

D4.17 JIVE 2 – Report on supply and demand for alternative FCBs in Europe – focus on articulated buses and coaches – Executive Summary



ERM



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| Steps | Status |
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| Work Package Leader | Approved |
| Coordinator | Approved |
| Clean Hydrogen Partnership | Pending |



JIVEs / MEHRLIN projects



Co-funded by the European Union

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Disclaimer 2:

This report is an Executive Summary of the JIVE 2 report D4.15 – Report on supply and demand for alternative fuel cell buses in Europe – focus on articulated buses and coaches. Some information presented in this document were updated compared to the report with the latest news from the sector and those communicated by the project’s cluster coordinators (update Q2 2025).



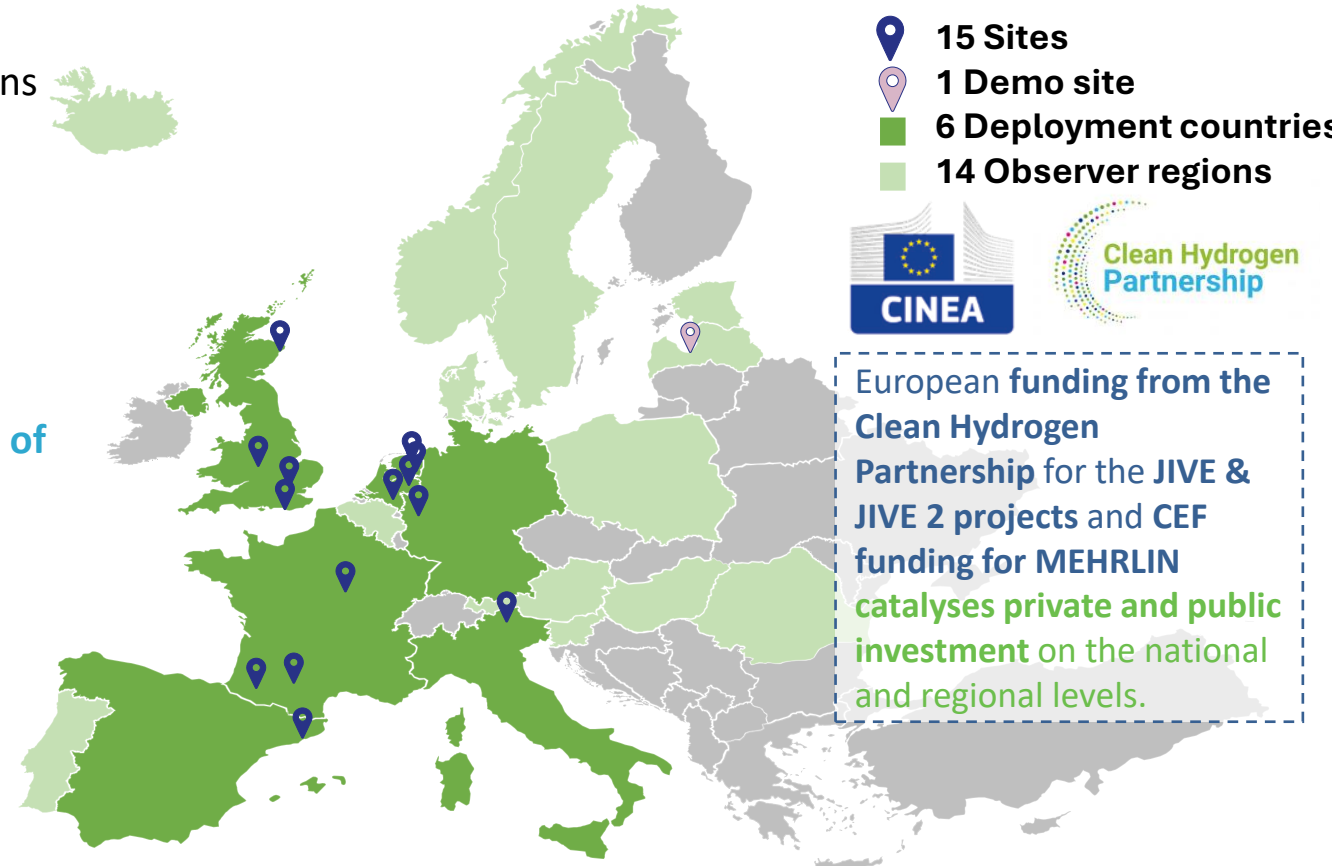
| Introduction |
|--|
| The articulated fuel cell bus market |
| The coach fuel cell bus market – focus on France |
| Challenges and enabling factors |
| Conclusion |

The JIVE, JIVE 2 and MEHRLIN projects are the flagship fuel cell bus projects in Europe deploying 290 buses and 17 HRs by mid-2025



Objectives:

- **Deploy 290 buses** across 16 European cities and regions in **7 countries** – the **largest deployment attempted to date**
- Validate large scale fleets in operation
- Stimulate the FCB market
- **Achieve a maximum price of €650k (JIVE) and €625k (JIVE 2)** for a standard fuel cell bus
- Trial joint procurement methods to **access economies of scale**
- **Deploy 17 Hydrogen Refuelling Stations (HRs)**
- **Enable new cities and regions to trial hydrogen technologies**
- Demonstrate routes to **low cost renewable H₂**
- Analyse the **technical and economic performance of HRs** under real conditions



Timeline of the 3 projects (JIVE/JIVE2/MEHRLIN)



In this study, seven 'clusters' were studied. Some of the countries are directly deploying buses through the JIVE initiatives, while others have strong connections with the projects



Cluster coordinators



UK and Ireland Cluster
Deployment countries involved: The UK

Germany / South Tyrol / Austria Cluster
Deployment countries/regions involved: Germany, South Tyrol

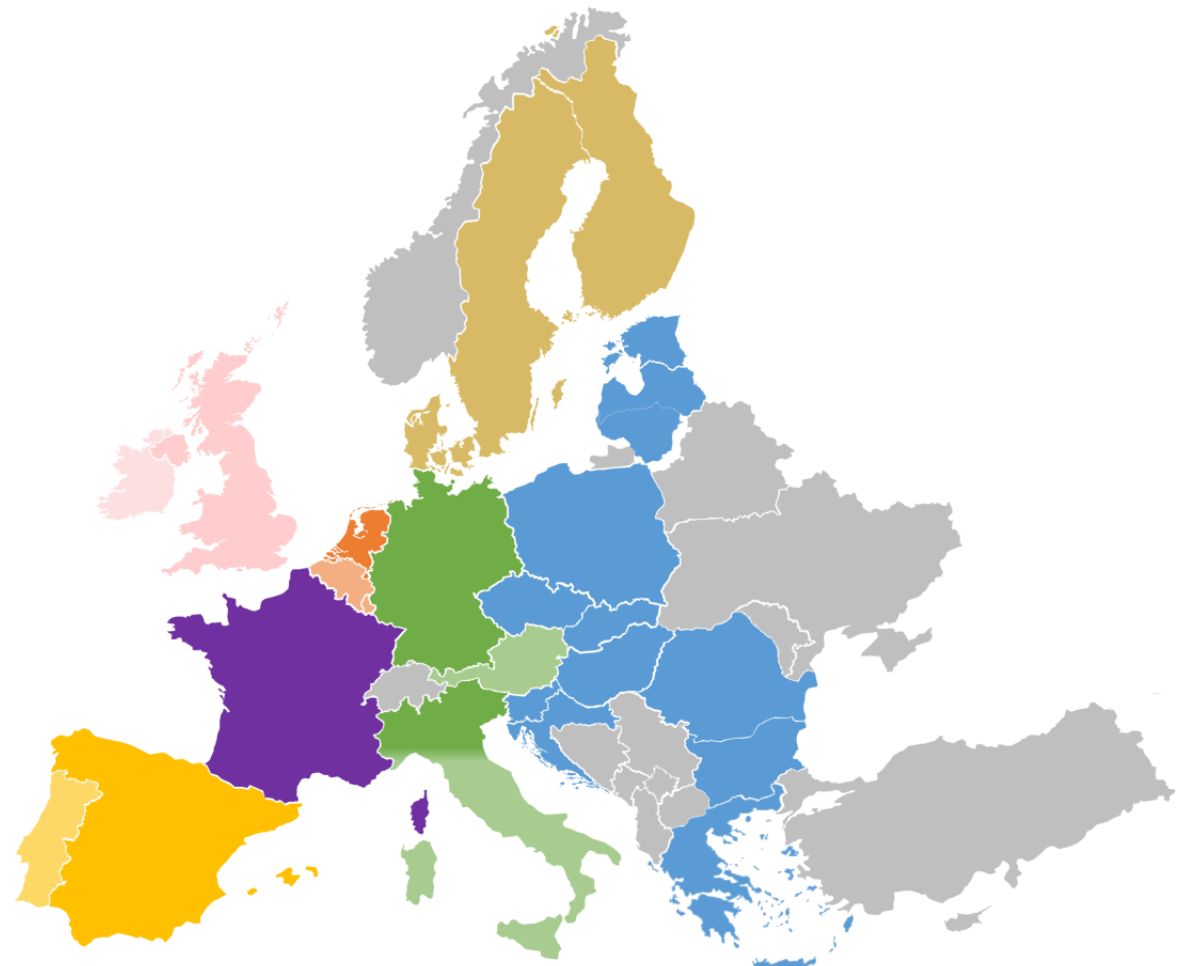
Benelux Cluster
Deployment countries involved: The Netherlands

Eastern Europe Cluster
Involvement in the FCB Roadshow initiatives

Iberian Cluster
Deployment countries involved: Spain

Nordic Cluster
Involvement in the FCB Roadshow initiatives (Sweden, Finland)

France Cluster
Deployment countries involved: France



Map of the EU clusters included in the report (non-EU Member States have been greyed out, except the UK which participated in the JIVE projects – lighter coloured countries in each cluster are those not directly addressed in the report. For Eastern Europe, the analysis was done on a regional basis rather than a country-by-country basis)

This study focuses on fuel cell articulated buses and coaches and aims at better understanding the possible market development for these models



Articulated buses

Characteristics:

- Extended length: >18-meter
- High capacity: +/- 150 passengers

Typical uses:

- Interurban & city routes
- Rapid transit routes
- Densely populated areas



Coaches

Characteristics:

- Types: Normal Floor and Low Entry coach
- Capacity: +/- 50 seated passengers

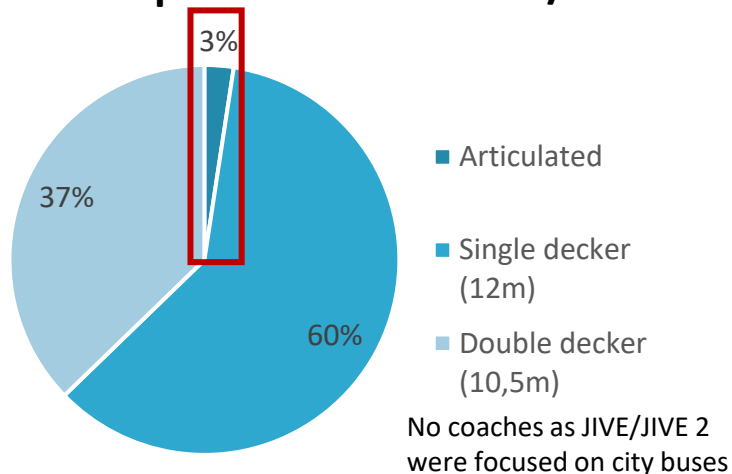
Typical uses:

- Regional & interurban routes
- Tourism & freely organised service transport
- School transport



The following factors contributed to an increased interest in these models:

Low representation in JIVE/JIVE 2



Evolving regulatory landscape(s)

- Clean Vehicle Directive
- Low and Zero-Emission Zones
- Regulation on CO2 emission standards for heavy-duty vehicles
- National specificities

Specific segments which could benefit from fuel cell models' characteristics, notably:

- Quick refuelling times compared to BEB
- High range and higher autonomy
- Higher capacity / less reduced space due to batteries

| |
|--|
| Introduction |
| The articulated fuel cell bus market |
| The coach fuel cell bus market – focus on France |
| Challenges and enabling factors |
| Conclusion |



Articulated fuel cell buses have been commercialised since 2019 in Europe and an increasing number of OEMs is integrating these models in their offer




Commercialised models




 Van Hool*
Exqui.City 18 fuel cell
2019

 Mercedes-Benz
eCitaro G Fuel Cell
2023
(range extender)

 Solaris
Urbino 18 hydrogen
2023

OEMs having announced the development of new FC articulated buses models for future commercialisation:



*VanHool officially filed for bankruptcy in April 2024. VDL has since announced the acquisition of the company. This acquisition has significantly altered the model portfolio, as none of the previous urban bus models are now available or listed on the company website.

**SAFRA entered in receivership in February 2025 raising concerns around the development of its models.

Articulated fuel cell buses are already in operation in the following European clusters and new orders are being placed in several countries



France Cluster

Market context

~**27,000** – bus fleet size (excl. coaches)
 ~**22%** of articulated buses
58 fuel cell buses as of 2024 (~**0.3%** of the total fleet)

Fuel cell articulated buses

- In operation:
 - Pau: **8** Fébus (Van Hool Exqui.City 18 FC) since 2019
- Coming soon: orders have been placed for Le Mans, Metz, Saint-Brieuc, Belfort, etc. with fleets around 8 to 18
- All three major public transport operators in France have fuel cell bus deployment projects/plans.

Sources: [ACEA \(February 2024\) Vehicles on European Roads](#), [UTP \(Union des Transports Publics et ferroviaires\) \(October 2022\)](#), [Le Parc des Véhicules des Services Urbains au 1^{er} janvier 2022 \(Urban Services Vehicle Fleet at January 1, 2022\)](#); [La mobilité – France Hydrogène - France Hydrogène](#)



Germany/South Tyrol/Austria Cluster

Market context (Germany)

~**34,000** – bus fleet size (excl. coaches)
 ~**25%** of articulated buses
 ~**470** fuel cell buses as of 2024 (<**1.5%** of the total fleet)

Fuel cell articulated buses

- In operation/coming soon:
 - **Germany**: announcements of articulated FCBs being deployed/ordered: Mannheim (25), Rebus Rostock (5), Wuppertal (13), Cologne (18), Bremerhaven (3).
 - As of March 2025, 86 articulated fuel cell buses were in operation and 222 are expected to be operating by the end of 2025.

Sources: [Verband Deutscher Verkehrsunternehmen \(VDV\). \(2022\) Statistik Sustainable Bus \(24 November 2023\)](#); [Urban Transport Magazine \(22 April 2023\)](#); [Urban Transport Magazine \(05 March 2025\)](#); [Solaris \(11 September 2024\)](#); [Diersch & Schröder. Green hydrogen for Bremerhaven](#), German fuel cell bus cluster survey (on behalf of NOW)



Iberian Cluster

Market context

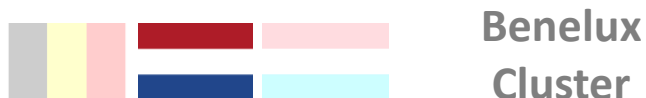
>**12,000** – bus fleet size (excl. coaches)
 ~**11%** of articulated buses
20 fuel cell buses as of beginning 2025 deployed in **Barcelona** and **Madrid**

Fuel cell articulated buses

- In operation:
 - Barcelona (TMB): **2** articulated fuel cell buses from Solaris since Nov. 2024.
- Coming soon: TMB's decarbonisation plan includes increasing the number of fuel cell buses in its fleet (62 by 2026).

Sources: [Ministry of Transport and Sustainable Mobility \(Spain\). \(2022\) Number of vehicles by metropolitan areas, type of bus and environment](#), [ACEA \(February 2024\) Vehicles on European Roads](#)

The hydrogen market has developed in the UK and Benelux clusters; however, there is little to no perspective for development of FC articulated buses



Benelux
Cluster

Market context

5,200 – bus fleet size (excl. coaches)
~**17%** of articulated buses
59 fuel cell buses all deployed in the JIVE and JIVE 2 project in the Netherlands (~1%)

Fuel cell articulated buses

- No orders have yet been announced. Battery electric models are currently being deployed
- According to the interviewed PTOs, the choice of technology is based on operational schedules and deployment routes: BE articulated buses currently suffice for urban usage where higher passenger capacity needed

Future perspective of the FC market

- Grid capacity is becoming a growing issue. Fuel cell buses could help alleviate the strain on the grid if the hydrogen is produced during low electricity consumption periods and the hydrogen ecosystem is sufficiently well developed



United Kingdom and
Ireland Cluster

Market context

36,500 – bus fleet size (Great Britain, excl. coaches - 2022)
Articulated buses: very little (airports)
>**100** fuel cell buses (<0.3% of the bus fleet)

Fuel cell articulated buses focus

- Prior to 2009, “bendy” buses were used in London. From 2009 the transition to double deck buses took place
- Today, double deck buses represent the standard bus model for public transportation
- These models have fuel cell options deployed – **1st FC bus** was deployed by Wrightbus in the framework of the JIVE project

Offer for fuel cell double deck buses

- Wrightbus - Streetdeck Hydroliner FCEV
- Alexander Dennis (ADL) - Enviro400FCEV

The Scandinavian and Central and Eastern Europe clusters currently have little to no hydrogen mobility developed. However, the interest is growing, and the perception of hydrogen mobility could change, bringing in new opportunities



Nordic Cluster

Market context – Results from project survey

- **10,000** buses – total bus fleet surveyed
- ~**25%** of the articulated buses across the fleet surveyed
- Fuel cell buses: Currently very little deployment rate across the four countries
 - There are various reasons: historical explanations, slow infrastructure development, high domination of natural gas/biofuel and battery-electric buses

Future perspective of the FC market

- Currently driven by battery electric buses, as well as natural gas
- Hydrogen is not excluded as tests and small deployments are planned (e.g. Sweden – 2024)
- The 4th JIVE 2 Roadshow was successful in raising awareness around the technology through hands-on demonstrations

Sources: Survey carried out by Vatgas Sverige



Eastern Europe Cluster

Market context

- High disparity across the countries (e.g., Poland more advanced with tests and orders already passed)
- Articulated buses are largely deployed in only a few specific areas (e.g., Warsaw - 62% of buses deployed are articulated)

Future perspectives of the FC market: overall growing commitment towards hydrogen mobility

- Lithuania: Government is committed to supporting the acquisition of hydrogen buses in Vilnius.
- Slovakia: The chairman of the Trnava self-governing region and the State Secretary of the Ministry of Economy of the Slovak Republic expressed their support for hydrogen public transport.
- Poland: **132 FCBs** are expected to be acquired by 2025.

Sources: [Municipal Transport Authority in Warsaw - 2023 Report](#); JIVE/JIVE 2 Roadshow deliverables #1 and #2

| |
|---|
| Introduction |
| The articulated fuel cell bus market |
| The coach fuel cell bus market – focus on France |
| Challenges and enabling factors |
| Conclusion |

Fuel cell coach offers are emerging in Europe. Homologation processes have already started in 2023 for retrofitted models and some were successfully completed. New models are expected in the upcoming years.



 **NOMAD CAR H2**
IVECO Crossway
2023-2024 



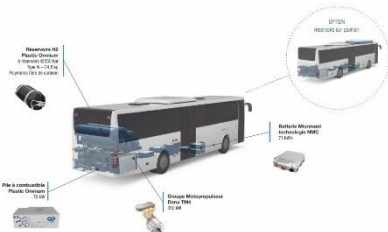
GCK
IVECO Crossway* 
2023-2024 



  **CaetanoBus & TEMSA**
2024-2025** 





 **Otokar**
Territo H2
2025 



Safra
Mercedes Intouro 
2023-2024 



 **Irizar**
i6S Efficient
2024-2025 


WRIGHT 
Wrightbus
2026 

An extensive study tackling zero-emission coaches was published in October 2023 by France Hydrogène and AVERE-France, written by ERM (« [La transition de l'autocar vers des technologies zéro émission : quels besoins et perspectives](#) »). All information on the French cluster have been taken from this report.

*3 Crossway retrofitted models exist: IVECO Crossway NF 150, IVECO Crossway NF 80, IVECO Crossway LE 75
** Little updates on progress have been given by the two companies in 2024 and 2025. During the Clean Bus Europe conference in June 2024, Caetano mentioned focusing on a battery electric coach.

The coach market represents a major share of the total bus market for certain countries. They are and expected to be further impacted by regulations and policies aiming at reducing transport related emissions



In some countries, coaches represent a large proportion of the total bus fleet:

France: Total bus fleet (all models) of 94,000 vehicles - includes a total coach market: **66,000**, i.e. 70% (2022)

The Netherlands: Total bus fleet (all models) of 10,000 vehicles - includes a total coach market: **~4,700**, i.e. 47% (2019)

Use cases for coaches include

Regular interurban and intercity routes

Tourism

Private intercity and long distance

School transportation

Regulatory framework is less defined for the transition of coaches to zero-emission; however, some regulations and policies may have a greater influence in the upcoming years

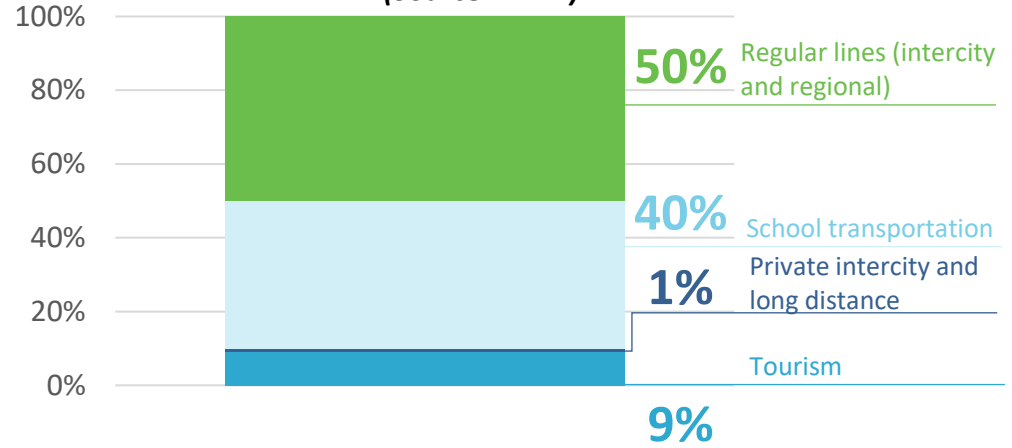
- **Clean Vehicle Directive**: Coaches are, as of now, not included in the Directive and targets. Some countries have included coaches in their national transcriptions (e.g., France).
- **Regulation on CO2 emission standards for heavy duty vehicles manufacturers**: The revised Directive includes buses and coaches.
- **Low and Zero Emission Zones**: These zones, in place in a lot of European cities, restrict access to certain urban areas for polluting vehicles. Coaches are not always concerned, but level of restriction could evolve in the next years.

In France specifically, the decarbonisation of coaches is less advanced than urban buses with still 98% powered by diesel

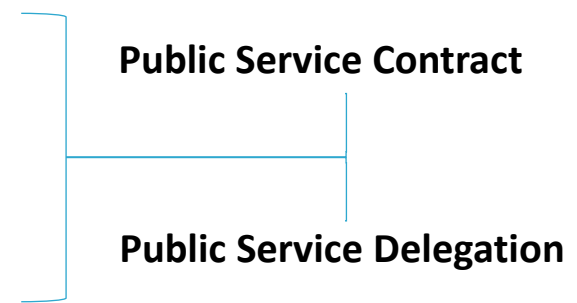


Breakdown of the French coach fleet by uses

(Source: FNTV)



For public transport coaches, **Regions** organise the coach transport and contract with a private service provider through public tenders. The carriers own the vehicles.



Market context

- Coaches: **2%** non-diesel of which 0.1% BE (<200) and 0% FC as of Jan. 2022 – vs Buses: 5% BE as of 2022.
- Fuel cell models would be the most favorable technology for ~**20%** of the fleet deployed in France based on kilometers driven
- Test projects are ongoing in Normandy Region, AURA Regio and Occitanie Region

Commitment towards zero emission solutions is not equally strong in the country

- 60% of the Regions give great importance to electrification
- 40% do not have a clear vision of their zero emission technology mix in the next years (2025 – 2030)
- Transition targets are conditional on costs

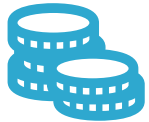
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|--|
| Introduction |
| The articulated fuel cell bus market |
| The coach fuel cell bus market – focus on France |
| Challenges and enabling factors |
| Conclusion |

The main challenges identified in the deployment of articulated buses and coaches are similar to those of the rest of the hydrogen mobility sector. Several levers can be activated to enable more favourable development



Main challenges to the deployment of FC articulated buses and coaches

Costs (CAPEX and OPEX) and Financial Support



Given the technology neutral stance most PTOs/PTAs have, costs are a major factor in the decision-making process. Despite a decrease in the prices of vehicles deployed in JIVE/JIVE 2 projects compared to past years, CAPEX is still significant. Financial support is still required in the majority of cases for the initial purchase (CAPEX), as well as to support high maintenance and operational costs (e.g. price of H₂).

Hydrogen Refuelling Infrastructure (HRS)



The main obstacles identified include an insufficient number of stations in the network, lack of space in depots, insufficient availability and reliability of the stations and of the hydrogen supply chain. Improving these aspects is key to ensure a smoother experience and foster the deployment of more FC buses.

OEMs' offer on the market



The limited offer of models from OEMs also hinders the adoption of FCB. It is worth noticing that OEMs are impacted by the lack of a comprehensive overview of the political landscape regarding FCB, including the available financial support, which contributes to the factors slowing down the increase of their portfolio.

Knowledge and understanding of the technology, including safety



The deployment of FC buses is still in some cases slowed down by the wariness on the vehicles' safety. In this framework, projects such as JIVE and JIVE 2 play a major role in reassuring stakeholders and improving awareness of the technology. Knowledge and lessons learned sharing is a main objective of the projects and was achieved with several reports such as the [Best Practice Report](#).

| |
|--|
| Introduction |
| The articulated fuel cell bus market |
| The coach fuel cell bus market – focus on France |
| Challenges and enabling factors |
| Conclusion |

Both segments have seen developments in recent years but remain small. However, new deployments may occur as regulatory frameworks strengthen, more buses are deployed and share feedback on experience, and as new countries integrate FC buses in their fleets



Fuel cell articulated buses and coaches are at different levels of maturity; however:
Offers are under development and already commercialised by OEMs in both cases

- Articulated buses: Articulated fuel cell bus models have been commercialised since 2019. Additionally, more OEMs have announced the development of models to be commercialised in the upcoming years
- Coaches: Retrofit and new models are currently being developed and homologated

Operators are already buying and operating both models

- Articulated buses: Buses are already in operation in Pau (FR), Barcelona (ES) and in German cities. Orders for more buses have also been placed in Germany, Italy, France and Spain. Many operators started with the deployment of standard FCBs but in countries such as Germany the focus is gradually turning towards articulated buses which have always played a major role in their fleets.
- Coaches: Fuel cell coaches are being procured in the framework of several projects (including Hydrogen Valleys) and are expected to start operations in the upcoming years

1

The **level of development of the market** greatly differs from one cluster/country to another and the **political framework** (including financial support schemes) for the development of zero-emission buses and coaches continues to play a major role

2

The **challenges** encountered are similar across the whole hydrogen mobility sector, independently from the vehicle model. **Sharing lessons learned** remains critical for the sector to progress and for the technology to continue supporting the decarbonisation of public transportation.

3

The decarbonisation of public transport will require the implementation of **several zero-emission technologies**, including hydrogen.



- [JIVE Final Best Practice Report and Commercialisation Report \(D3.26\) / JIVE 2 Final Best Practice Information Bank Report \(D3.29\)](#), June 2024, Sphera and PLANET.
- [The potential for hydrogen buses in Europe: Results from the bulk analysis of passenger schedules](#), July 2024, ERM
- [Fuel cell bus deployment in the UK – lessons from JIVE and next steps](#), June 2024, ERM
- [Fuel cell bus rollout in Sweden – Developing pathways to post-JIVE deployment in Scandinavia](#), November 2024, Vätgas Sverige
- Project website: [Fuel Cell Electric Buses | Knowledge base](#)

Thank you for your attention

Project coordination:



Project dissemination:



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