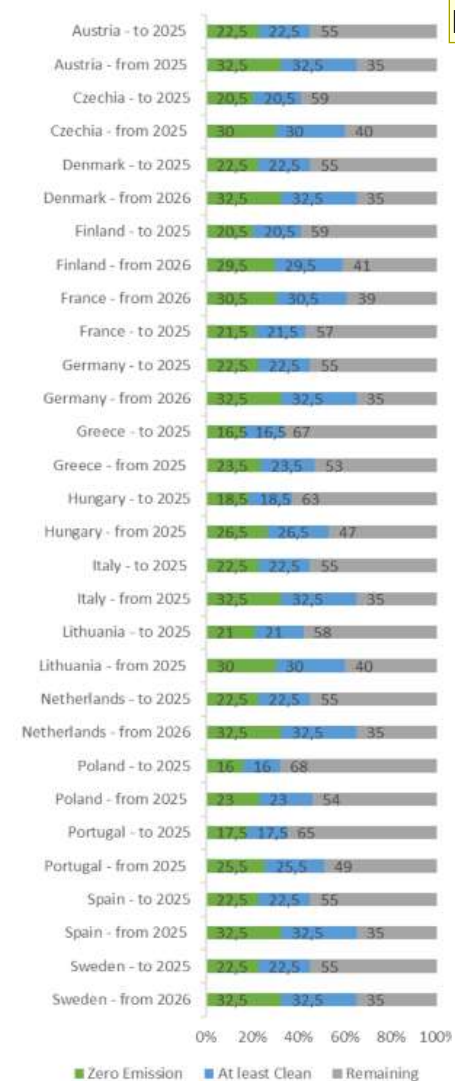
Public transport is an **invaluable springboard to create a volume demand for clean vehicle fleets** in order to kickstart development and manufacturing of such systems at scale.

## EU Clean Vehicle Directive

**The revised CVD** came into force in August 2021 and **sets national targets for public procurement of road vehicles** and services employing road vehicles.

Targets describe to what percentage public vehicle or service procurement must base on clean and zero emission vehicles.

Targets become even more progressive from 2026 onward.



National CVD Targets for buses

## Diapositiva 10

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**MGM0** A la presentació original només sortia el cas de França, m'ha semblat interessant que hi sortin tots. No sé si hi ha temes polítics/administratius a tenir en compte

Marc Guede March; 2022-04-27T20:38:04.024



# Clean and Zero Emission Bus Systems





## Clean Bus Systems

According to the CVD, a heavy-duty vehicle – including buses – is clean if propelled with fuels not originating in oil production.

### Liquid bio- and synthetic fuels

#### Compressed Natural Gas (CNG)

##### Biomethane

is a renewable and thus climate neutral methane gas and indistinguishable from CNG. It is therefore not currently considered a zero-emission option – not even as bridge technology until green hydrogen driven buses are market ready.

#### Battery Electric

While requiring more energy in their production, **battery electric bus operation is highly efficient with regards to energy consumption** and break energy is recuperated completely.

#### Hydrogen Fuel-Cell Electric

**Requires more energy in vehicle production, which cannot be offset as the operational efficiency** with regard to energy consumption is comparable to conventional fuels.

Hydrogen buses still suffer from reliability issues and green hydrogen supply chain not sufficiently established: not market ready!

# Decarbonisation in Practice

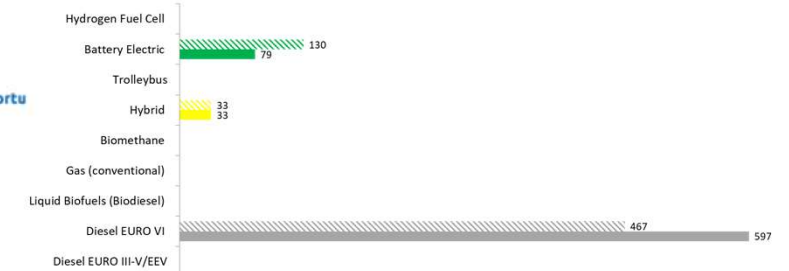
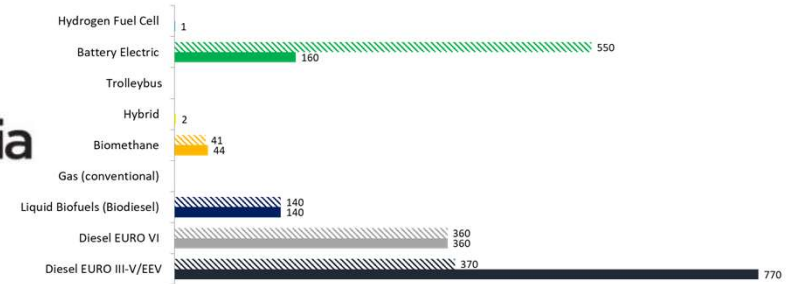




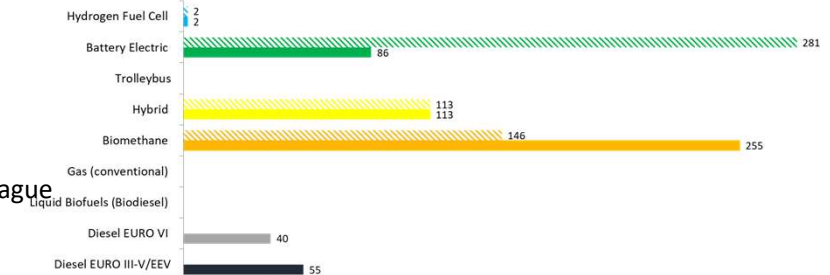
## Where are we at – European Overview

„realizing that public transport should be exemplary to drive forward the energy transition of road transport in Europe...”

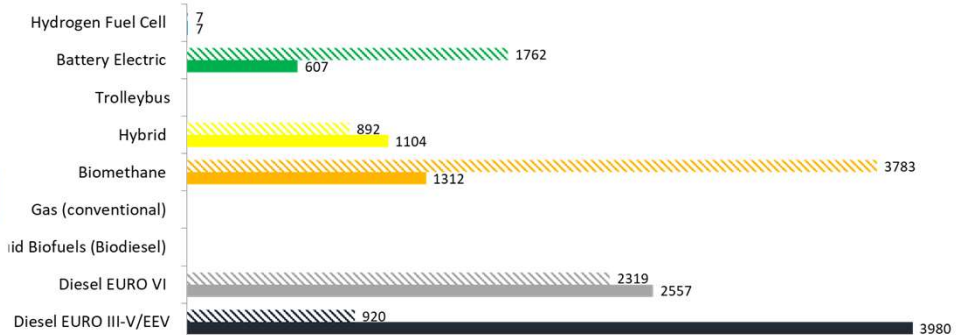
EMTA 2018 Declaration of Intent for the promotion of a scaled transition to zero emission buses





Rotterdam/The Hague



Paris / île de France



 2021 actual fleet data  
 2025 non-committal projections



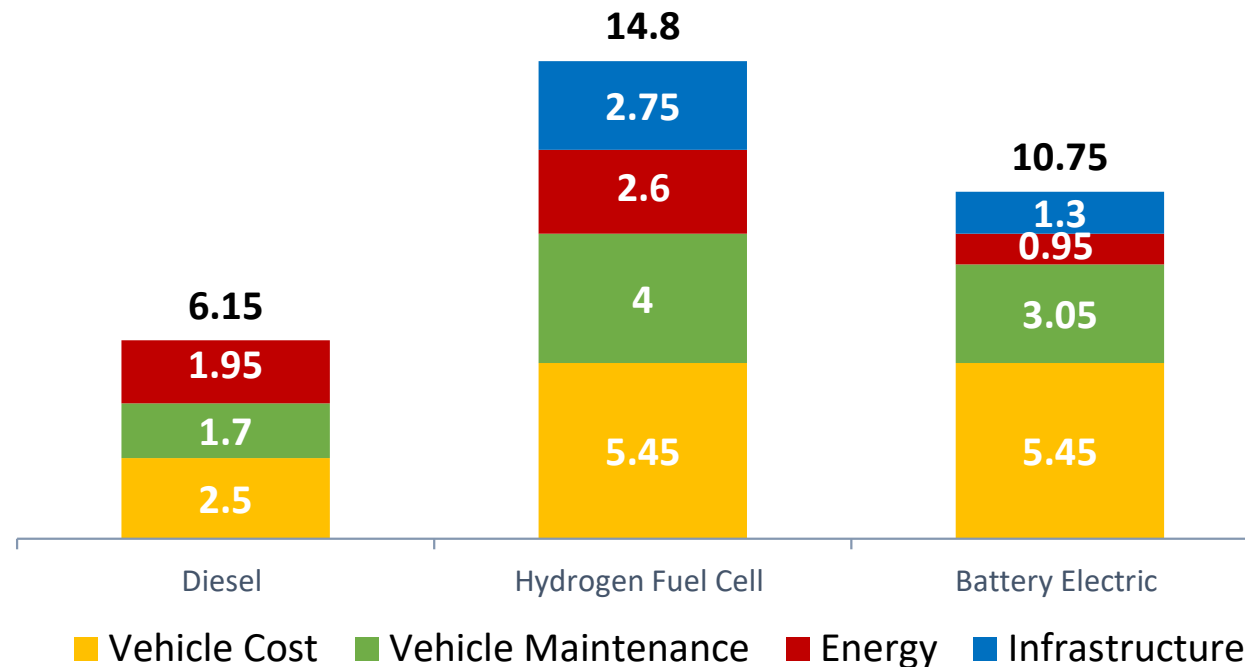


## Total Cost of Ownership Comparison

Example calculation for generic operation with 100 standard buses in million Euro per year.

Assuming:

- Equal amount of vehicles with each technology, favourable route lengths = 200km/d
- Hydrogen fuel cell buses nearing current battery electric bus price point
- Vehicle life of 15 years
- One exchange of battery/fuel cell + battery in the vehicles lifetime





**Issues yet to overcome**

**Part 1: Necessary  
developments regarding  
ZE products**





## Mismatch of operational requirements and current capabilities of zero emission bus systems

- **Autonomy of vehicles of battery electric** buses remains limited so Bus services covering substantial distances cannot be decarbonised with existing battery electric bus systems.
- **Vehicle exchanges to accommodate charging** often required.
- Hence, **more vehicles compared to conventional** operation required
- **Hydrogen fuel-cell electric buses**, that would resonate with such long distances or complex route conditions, **have not reached market maturity.**

## Slow development of zero emission bus manufacturing

- Zero emission bus orders in Europe are doubling year-on-year since 2017 but **European manufacturers have been slow in meeting their announced commitments.**
- **Manufacturing capacity remains insufficient**, resulting in disproportionate with delivery lead-times for vehicles
- **Manufacturers need to grow experience** to achieve more accurate cost estimates and planning security.

## Lack of price development for zero-emission vehicles

- **Prices for battery electric and hydrogen fuel-cell electric buses have been decreasing.**
- **Prices development** at the side of incumbent manufacturers **remaining at a high level**
- **H2 fuel-cell electric buses are approaching current price level of battery electric buses.**



**Issues yet to overcome**

**Part 2: Need for  
structural funding and  
financing opportunities**







## **Insufficient Structural Funding and Financing Opportunities**

- The transition to zero emission in public transport is a structural effort
- Funding and financing mechanisms remain project and case-dependent
- Different PT decarbonisation efforts essentially compete for funding

## **Financial Support Coupled to Asset Ownership**

- Support for zero emission vehicles is mainly geared at the legal owner of the asset
- Many PTAs operate asset-light and delegate the purchase of the vehicle to their operators
- Operators are only able to apply for support once their business is certain (=winning a tender)
- This results in escalating time-lines from tender to service production and financial uncertainty



## **Detrimental Budget Competition**

- Where to spend the available, limited public transport budget?
- On network and service level enlargement to induce modal shift or on decarbonisation of existing services

## **Hidden Additional Workload and Overhead Costs**

- Zero emission bus procurement leads to immense additional workloads and overhead and risk costs for PTAs
- ZE bus operations require negotiations with a significantly increased circle of stakeholders
- Cost for extended legal support and more complex procurement processes are borne by PTAs and hardly considered in support programs

## **Extraordinary budget pressure due to COVID-19 Pandemic**

- public transport ridership and farebox revenue was significantly reduced during the pandemic and is yet to fully recover.
- The resulting losses are incurred by transport authorities and have created extraordinary budgetary pressure.



**Issues yet to overcome**

**Part 3: Recognition of  
the importance of  
strong Transport  
Authorities**



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## Need for Strong Transport Authorities

With alternative fuels and zero emission propulsion in public transport, the very efficient and accustomed processes and risk distributions between PTAs, Operators and OEMs are no longer workable.

More complex procurement structures, uncertainties regarding the capabilities and requirements of new technologies, longer lead-times and an enlarged circle of involved stakeholders require significant institutional innovation.

Given their technical and planning experience and their central role as transport integrators in connection with their local/regional democratic legitimization, **PTAs are essential and well positioned to coordinate the transition towards zero emission transport in Europe's metropolitan areas.**

**Public Transport authorities should be recognised and clearly mandated by European institutions and national laws as the leading authorities for decarbonisation and sustainable mobility**, putting into the practice the Green Deal and Smart and Sustainable Mobility Strategy on the ground.



The full EMTA Discussion Paper is available at: [emta.com](http://emta.com)

## Towards Zero Emission Public Transport

An exploration of the challenge of bus decarbonisation and its pioneering role in terms of climate action and air quality initiatives from the perspective of Europe's metropolitan transport authorities





## Summary of Necessary Actions

- **Support the development of zero emission buses and associated energy infrastructures** that meet the operational requirements of Europe's transport networks
- **Invest in hydrogen as propulsion technology** for buses and heavy goods vehicles, to reach market maturity
- **Ensure the establishment of productive supply chains for green hydrogen and clarify the regulatory and environmental status** of hydrogen produced through local electrolysis and recognize the environmentally damaging use of the current (grey) hydrogen supply.
- **Consider biomethane as a zero-emission propulsion technology for buses** as long as hydrogen fuel cell electric bus systems and green hydrogen supply remains unavailable
- **Create structural funding and financing mechanism** that do consider additional technology, workload- and overhead costs to prevent detrimental budget competition in public transport
- **Manage the essential issue of large-scale battery recycling**
- **Provide transport authorities with a clear mandate and the capacities to manage the complex stakeholder structure of zero emission bus systems**
- **Help transport authorities to find solutions to the current financing crisis of public transport** resulting from the COVID-19 pandemic.



# Muito Obrigado Thank you

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