



# ***FCH JU PDA – outcomes event*** ***- City of Zagreb results & next steps***



**PROJECT DEVELOPMENT  
ASSISTANCE FOR REGIONS**



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**Ivan Ivanković, M.Eng.** 

Head of Energy & Climate  
[ivan.ivankovic@zagreb.hr](mailto:ivan.ivankovic@zagreb.hr)



**City of Zagreb**

**City Office for Economy, Energy &  
Environment Protection  
Sector for Energy & Climate**

# Motivation

- **Air quality issues**
  - Diesel vehicles dominance (68% FEC in transport)
  - Transport sector -> highest emission share (36%)
- **Ever more stringent energy & climate targets**
  - ...which will increase over time („Fit for 55” consequences)
  - ...but also, the largest amount of support for zero-emission activities within the *EU MFF 21-27 & NextGeneration EU (RRF, InvestEU, ...)*
- **Huge changes in the regulatory environment**
  - On all levels (EU, HR & ZG)
    - RED II & CVD implementation in HR in 2021
- **Putting ZET on track for a full fleet renewal**
  - 82 million passengers | 29 million km (2019)
  - 480 buses, average age 11y
    - predominantly EURO III & IV, 76 CNG buses
- **Developing a sustainable fleet renewal plan**
  - Zero emission mandate

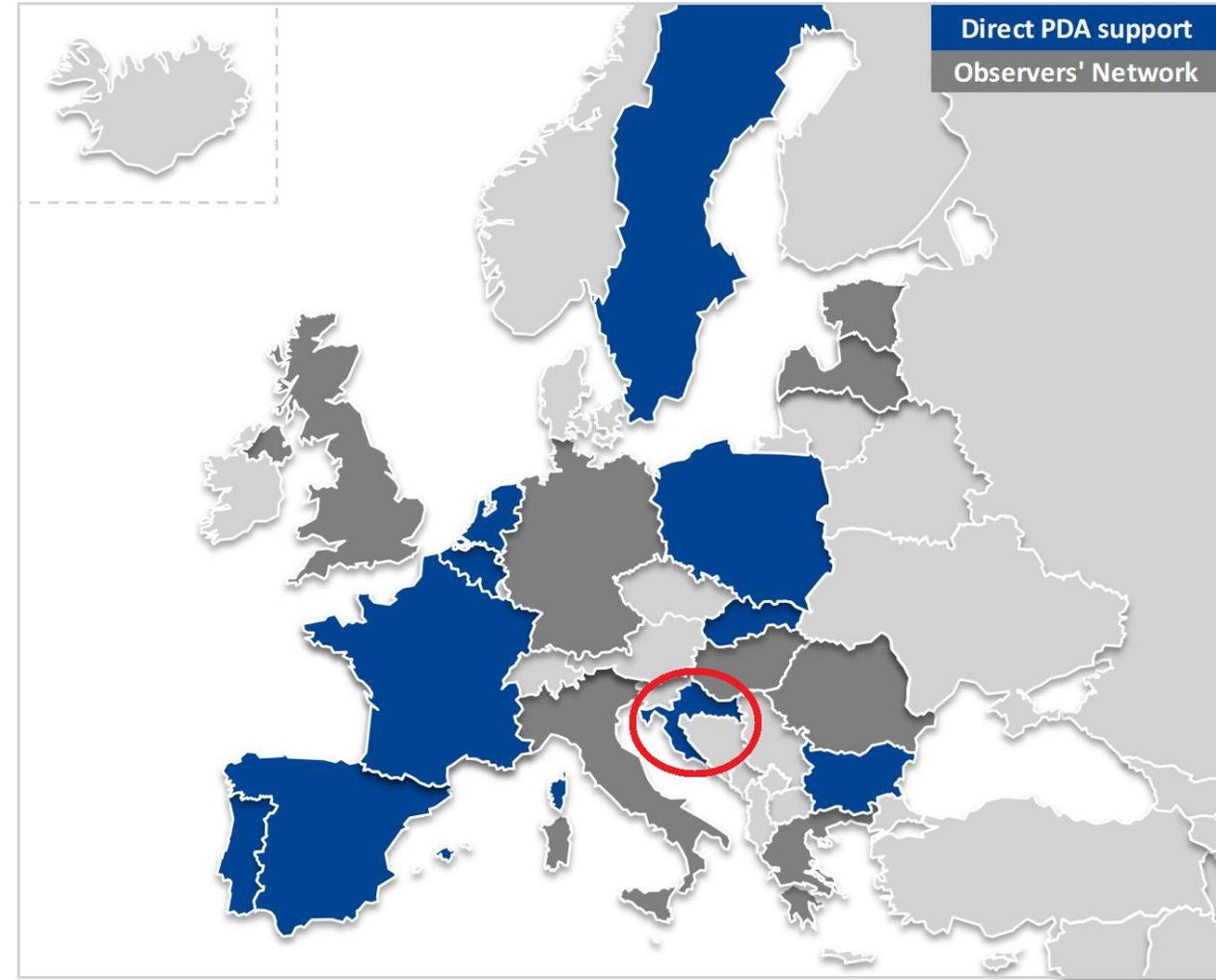


12.7.2019		EN		Official Journal of the European Union		L 188/129	
Table 4: Minimum procurement targets for the share of clean heavy-duty vehicles in the total number of heavy-duty vehicles covered by contracts referred to in Article 3 at Member State level (*)							
Member State	Trucks (vehicle category N <sub>2</sub> and N <sub>3</sub> )		Buses (vehicle category M <sub>3</sub> ) (*)				
	From 2 August 2021 to 31 December 2025	From 1 January 2026 to 31 December 2030	From 2 August 2021 to 31 December 2025	From 1 January 2026 to 31 December 2030			
Croatia	6 %	7 %	27 %	38 %			

(\*) Half of the minimum target for the share of clean buses has to be fulfilled by procuring zero-emission buses as defined in point 5 of Article 4. This requirement is lowered to one quarter of the minimum target for the first reference period if more than 80 % of the buses covered by the aggregate of all contracts referred to in Article 3, awarded during that period in a Member State, are double-decker buses.

# FCH JU PDA project

- June '20 – June '21
- The project included a detailed analysis of the current situation and comprehensive preparation for the introduction of hydrogen buses in public urban transport, together with all the necessary supporting infrastructure (hydrogen filling stations and storage facilities, supporting equipment, hydrogen supply, development of a comprehensive business model, etc.)



# PDA results

- **Review of select outcomes:**
  - Analysis of regulatory barriers for HRS deployment and hydrogen application in transport (coordination with Ministries and various technical agencies)
  - Analysis of ZET bus routes in the context of FCH technology application
  - Whole-value chain RFI development & feedback process
  - Techno-economic modelling and best-practices transfer from other Member states
  - Detailed implementation plan with a TCO focus

**Deployment of fuel cell buses and supporting infrastructure in the City of Zagreb**

*A paper to set out the business case for the project to create 600kg/day of hydrogen demand from the deployment of hydrogen fuel cell buses in the City of Zagreb, alongside the supporting hydrogen production, distribution, and refuelling infrastructure.*






Fuel cell buses	
Number of FC buses deployed	-
Average annual distance per FC bus	km/year
Average fuel consumption per FC bus	kgH <sub>2</sub> /km
Lower bound hydrogen price	€/kgH <sub>2</sub>
Upper bound hydrogen price	€/kgH <sub>2</sub>
Average FC bus availability	-
FC bus capital cost (per vehicle)	€
FC bus lifetime	Years
Other offset costs	€/km
FC bus maintenance cost per vehicle	€/km
FC bus maintenance cost per vehicle	€/yr
Cost of depot upgrade	€

Diesel buses	
Equivalent bus capital cost (per vehicle)	€
Equivalent bus maintenance cost (per km)	€/km
Equivalent bus maintenance cost (per vehicle)	€/yr
Equivalent diesel bus fuel consumption	litres/100km
Equivalent diesel bus fuel consumption	mpg
Diesel cost (ex. VAT)	€/litre
Fuel cost per bus (ex. VAT)	€/yr
Expected contribution from bus operator over project life (per bus)	€

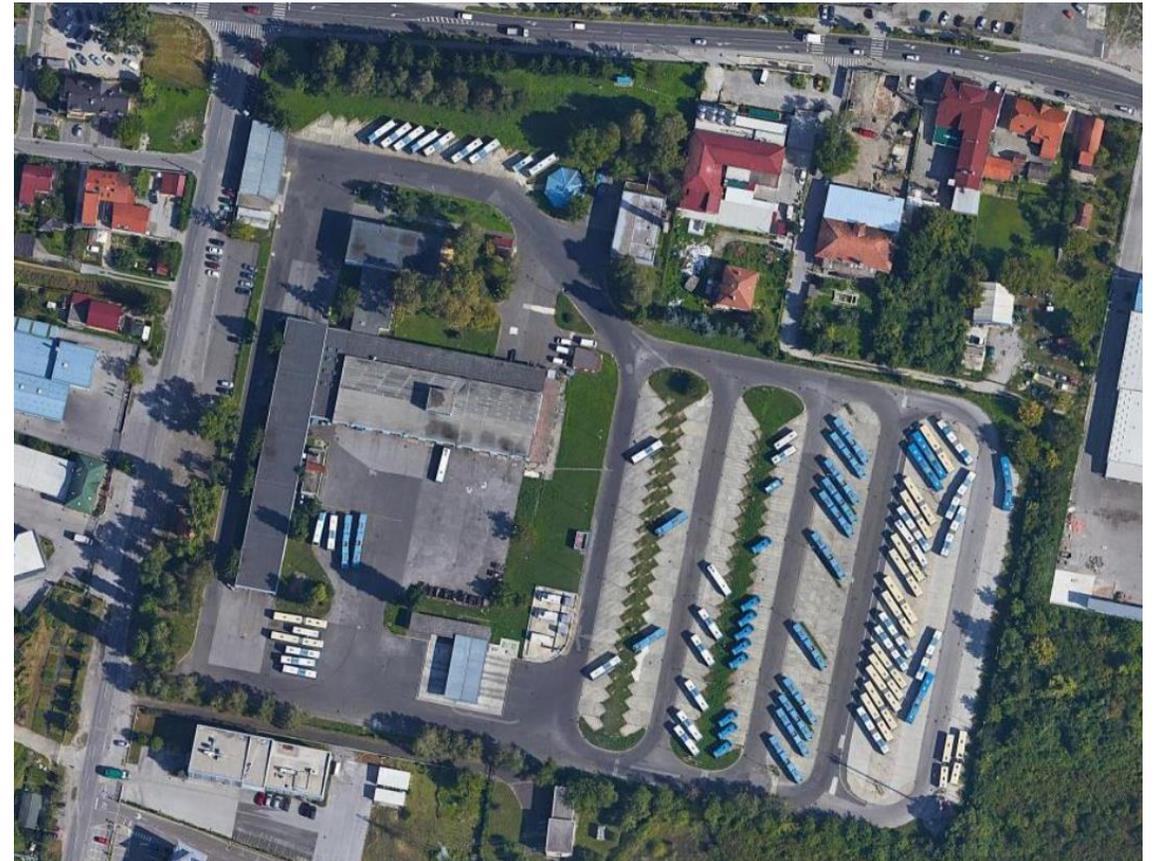
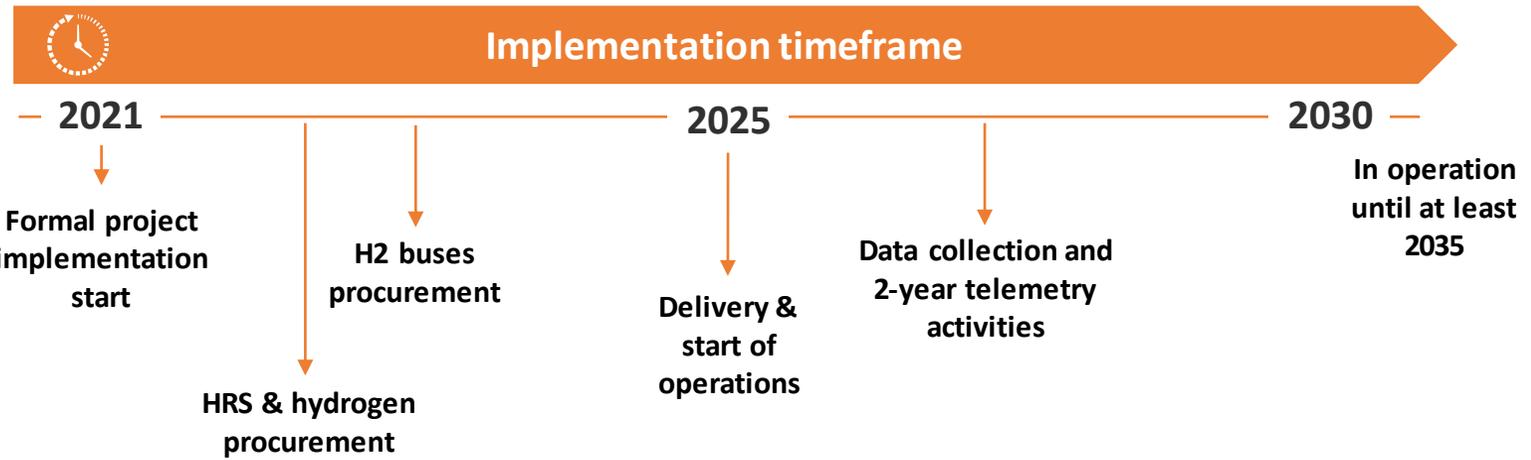
Funding contributions	
<i>Funding contributions per FC bus (over the whole project)</i>	
International (EU) funding - per bus	€
National funding - per bus	€
Local funding - per bus	€
<i>Funding contributions per HRS (over the whole project)</i>	
International (EU) funding	€
National funding	€
Local funding	€

## Select key results:

- **CAPEX: €16m – €23m**
  - min. 20 articulated or ~32 solo buses
  - HRS + bus depot adaptation
- **OPEX: €17m - €30m**
  - Hydrogen (initially 600kg/day) + 10y maintenance
- **Green hydrogen price a key variable**
  - ...and also the biggest current unknown
- **„At the end of the beginning” -> implementation is the next step**
- **Zagreb & ZET as lighthouses for other (large) cities in Croatia**

# Next steps

- **Successful project implementation requires:**
  - Formal start of the project implementation within the city structures (mayor, assembly) and strong political consensus
  - Securement of (co)financing via the RRF and continuation of excellent cooperation with the relevant Ministries (Energy & Transport)
  - Q2/Q3 '22 – start of first public procurements (bus depot preparation activities)
  - Keeping a watchful eye on EU/HR legislation process („Fit for 55”, RED III, ETS in transport, H2 certification, ...)
- **This project represents a small (but meaningful) part in the overall, much larger story regarding transport decarbonization of ZET & Zagreb**



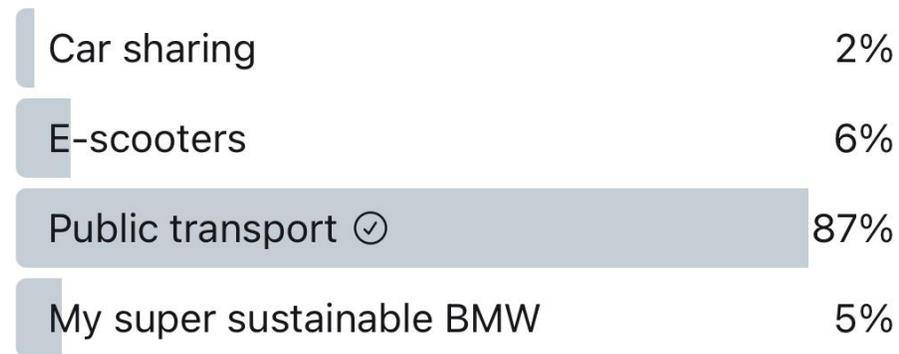


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# Thank you!



**Ivan Ivanković, M.Eng.** 

ZG PDA project lead

[ivan.ivankovic@zagreb.hr](mailto:ivan.ivankovic@zagreb.hr)



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