

Interreg



Co-funded by
the European Union

Alpine Space

Strasbourg.eu
eurometropole

H2MA

Deliverable D.1.2.2

Lessons Learnt Report

**On planning specifications and requirements for setting
up green H2 urban infrastructure**

Activity 1.2

October, 2023



Project reference

Project title	Green Hydrogen Mobility for Alpine Region Transportation
Acronym	H2MA
Programme priority	Carbon neutral and resource sensitive Alpine region
Specific objective	SO 2.1: Promoting energy efficiency and reducing greenhouse gas emissions
Duration	01.11.2022 – 31.10.2025
Project website	https://www.alpine-space.eu/project/h2ma/
Lead partner	KSSENA

Short description

H2MA brings together 11 partners from all 5 Interreg Alpine Space EU countries (SI, IT, DE, FR, AT), to coordinate and accelerate the transnational roll-out of green hydrogen (H2) infrastructure for transport and mobility in the Alpine region. Through the joint development of cooperation mechanisms, strategies, tools, and resources, H2MA will increase the capacities of territorial public authorities and stakeholders to overcome existing barriers and collaboratively plan and pilot test transalpine zero-emission H2 routes.

Document details

Full document's title	Lessons learnt report on planning specifications and requirements for setting up green H2 urban infrastructure
Version	V1
Author/s	Charitini Karakostaki, Sincnify
Organization/s responsible	Eurométropole de Strasbourg
Delivery period	2, 6-12

IMPRINT

This document is issued by the consortium formed for the implementation of the **H2MA** project, and made by the following partners:

- PP1 (LP) Energy Agency of Savinjska, Saleska and Koroska Region (SI)
- PP2 BSC, Business Support Centre, Ltd, Kranj (SI)
- PP3 EUROMETROPOLE DE STRASBOURG (FR)
- PP4 Lombardy Foundation for the Environment (IT)
- PP5 Cluster Pole Vehicule du Futur (FR)
- PP6 Turin Metropolitan City (IT)
- PP7 Climate Partner Upper Rhine Valley (DE)
- PP8 4ward Energy Research Ltd (AT)
- PP9 Lombardy Region (IT)
- PP10 Codognotto Austria (AT)
- PP11 Italian German Chamber of Commerce Munich-Stuttgart (DE)

Responsible Partner/s for the compilation of this document

- PP3 EUROMETROPOLE DE STRASBOURG (FR)

SUMMARY

This report presents the lessons learnt of the Study visit and workshop on “Planning specifications and requirements for setting up green H2 urban infrastructure” which was held in Strasbourg, France, in the context of Activity A1.2 of the H2MA project, funded under the Interreg Alpine Space program.

During the study visit and workshop, partners’ and stakeholders’ representatives exchanged knowledge and experience on HRS design, good practices, and safety specifications, discussed issues hindering the development of green H2 infrastructure. Lessons learnt include valuable insights including the absence of harmonized frameworks, long homologation procedures and highlighted the need to develop common European standards and certification systems.

Section 1 of this report provides an overview of Activity 1.2 of the H2MA project, the study visit’s objectives and the workshop’s speakers and participants.

Section 2 key issues discussed on the 1st day of the workshop, that took place at the premises of PH8, a local incubator.

Section 3 introduces the 2nd day of the workshop

Sections 4 presents the development of an H2-corridor in the Grand Est Region

Section 5 recaps the feedback from the deployment of the first hydrogen buses in France

Section 6 summarises key points from the roundtable discussion between local authorities representatives from Auxerre and Belfort after having integrated hydrogen buses into their local fleets

Section 7 delves into the Strasbourg’s renewable hydrogen ecosystem

Section 8 presents the Nomad Car Hydrogen, a technological innovation by Transdev in Normandy

Section 9 recaps the main discussion points from the guided tour in the R-Hynoca station and the R-Hyfie risk management platform.

Section 10 delves into the lessons learnt from both the workshop and the study visit regarding specifications and requirements to be considered when planning H2 infrastructure to ensure the successful design and operation of the HRS and provides policy recommendations to be used by the H2MA consortium in the upcoming activities.

An Annex includes the workshop’s final agenda and the list of participants.

TABLE OF CONTENTS

Summary	3
1. Introduction	6
1.1 H2MA Activity 1.2 – Addressing planning requirements for green hydrogen infrastructure.....	6
1.2 Two-day workshop in Strasbourg and site visit at R-Hynoca station	6
2. The first day of the workshop	8
2.1 Getting acquainted with the organising partners: Eurometropole of Strasbourg and Pôle du Vehicule du Futur	8
2.1.1 City and Eurometropole of Strasbourg.....	8
2.1.2 Pôle du Vehicule du Future	10
2.2 The Hydrogen Sector in the Grand Est Region.....	11
2.2.1 French National Hydrogen Strategy	11
2.2.2 Regional Hydrogen Strategy for Grand Est.....	12
2.2.3 The DYNAMHySE Consortium	14
3. Opening the second day of the workshop	15
3.1 President Pia Imbs' Welcome Address.....	15
3.2 PVF President's Welcome Address	16
3.3 Presentation of the H2MA project	16
4. Developing an H2 corridor in the Grand Est Region	18
4.1 Regional commitment to hydrogen and development of a regional Hydrogen Strategy	18
4.2 Hydrogen Corridor Study	18
5. Feedback from the first deployments of hydrogen-powered electric buses in France.	21
6. Exchange of experience between Auxerre and Belfort	25
7. Strasbourg's renewable hydrogen ecosystem	27
8. Nomad car Hydrogen	29
9. Site visit in R-Hynoca station and R-Hyfie platform	32
9.1 R-Hynoca station	32
9.2 R-Hyfie platform.....	33
9.3 Guided tour and discussions during the H2MA partnership's site-visit	34
10. Lessons learnt and policy recommendations	36
10.1 Lessons Learnt.....	36
10.2 Policy recommendations	37
Annex 1 – Study visit agenda	39
Annex 2 – Participants' list	41

Annex 3 – Photos from the 2-day study visit in Strasbourg..... 43

1. INTRODUCTION

1.1 H2MA Activity 1.2 – Addressing planning requirements for green hydrogen infrastructure

Activity 1.2 within the H2MA project was designed to address the issue of planning requirements and specifications when developing green hydrogen infrastructure. To this end, it included two study visits in Hydrogen Refuelling Stations (HRS), one in Bavaria, Germany, organised by ITALCAM on 17-18 April 2023 and another one in Strasbourg, France organized by EMS with the support of PVF on 19 and 20 September 2023. These study visits aimed to provide hands-on knowledge on planning requirements for HRS, focusing on heavy duty trucks and trains during the study visit in Augsburg and urban buses during the study visit in Strasbourg.

This document summarises the main discussions, results and lessons learnt of the second study visit in Strasbourg. The overall objective of this report is to provide key insights that can contribute to the enhancement of national and regional hydrogen strategies, as part of WP1 Activity A1.6.

1.2 Two-day workshop in Strasbourg and site visit at R-Hynoca station

The study visit in Strasbourg concluded H2MA Activity 1.2, the first part of which was held in Augsburg in April. EMS, supported by PVF, assumed the role of the organizing host, and presided over the event. The program encompassed a two-day workshop and a site visit at R-Hynoca station, a multi-station under construction soon to be operational.

The workshop sessions on the first day were conducted at PH8, an incubator for local start-ups. The 2nd day's workshop took place at the municipal council hall within the Administrative Center of Strasbourg Eurometropole. The workshop saw active participation from representatives of all project partners contributing with their own experiences and expertise. Additionally, key stakeholders including the Industrial Association of Chivassesse, Thermal Power Plant Šoštanj, Messe Stuttgart, PUNCH Group, CTS, and e-mobil BW GmbH were also in attendance. A comprehensive list of all 45 participants can be found in the Annex at the end of this document.

During the opening session on the first day, Jean Melounou, Head of Mission for Innovative Mobility at EMS, extended a warm welcome to participants and commenced the two-day study visit with a presentation on the Eurometropolis. Subsequently, Auriane Agard delivered a presentation on PVF and its pivotal role. Then, a representative from the DYNAMHySE consortium, Caroline Rey, Head of Environmental and Energy Transitions at Grand E-Nov+ Regional Innovation and International Prospecting Agency, offered insights

into the hydrogen sector in the Grand-Est Region, including national and regional strategies, and an overview of the Dynamhyse consortium. Following a coffee break, an internal project meeting was convened, chaired by Matevz Silc from KSENA, who presented the project's results and main achievements up to that point. In the evening, H2MA project partners enjoyed a boat tour along the Ill River channels.

Activities on the second day convened at the Hall of the Municipal Council, within the Administrative Center of Strasbourg Eurometropolis. Jean Melounou from EMS chaired the thematic session. Pia Imbs, President of the Eurometropole of Strasbourg, and Bruno Grandjean from PVF greeted H2MA partners and stakeholders, offering their support to H2MA objectives. Jean Melounou introduced the day's agenda and then passed the floor to Matevž Šilc, who greeted the audience and briefly outlined H2MA's objectives and goals.

The day's first presentation was delivered by Sabine Goetz from the Grand Est Region, who detailed the Grand Est H2 corridor approach. Jan-Erik Starlander from France Hydrogène provided insights into the initial experiences with deploying hydrogen-powered electric buses in France. After a short break, Emmanuel Jobard from the Community of Auxerrois and Marc Rovigo shared their experiences launching H2 buses in their respective cities during a roundtable discussion facilitated by Charitini Karakostaki, an external expert from Syncnify. Following the roundtable, Philippe Follet from Hynamics discussed the creation of a territorial hydrogen ecosystem at the Ports of Strasbourg. Lastly, via teleconference, Amandine Allard from Transdev presented the Nomad Car Hydrogen, focusing on the retrofitting of a diesel-powered coach.

Following lunch in the city hall foyer, participants and stakeholders embarked on a bus journey to visit the R-Hynoca station premises and the R-Hyfie risk education platform. Participants were divided into two groups, each visiting both sites. Constructors, operators, and managers warmly received the H2MA group, providing valuable, in-depth information about planning requirements and technical specifications, with a special emphasis on safety. Engaging discussions ensued, with participants asking pertinent questions and receiving insightful answers. The study visit concluded with a brief closing message from Jean Melounou from EMS and a closing statement from Boštjan Krajnc from Lead Partner KSENA, who expressed gratitude to EMS and Jean Melounou for the excellent organization of the study visit.

In the evening, H2MA partners gathered for a dinner in the city center near the Cathedral. The dinner provided a conducive environment for further networking, idea exchange, and discussions on hydrogen and interregional cooperation.

2. THE FIRST DAY OF THE WORKSHOP

The opening day's meeting sessions took place at PH8, an incubator nurturing innovative local businesses in the fields of health, new technologies and the creative industry. The day commenced with a warm welcome from Jean Melounou, Head of Mission for Innovative Mobility at EMS, who set the stage with a presentation of the Eurometropolis. Subsequently, Auriane Agard provided insights into PVF and its pivotal role in the Grand Est Region. Caroline Rey, representing Dynamhyse and serving as Head of Environmental and Energy Transitions at Grand E-Nov+ Regional Innovation and International Prospecting Agency, presented a comprehensive overview of the hydrogen sector in the Grand-Est Region. This presentation encompassed national and regional strategies, an industry overview, and an introduction to the Dynamhyse consortium. This section summarises key points from the first day's sessions.

2.1 Getting acquainted with the organising partners: Eurometropole of Strasbourg and Pôle du Vehicule du Futur

2.1.1 City and Eurometropole of Strasbourg

The Eurometropole of Strasbourg is a vibrant and strategically positioned metropolitan area located in the eastern part of France, near the German border. It is a vital part of the Grand Est region and serves as a pivotal point at the intersection of four Trans-European Transport Network (Ten-T) corridors, which include the Rhine Alpine, Atlantic, North Sea – Mediterranean, and Rhine – Danube corridors. This is the reason why the city's administration places particular emphasis on mobility administrative efficiency, prioritizing infrastructure development, including roads and digital connectivity. This commitment ensures that the region remains well-connected, both physically and digitally, supporting economic growth and innovation.

During the presentation of the Eurometropole's administrative capacities, the following aspects have been highlighted:

Conurbation: The Eurometropole comprises 33 city councils, collectively representing more than half a million inhabitants. This makes it the largest community in the eastern region of France, emphasizing its significance within the nation.

Strategic Transborder Location: Positioned at the heart of the Upper Rhine Region, the Eurometropole of Strasbourg holds a crucial transborder location. This strategic placement fosters international cooperation and trade with neighboring countries, particularly Germany.

Civil Servants: With over 7,000 civil servants, the Eurometropole has a robust administrative apparatus dedicated to managing and enhancing the quality of life for its residents.

Focus on Mobility: As a pivotal point for four Ten-T corridors, the Eurometropole of Strasbourg is committed to fostering efficient and sustainable mobility solutions. These corridors facilitate the movement of goods and people across Europe, making the region a hub for trade and transportation.

Support for Higher Education: The emphasis on higher education not only enhances knowledge and skills in the region but also attracts talent, contributing to a dynamic workforce and innovation in mobility solutions.

Economic, Social, and Cultural Development: The region actively promotes economic growth and cultural development, offering amenities such as stadiums, media libraries, and swimming pools to enrich the lives of its residents.

Local Housing Policy: The Eurometropole is committed to providing social housing options, ensuring that all residents have access to quality housing.

Sanitation and Environmental Protection: It manages essential services like water supply and waste management, contributing to a clean and sustainable environment.

Urban Policy: The Eurometropole actively engages in urban development and crime prevention strategies, making the region safer and more attractive for residents and visitors alike.

Photo 1. Caption from the presentation with the Eurometropole's logo: 'Europtimist'



A short video revealing key aspects that are unique to Strasbourg Eurometropole is to be found in the following link: <https://www.youtube.com/watch?v=RqCRzPhttcA>. This video presentation highlights five distinctive values that define Strasbourg:

- Cycling: Strasbourg proudly ranks as the world's 4th most bike-friendly city.
- Environmental Stewardship: Recognized as the 3rd greenest city in France, Strasbourg is a beacon of sustainability and a pioneer in promoting eco-friendly transportation options.
- Innovation Hub: Strasbourg stands out as a city of networks, fostering both technological and social innovations.
- European Crossroads: Positioned at the intersection of four major European corridors, Strasbourg serves as a cosmopolitan, cross-border city that embraces its role as the home of European institutions, where Europe is an integral part of daily life. It boasts a cutting-edge cross-border tram connecting France and Germany daily, serving as a testament to its connectivity.
- Entrepreneurial Optimism: Strasbourg thrives as a hub of entrepreneurship, fueled by an unwavering spirit of optimism. The region hosts a vibrant start-up ecosystem and a diverse array of businesses, all united by a common commitment to innovation and progress.

Underpinning Strasbourg's economic vision, as articulated in Strasbourg Eco 2030, the city's economic roadmap, is the slogan 'a territory to grow together.' The Strasbourg Eurometropole places a significant emphasis on collaboration, recognizing that working together contributes not only to the region's prosperity but also to the quality of life for its residents.

2.1.2 Pôle du Vehicule du Future

PVF is a distinguished automotive and mobility cluster situated in the eastern region of France, founded in 2005, and led by President Thierry Tournier. With a visionary board, 30 members, three college representatives, and a dynamic team of 22 employees, PVF stands at the forefront of fostering innovation and collaboration within the industry.

Strategic Geographic Reach: PVF's influence extends across the high-industrial-potential territories of Grand Est and Bourgogne-Franche-Comté, encompassing two pivotal regions in France. The cluster operates from five strategically positioned locations, spanning Nancy, St Dizier, Mulhouse, Montbéliard, Nevers, and Magny-Cours.

Diverse Membership Network: Boasting an extensive network of 500 members, PVF's membership includes a rich tapestry of companies, public research institutions, training organizations, and regional stakeholders. This vibrant ecosystem nurtures collaboration and growth. PVF collaborates extensively with key national partners, including PFA Filière Automobile & Mobilités, CARA European Cluster for Mobility Solutions, ID4 Mobility, Next

move, France Hydrogène, Avere France, AFPC, Alliance Industrie du Futur, and France Mobilité.

Addressing Critical Industry Challenges: PVF's mission aligns with pivotal industry challenges, actively supporting decarbonization of the automotive and mobility industry and promoting digital integration. Some of PVF's innovative products and services are to be found in the following domains:

- Powertrain Electrification and Hydrogen
- Connected & Autonomous Vehicles
- Mobility as a Service
- Future Vehicle Design
- Digitalization, deploying industry 4.0

EU Funding and Collaborative Engagement: PVF is an active participant in European project consortia, having contributed to 52 EU-funded projects. This active involvement underscores its unwavering commitment to innovation and access to international resources.

Hydrogen: PVF emerges as a pioneering force in the hydrogen sector, marked by its long-term vision for potential identification and ecosystem development. The cluster actively fosters collaboration among regional stakeholders, driving economic growth and development.

2.2 The Hydrogen Sector in the Grand Est Region

This section covers the workshop presentation of Caroline Rey, Head of Environmental and Energy Transitions. She discussed both the national and regional hydrogen strategies, highlighting key objectives and initiatives of the hydrogen sector in the Grand Est Region, with a particular focus on the DYNAMHySE consortium.

2.2.1 French National Hydrogen Strategy

The French government recognizes hydrogen as a pivotal and groundbreaking technology with the potential to:

- Facilitate the decarbonization of the economy
and
- Accelerate the ecological transition.

At the heart of this strategy is carbon-free hydrogen, which addresses the dual challenges of industrial decarbonization and green reindustrialization, research and innovation investments, and professional skill development. The projected demand for carbon-free hydrogen by 2030 stands at 680 kilotons.

The French hydrogen deployment strategy outlines several key objectives, including:

- Establishing a French electrolysis sector to enable mass production of hydrogen via electrolysis, with a target installed capacity of 6.5 gigawatts by 2030. This will contribute to the decarbonization of various industries by replacing carbon-based hydrogen.
- Promoting carbon-free hydrogen for heavy mobility and fostering large-scale territorial projects that involve collaboration between local authorities, manufacturers, producers, and end-users.
- Supporting research and innovation, developing the necessary skills, and strengthening competences for working with hydrogen gas, its components, and intervention methods.

France has committed substantial funding to these initiatives, with plans such as "Plan H2 2020" providing 7 billion euros and a total investment of 9 billion euros by 2030. Additionally, France aims to secure 1.7 billion euros under the IPCEI H2 program, with a total IPCEI investment of 3.275 billion euros. Furthermore, there's a 200 million euros call for the Territorial Ecosystem by ADEME (The French Agency for Ecological Transition).

Key Figures for Mobility in 2030:

Based on the national hydrogen strategy and the PPE 2028 (Pluriannual Energy Plan), the objectives include:

- Increasing the production of hydrogen for industrial and new uses, with a shift from 95% carbonated hydrogen in 2020 to 52% decarbonated and 48% carbonated hydrogen by 2030.
- A substantial increase in job opportunities, with 100,000 jobs expected by 2030 compared to 2,000 in 2020.
- Significant growth in the number of hydrogen-powered vehicles, including commercial cars, heavy-duty vehicles, trains, and boats.

2.2.2 Regional Hydrogen Strategy for Grand Est

Grand Est Region at a glance:

The Grand Est Region boasts significant geographical advantages, with 70% of European waterway traffic, strategic proximity to Western Europe's markets, and extensive transportation infrastructure. This region features a comprehensive east-west and north-south motorway network, high-speed train connections to major European cities, access to international airports, and multimodal harbors along major rivers. It is also uniquely positioned with connections to four TEN-T corridors in the Trans-European Transport Network and benefits from a robust regional broadband network.

The **H2MA** project is co-funded by the European Union through the Interreg Alpine Space programme

Regional Hydrogen Deployment Strategy

The regional hydrogen strategy for 2020-2030 is based on five core axes:

- Positioning hydrogen within the energy mix to meet regional needs.
- Developing carbon-free heavy mobility, including rail, heavy vehicles, and river transportation.
- Engaging the industrial sector in the hydrogen domain and decarbonizing its applications.
- Fostering access to information and promoting the development of necessary skills.
- Establishing a governance framework that aligns with national and European plans.

This strategy encompasses various ambitious initiatives, including:

- The deployment of five massive production units, featuring 600 megawatts of electrolysis and 90,000 tons of annual production by 2030, alongside dedicated pipelines and storage.
- The transformation of industrial energy supply to green hydrogen.
- The commissioning of 30 refueling stations, 700 buses, 1,200 trucks for household garbage collection, 100 barges, and three bi-mode trains.
- Implementation of targeted training actions to accelerate the transition of companies to hydrogen.

Region Assets for a Hydrogen Activity:

The Grand Est Region possesses several assets for a thriving hydrogen sector, including abundant renewable energy sources like biomass, wind power, hydroelectricity, photovoltaic, and geothermal energy. It ranks as the second-largest French region in terms of wind power capacity and production. The region also benefits from a well-developed infrastructure, dense electricity and gas networks, quality underground storage options, and extensive road and river transport networks. It is a significant European logistics base linked to four TEN-T corridors, with subcontractors possessing expertise in various hydrogen-related fields. Furthermore, there is a strong focus on higher education and research in hydrogen sciences and technologies.

Innovative Projects Already Underway:

The Grand Est Region is actively engaged in several innovative projects, such as R-Hynoca in Strasbourg, LE3 for barges between Mulhouse and Metz, Saint-Marie-aux-Mines, RHYn with a dedicated pipeline between France and Germany, Vynova in Thann, FaHyence in Sarreguemines, VitHydrogen in Vitry-le-François, MHyabel in Audun-le-Roman, Hydreol in Chaumont, Saint-Avold with a project for massive hydrogen production, and Mosahyc with a dedicated pipeline connecting Germany, France, and Luxembourg.

Regional Hydrogen Ecosystem:

The Grand Est Region is driving hydrogen innovation with 25 projects for hydrogen production and utilization. By 2030, it aims to produce 90,000 tons of hydrogen per year and

The H2MA project is co-funded by the European Union through the Interreg Alpine Space programme

establish 15 hydrogen distribution stations by 2025. Additionally, there are plans to generate more than 17 terawatt-hours of renewable energy production by 2030.

2.2.3 The DYNAMHySE Consortium

The DYNAMHySE Consortium plays a pivotal role in the Grand Est Region's hydrogen sector. Established in 2018, its mission is to foster the development of an industrial hydrogen sector in the region and integrate hydrogen into the broader energy transition. The consortium encompasses six companies, two research organizations, a community, three competitiveness clusters, and an innovation agency. It was officially launched on March 22, 2019.

DYNAMHySE also oversees the Club Hydrogène Grand Est, which boasts more than 90 members. This club serves as a hub for collaboration and business activities and connects with national and international hydrogen networks, including France Hydrogen and Hydrogen Europe. DYNAMHySE maintains strong ties to France Hydrogène, further solidifying its position in the hydrogen ecosystem.

3. OPENING THE SECOND DAY OF THE WORKSHOP

During the workshop's second day, participants gathered at the administrative center of the Strasbourg Eurometropole, notably within the newly refurbished circular hall of the Eurométropole Council. Chairing the workshop, Jean Melounou commenced proceedings by extending his opening remarks to Pia Imbs, who serves as the President of the Strasbourg Eurometropole, Mayor of Holtzheim, and President of PVF, Bruno Grandjean. Then he gave a brief overview of the H2MA project followed by an opening statement by Matevz Silc from Lead partner KSSENA.

3.1 President Pia Imbs' Welcome Address

Pia Imbs, President of the Strasbourg Eurometropole and Mayor of Holtzheim, extended a warm welcome to all attendees at the Eurometropole Council Chamber. In her address, she underscored the critical issues of climate change and environmental degradation, emphasizing the urgent need for robust action.

President Imbs highlighted the transportation sector as a significant contributor to greenhouse gas emissions, amounting to 30% of such emissions in France. Furthermore, the transportation sector has a substantial impact on air quality in the Eurometropolis, with road traffic being responsible for 84% of nitrogen oxide emissions. This concern is exacerbated by revised measurement thresholds by the World Health Organization (WHO).

President Imbs drew attention to the alarming impact of poor air quality, responsible for approximately 500 deaths annually in the Eurometropole. She emphasized the region's commitment to addressing these challenges through policies that incentivize individuals and businesses to adopt carbon-free mobility solutions.

Aligned with Europe's Green Deal initiative and France's climate and resilience law, the Eurometropole is steadfast in its goal to achieve carbon neutrality by 2050. President Imbs stressed that carbon-free mobility is central to their strategy, with plans to enhance public transportation options, including buses, trams, and trains, along with a strong emphasis on soft mobility, such as cycling.

The Eurometropole's dedication to sustainable mobility was further illustrated by its recent launch of a metropolitan RER, making it one of the few metropolises, after Paris, to provide frequent green transit services. Collaboration with the Grand Est region is underway to develop express coach services.

President Imbs also highlighted initiatives in active mobility, car-sharing, and on-demand transportation. Investment in biofuel supplies, electric recharging points, and exploration of synthetic fuels, particularly green hydrogen, forms a vital part of their sustainability efforts. She underscored green hydrogen's significance as part of the European Union's hydrogen strategy.

In conclusion, President Pia Imbs assured attendees that the Strasbourg Eurometropolis is fully committed to sustainable mobility and is particularly interested in the development of hydrogen technologies. She expressed hope for a productive and inspiring working day and then yielded the floor to partners from the Vehicle of the Future competitiveness cluster.

3.2 PVF President's Welcome Address

On his turn, the President of PVF, Bruno Grandjean, extended a warm welcome to the H2MA partners, some of whom he had previously collaborated with in other projects. In his address, he provided an overview of PVF, a dynamic ecosystem comprising 500 members, including companies, economic development stakeholders, and territories. He highlighted PVF's three key roles:

1. **Regional Automotive Expertise:** PVF stands as a regional authority and expert in the automotive sector, serving as a valuable resource for industry insights.
2. **Support Program Development:** PVF plays a pivotal role in the creation and execution of support programs, channeling resources into initiatives that drive innovation and growth.
3. **Innovation Project Facilitation:** PVF excels in facilitating innovation projects, with an impressive portfolio totaling 1 billion euros in investments.

President Grosjean underscored PVF's unwavering commitment to hydrogen technologies. PVF has been a staunch supporter of the hydrogen industry from its inception, even before it gained widespread recognition. Today, it unites 160 members across two hydrogen clusters, affirming PVF's dedication to fostering innovation, embracing new technologies, and championing sustainability. In conclusion, President Grosjean once again welcomed all workshop participants and expressed his best wishes for a productive and insightful workshop ahead.

3.3 Presentation of the H2MA project

Then Jean Melounou from EMS and Matevz Silc from Lead Partner KSSENA gave a short presentation of the H2MA project, setting out its main objectives and planned activities.

H2MA brings together 11 partners from all 5 Interreg Alpine Space EU countries (SI, IT, DE, FR, AT), to coordinate and accelerate the transnational roll-out of green hydrogen infrastructure for transport and mobility in the Alpine region. Through the joint development of cooperation mechanisms, strategies, tools, and resources, H2MA aims to increase the capacities of territorial public authorities and stakeholders to overcome existing barriers and collaboratively plan and pilot test transalpine zero-emission H2 routes.

H2MA has already established a transnational collaboration mechanism to increase the capacities of territorial public authorities and stakeholders (incl. energy and transport agencies, H2 infrastructure providers, RES producers) to jointly plan and pilot test transalpine zero-emission 'green H2 routes and urban mobility solutions.

H2MA's integrated planning and implementation solutions for H2 mobility will enable the synchronised deployment of transnational infrastructure for freight and passenger transport (heavy-duty trucks and railway in the short-term, maritime and aviation in the long-term), in tandem with urban mobility planning (buses), amplifying the macro-regional impact of currently siloed initiatives.

H2MA's objectives include:

1. Improve the governance of green H2 mobility in the Alpine region, as over 20 policy authorities and 80 stakeholders will use and upscale project outputs (resources, tools, strategies), optimising mobility plans.
2. Boost the uptake of green H2 for heavy-duty transportation across the Alpine space by supporting infrastructure development for at least 2,000 H2-powered vehicles, thus contributing to saving approximately 240 thousand CO2 tons (per year) by 2030.
3. Unlock green financing and improve the cooperation framework between public authorities and businesses involved in green H2 mobility in the Alpine region, by deepening public-private synergies and harmonising policy planning with automotive and green H2 production and distribution value chains.

Matevz Silc particularly underlined the importance of the H2MA planning tool which will help the selection of the most suitable locations for building hydrogen infrastructure, thus helping Alpine countries design transnational green hydrogen mobility supply and distribution networks across the Alpine space, based on technoeconomic and safety parameters.

4. DEVELOPING AN H2 CORRIDOR IN THE GRAND EST REGION

The presentation of Sabine Goetz from the Grand Est Region discussed the Grand Est Region's comprehensive approach to hydrogen integration and the strategic steps taken since 2019 to drive the energy transition and address various sustainability challenges. The focus was on the adoption of a regional hydrogen strategy, including the creation of DYNAMHySE, the purchase of bimodal trains, and the launch of the 'Grand Est H2 Corridors' study in partnership with the European Investment Bank. This section aims to provide an overview of the key themes, objectives, and strategies presented during Sabine Goetz's presentation.

4.1 Regional commitment to hydrogen and development of a regional Hydrogen Strategy

The Grand Est Region has been actively involved in promoting hydrogen since 2019 as part of its energy transition efforts. Hydrogen was identified as a pivotal component following the principles of sobriety, energy efficiency, and the utilization of renewable energies. The presentation emphasized the importance of hydrogen in reducing greenhouse gas emissions, aligning with the region's long-term sustainability goals.

In 2020, the region officially adopted its 'Grand Est 2020-2030 hydrogen strategy,' which revolves around renewable energy sources. Unlike the French government's preference for nuclear-generated hydrogen, the Grand Est Region focuses on renewable hydrogen, sourced from water electrolysis and biomass gasification.

In 2021, the region made a significant commitment by investing 59 million euros (excluding tax) to purchase three bimodal trains (TER), which are expected to be delivered by the second half of 2026. This investment signifies a crucial step in the regional hydrogen deployment plan. Furthermore, to facilitate the proliferation of multi-energy stations and encourage the transition to biofuels, electricity, and hydrogen-powered vehicles, the 'low-emission motorization plan' was introduced in 2021.

4.2 Hydrogen Corridor Study

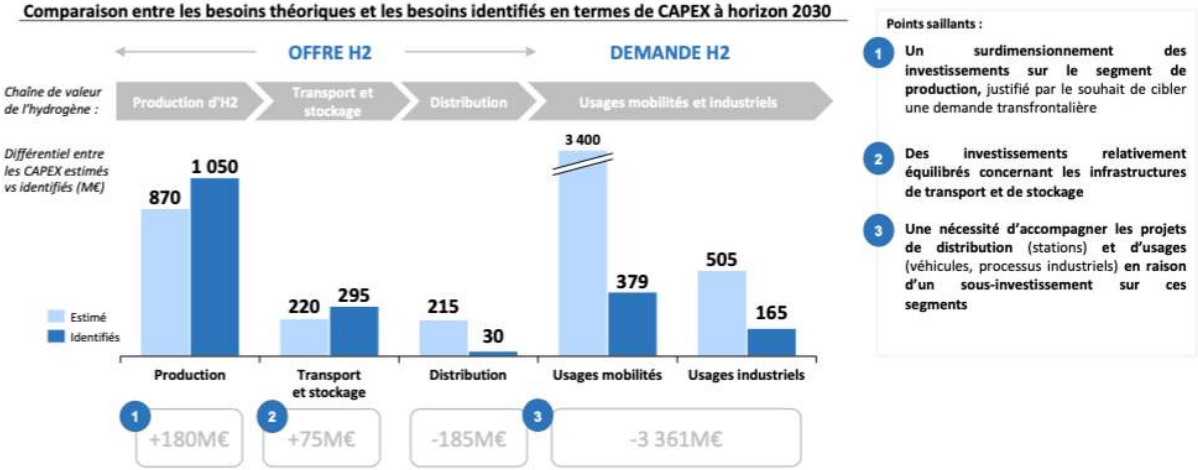
In 2022, the Grand Est Region initiated the 'Grand Est H2 Corridors' study in collaboration with the European Investment Bank. This study aims to make the regional hydrogen strategy more operational. It encompasses a range of objectives, including the development of production and distribution infrastructure, connections to neighboring regions, and the creation of economic conditions for scaling up hydrogen applications.

The Grand Est region has outlined four primary objectives to establish a thriving hydrogen industry by 2030, presented below:

1. **Secure Green Hydrogen Supply.** This involves leveraging local renewable energy production to promote and expand green hydrogen production.
2. **Decarbonize Industrial Sectors.** Recognizing that the industrial sector contributes significantly to greenhouse gas emissions, the region seeks to involve the industry in the hydrogen sector and promote decarbonization.
3. **Develop Multi-Purpose Hydrogen Ecosystems.** By integrating hydrogen into the energy mix for heavy mobility, the region aims to establish five multi-purpose hydrogen energy ecosystems.
4. **Facilitate Governance.** A crucial aspect of the strategy involves bringing stakeholders together, developing cross-border interconnections, and promoting skills and research and development.

Photo 2. Comparison between prospective and identified needs in hydrogen production, transport, distribution and uses by 2030

L'étude des projets identifiés à date permet d'observer un fort besoin de stimuler les financements relatifs aux usages et aux stations de distribution pour répondre à la demande de 124kt d'H2 projetée à horizon 2030



The creation of an H2 corridor is essential to stimulate hydrogen applications by providing production capacity, hydrogen stations, and necessary infrastructure across the region. The objectives include securing hydrogen usage, linking the Grand Est Region with neighboring regions, and creating economic conditions for scaling up the hydrogen industry.

The 'Grand Est H2 Corridors' study involves several phases, including consultation with stakeholders, analyzing existing projects, assessing regional ecosystem maturity, gathering

needs and expectations, and formalizing the corridor's characteristics. To fund the hydrogen sector's growth, the region aims to leverage public and private funding, including European and national support. The first phase of the study is focused on assessing the current situation and identifying conditions for success and stakeholder expectations in setting up an H2 corridor. The second phase of the study, set to begin soon, aims to refine mobility usage needs, and explore different scenarios related to funding, governance methods, and subsidy/investment. The goal is to determine whether specific mechanisms for the hydrogen sector are necessary and develop corresponding procedures.

Audience Questions

Two key questions raised during the presentation. The first was about the intermittent nature of renewables and the absence of available storage options as well as the choice of hydrogen over nuclear power, especially since the still high price of hydrogen remains very high. The speaker highlighted the critical issue of intermittent energy but revealed that France has been actively exploring alternative solutions to store energy generated from renewable energy sources. One notable project in Nancy involves storing energy in salt caverns, providing a promising avenue for addressing energy storage challenges. This project signifies an ongoing effort to find efficient and sustainable energy storage solutions and promote RES.

The other question regarded the role of coordination played in DYNAMHySE, which could be also copied by the H2MA consortium. In response to this question, it was emphasized that effective coordination across different regions requires the active involvement of all interested parties and stakeholders. To achieve this, it is essential to bring these parties together and facilitate consultation processes. Organizing working groups, colloques, webinars, and other collaborative events can further enhance coordination efforts by providing opportunities for people to connect and share their insights and experiences. Such a coordinated approach aims to create a dynamic and inclusive environment for hydrogen-related initiatives.

5. FEEDBACK FROM THE FIRST DEPLOYMENTS OF HYDROGEN-POWERED ELECTRIC BUSES IN FRANCE

In this section are presented key ideas and main discussion points of Jan-Erik Starlander's presentation, who is the Head of Relations with Territories and Local Authorities. He offered feedback from the deployment of the first hydrogen-powered electric buses in France.

Mr. Starlander began by introducing France Hydrogène Mobilité, a collective association with 160 members, including companies along the hydrogen value chain, regional and local authorities, and more. The group's primary objective is to promote collective intelligence among its members to identify and address obstacles in hydrogen mobility projects effectively. Their work encompasses supply and visibility, knowledge sharing, funding, and education and awareness. France Hydrogène Mobilité, which is a group within France Hydrogène, has played a pivotal role in facilitating the hydrogen transition.

He then highlighted the deployment of 55 fuel cell buses in 10 French cities by September 2023. These buses, sourced from three different original equipment manufacturers (OEMs), represent significant progress in the adoption of hydrogen mobility.

Feedback from the three pioneering Fuel Cell bus deployment projects

Artois

Artois was the first French municipality to purchase hydrogen buses, even before any were available on the market. In initial months the buses required adjustments, particularly regarding communication between the fuel cell and the vehicle. Also, other design issues unrelated to fuel cell technology emerged, mainly in the conventional part of the bus, such as chassis welding. Yet, buses achieved excellent autonomy and distance range exceeding 500 kilometers.

Versailles

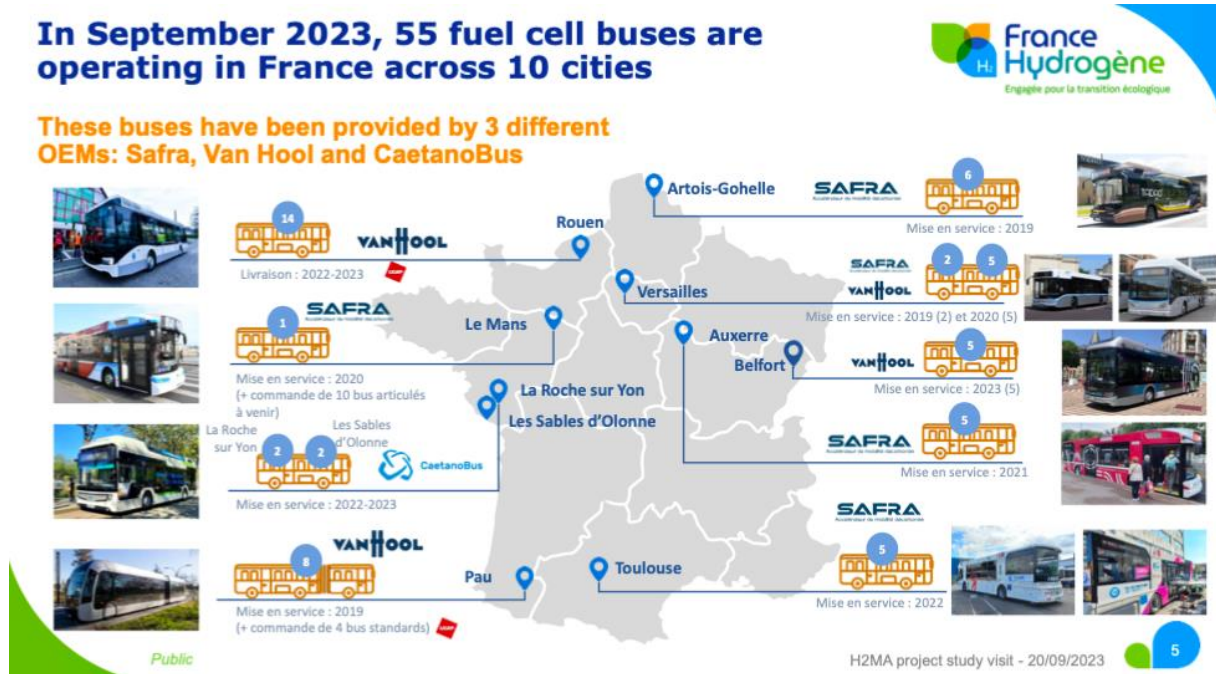
In the Versailles project there have been significant delays in Safran bus deliveries due to the COVID-19 pandemic. Choosing Safran, a non-traditional bus manufacturer, presented anticipated challenges due to deploying a new technology. Safran improved bus reliability through retrofitting in 2022, enhancing availability rates from 40% to 80-90%.

Pau (Fébus Project)

Hydrogen technology was the best fit for Pau's specific bus line, leading to its preference over biogas and electric battery options. After rolling out eight vehicles in 2019, the city of Pau continued the deployment by purchasing four more buses. Key challenges included adapting the bus depot and maintenance area and training technicians and bus drivers. The project experienced no issues with bus deliveries, achieving high availability and reliability

rates. These buses significantly contributed to environmental conservation and provided a valuable case study.

Photo 3. Hydrogen buses operating in France



Key Findings from the Feedback:

The feedback from these pioneering projects underlines the challenges and obstacles involved in transitioning demonstrators into everyday mobility solutions. Technical and reliability issues had to be resolved, both in the fuel cell technology and the conventional bus structure. However, these challenges were met, and the fuel cell buses fulfilled operational expectations while providing a zero tailpipe emission solution with all the operational advantages of combustion engine vehicles. The increasing number of such projects and the sharing of feedback are expected to accelerate the deployment of fuel cell buses in French cities, moving them from a niche market to mainstream adoption.

Audience Questions

1. Wolfgang Deloth from PUNCH Group (stakeholder) inquired about the use of internal combustion engines versus fuel cell vehicles, specifically the performance differences and the feasibility of hydrogen-gas mixes. He wanted to know if the feedback presented came solely from fuel cell technology or also included combustion engines. He also raised the question of using a mix of hydrogen and gases during the transition.

The response highlighted that European automotive manufacturers are actively working on 100% hydrogen engines. The initial development of internal combustion engines for hydrogen began in the early 2000s, but there were some challenges. Some industries are focusing more on hydrogen for heavy-duty vehicles. In France, there's a commitment to greening buses, with increasing requirements for low-emission vehicles. While internal combustion engines could potentially use a mix of hydrogen and gases, most focus on fuel cell technology. Different factors such as cost, performance, but most of all, environmental concerns impact the choice between the two technologies. Fuel Cell technology is indeed better positioned to help meet environmental regulations.

2. A second question on retrofitting was raised.

The speaker highlighted that retrofitting is now available, but it comes with its own set of challenges. The price of retrofitting new vehicles is quite high, even with government assistance. Moreover, the process of homologation can be time-consuming, and local regulations for retrofitting vary. Some regions, like Italy, are in the process of preparing for retrofitting. While retrofitting is an option for certain vehicles, such as coaches, it is not the primary choice for buses. However, some cities, like Toulouse, have started exploring retrofitting. The focus for retrofitting in France is currently on vehicles other than buses.

3. Then an audience member raised a question about homologation. They wanted to know more about the challenges associated with homologation in France and whether there is a need for a common European framework.

Homologation in France was described as a complex and challenging process. It was mentioned that there hasn't been a single case where a hydrogen vehicle, whether new or retrofitted, did not face difficulties during the homologation process. This is true for different types of vehicles and technologies. The process involves various technical aspects, and it can be particularly tricky for new technology. Then, the speaker gave the example of a German garbage collection vehicle, purchased by a French municipality, which was certified to circulate on the streets but was not authorised to collect garbage. It had to stay with the German matriculation for twelve months (the time a homologation lasts) before becoming fully operational in France. As a conclusion, it was emphasized that there is a need for a common European framework to streamline and standardize the homologation process.

4. Then Niko Natek from KSSENA, commented on the design of fuel cell buses in Versailles. They found it interesting to learn about the innovative design but noted that it wasn't very efficient. The design involved a powertrain on a different chassis. They further expressed that a balance between innovation and efficiency is crucial.

Jan-Erik Starlander acknowledged the innovative design of the Versailles buses and noted that the design was considered a bit too innovative. Subsequently, a more traditional chassis design was adopted to improve efficiency.

5. Finally, the audience raised the question about hydrogen pricing and the potential use of power-to-gas technology. They inquired about the cost of hydrogen and the feasibility of using hydrogen to increase the production of methane.

The speaker mentioned that the price of hydrogen in France and elsewhere has seen fluctuations and is subject to contracts. The price was initially quoted at around €9 per kilo but was considered unrealistic, and the actual price is now approximately €14 per kilo. The role of power-to-gas technology was discussed, as it is considered a promising approach in some areas. It was highlighted that the key issue is the design of the energy market and securing long-term contracts for stability in hydrogen prices. Additionally, the impact of magnetic radiation testing on vehicles with more than 4 kg of hydrogen was noted as a technical challenge in the homologation process. The discussion also touched on the importance of stable and predictable pricing for municipalities looking to adopt hydrogen technology.

6. EXCHANGE OF EXPERIENCE BETWEEN AUXERRE AND BELFORT

The middle thematic session of the second day's workshop was organized as roundtable discussion between Emmanuel Jobard from the Communauté de l'Auxerrois, and Marc Rovigo, Director at the Syndicat mixte des transports en commun, who shared their insights from their experiences with hydrogen buses from their respective communities, Auxerre et Belfort). The discussion was moderated by Charitini Karakostaki, an external expert from Syncnify.

Genesis of the hydrogen bus projects and implementation

Emmanuel Jobard commenced by saying that the project in the Auxerre metropolitan area was officially initiated in October 2021 with the inauguration of both a hydrogen production and a distribution station (HRS), which shows the will to create a whole hydrogen ecosystem, instead of only purchasing some buses and buying hydrogen from elsewhere. This HRS was thus constructed to refuel the first five Safran first-generation buses, with plans to acquire four more. There were technical issues and operational challenges in the initial phase, primarily associated with communication between the fuel cell and the vehicle but also other issues that were not necessarily tie to the hydrogen technology, such as “the human factor” and some kind of resistance from diesel bus drivers. But soon doubts and resistance have been resolved. Challenges related to the conventional part of the bus design were also encountered. Some of the buses had to function mainly on battery power during certain periods. However, these difficulties could be attributed to the fact that the buses were replacements for older models and were deployed without backup. The project represents a transformation from a public passenger transport organization into an industrial entity, Safran. Through this transformation, Safran was able to address design issues and make significant improvements. Yet, despite these hurdles, the buses exhibited good autonomy and range, exceeding 500 km.

Then, **Marc Rovigo** talked about the project in Belfort. This project aimed to equip of the public transport fleet with 7 hydrogen-powered buses and now the fleet is expected to integrate another 20 hydrogen buses by 2025, that have already been ordered. This project aligned with the broader political vision of the Belfort region, an industrial hub for the automotive and energy sectors. The Mayor of Belfort played a pivotal role in promoting energy-positive initiatives and creating an industrial ecosystem for hydrogen technology. As a long-term political initiative, this transition has quickly started yielding visible results. Companies like McPhee and another fuel cell manufacturer have established factories in Belfort, thereby creating an extensive ecosystem. Hydrogen technology was a logical choice for the public transport operator, which has been involved in hydrogen projects since 2011. However, initial high costs and a lack of a comprehensive strategy at the time deterred them. The strategic shift towards hydrogen began in 2015 when the Mayor of Belfort decided to create an ecosystem and transform the region into an energy-positive territory. The plan aimed to foster an industrial sector that could create jobs related to hydrogen. The positive

effects of this policy are now visible. The first phase of the project involved procuring and operating seven hydrogen buses. The second phase, extending to 2025, aims to acquire 20 more buses. The project was made possible through collaboration with Belfort Montbéliard, EDF, and LinaMixte, leading to the construction of a hydrogen station, which is essential for mobility operators who do not produce hydrogen themselves. Overall, the transition to hydrogen-powered buses in Belfort was smoother compared to Auxerre. Employees adapted well to the new technology. A structured transition history, including shifting from diesel to gas and then to hybrid, helped in the acceptance of hydrogen buses. Personnel received the necessary training, ensuring a seamless transition. However, challenges were encountered in different areas, including aligning maintenance facilities with hydrogen-specific requirements. Technical knowledge was insufficient, and difficulty finding specialized engineering firms posed hurdles. To address these challenges, Belfort engaged in significant training, certified its facilities through a third-party firm, and continued development in collaboration with academic institutions and engineering companies.

Advice for Local Authorities Embarking on Similar Projects

Emmanuel Jobard put emphasis on acknowledging and addressing the fears and concerns of local employees during the transition to hydrogen. The cultural shift towards hydrogen should be seen as an opportunity rather than a threat. Ensuring that employees understand that their jobs are changing, but not disappearing, is an essential part of the process.

Marc Rovigo on the other hand accentuated the factor of political will. In Belfort, the successful transition to hydrogen technology was attributed to setting up a clear long-term strategy by local authorities. This strategy included the comprehensive training of personnel and making strategic decisions regarding the procurement and operation of hydrogen buses. To successfully implement a similar project, local authorities should develop an ecosystem involving industrial players and create an environment where knowledge and expertise can be shared.

Both speakers put particular emphasis on the matter of training and capacity building for hydrogen related jobs. As part of a holistic approach towards the development of a hydrogen ecosystem, each community offers educational and training curricula and make sure to integrate some specialization on hydrogen into existing technical education programs (e.g. for mechanics, plumbers etc.).

7. STRASBOURG'S RENEWABLE HYDROGEN ECOSYSTEM

In this section are presented the key points from the presentation of Philippe Follet, Development Manager for the Grand Est & Bourgogne Franche-Comté regions at Hynamics, an EDF company, who discussed the creation of a territorial hydrogen ecosystem at the Ports of Strasbourg.

He started by giving some information about Hynamics, a subsidiary of EDF. Hynamics is deeply committed to investing in hydrogen as a means to reduce CO2 emissions. EDF is a major player in the energy transition, focusing on low-carbon energy solutions. The primary goal is to leverage hydrogen to decarbonize two of the most emissions-intensive sectors: industry and mobility.

Industry

Hynamics caters to a wide range of industries, from small and medium-sized enterprises to large-scale industrial operations. They are involved in projects ranging from 1 to 20 MW, emphasizing on-site hydrogen production to replace traditional gas cylinders. These efforts aim to significantly cut down CO2 emissions in energy-intensive sectors.

Mobility

Hynamics is actively engaged in various mobility sectors, including heavy transport, trains, river transportation, business fleets, buses, trucks, and captive fleets of professional vehicles tied to industrial projects. By integrating hydrogen into these sectors, they are helping to reduce emissions, especially in regions with strong industrial ties.

Strasbourg Renewable Hydrogen Ecosystem (Alsace-HY)

The Alsace-HY project, initiated in 2021, is centered around the establishment of a hydrogen station in the Port of Strasbourg. The location on Rue de la Rochelle is strategically chosen due to its proximity to major transportation arteries, a waterfront docking area, and connections to rail freight. The project aims to tap into the bustling logistics activities in the region. It offers the advantage of facilitating hydrogen distribution via multiple means, including road transport, river routes, pipelines within the port, and more. The Port of Strasbourg is a key logistics hub and the second-largest inland port in France.

The project has broad developmental prospects for the region. In addition to serving the local vicinity, it envisions exporting hydrogen to distant distribution stations through methods like tube trailers, river transport, or pipelines. This approach accommodates various applications, including port activities, logistics, road transportation, manufacturing, cross-border collaborations, and rail services (both freight and TER).

Hynamics' initiatives reflect a commitment to harnessing the potential of hydrogen to curtail CO2 emissions in energy-intensive industries and transform the mobility landscape, with the Alsace-HY project acting as a prime example of their forward-thinking approach.

Photo 4. The design of the HRS at the Strasbourg port

Implantation de la station hydrogène dans le port de Strasbourg

Rue de la Rochelle, sur le terrain de l'usine Punch:

- Proximité des axes routiers, bordure de darse fluviale, rail fret, ...)
- Au cœur des activités de logistique
- Permettant facilement la distribution de l'hydrogène (route, fleuve, rail, pipe sur le port,...)
- Le port = importante zone logistique (2^{ème} port fluvial de France)



8. NOMAD CAR HYDROGEN

The last contribution of the workshop's second day was by XXX, xxx, who presented an innovation from Normandy, the Nomad Car Hydrogen, which offers a zero-emission mobility solution.

Regional Context

In October 2018, Normandy launched the Normandie Hydrogen Plan, laying the foundation for a new hydrogen industry in the region. The plan's key elements include driving innovation, fostering new applications, promoting R&D, providing training, and raising awareness.

Nomad Car Hydrogen focuses on two core areas:

- a) Industry
- b) Heavy mobility.

Collaboration and community leadership are at the heart of this initiative.

Nomad Car Hydrogen a world-first for Transdev, and a unique territorial project for Normandy

- In Normandy, Transdev is at the forefront of an ambitious project called Nomad Car Hydrogen (NCH2).
- NCH2 is a pioneering effort globally, as it retrofits a traditional diesel bus into an electric hydrogen bus designed to operate on the Rouen-Evreux Express line.

What Is Retrofit?

Retrofit involves adapting existing technology to serve new purposes. In this particular case, the project aims to replace the diesel engine with an electric motor powered by a hydrogen fuel cell, converting hydrogen into electricity.

Nomad Car Hydrogen is an unprecedented two-year project initiated by Transdev Normandie, in collaboration with multiple institutional, industrial, and academic partners.

It is the first project in the world to retrofit a diesel bus into a hydrogen-powered vehicle.

This innovative project contributes to reducing greenhouse gas emissions and air pollutants, offering a sustainable, zero-emission mobility solution. It also supports climate change mitigation and air quality improvement in Normandy. Furthermore, this project opens the door to the retrofitting and extension of heavy vehicles, providing a fresh perspective on future mobility.

Collaboration and Innovation: Building Normandy's Hydrogen Ecosystem

Nomad Car Hydrogen promotes the emergence of Normandy's hydrogen ecosystem through continuous training, professional development, in-depth analysis, safety

The H2MA project is co-funded by the European Union through the Interreg Alpine Space programme

enhancements, and public engagement. The project's success hinges on the collective governance of all stakeholders involved, with seven thematic committees and one steering committee guiding technical, scientific, and sociological aspects of the project.

Collaborative Committees Include:

1. Fueling
2. Risks and Training
3. Environmental Studies
4. Retrofit and Reliability
5. Acceptability
6. Valorization

1. Fueling Committee (regulatory and legal oversight)

- Testing and training at the Old Evreux station.
- Half of the Nomad Car H2 hydrogen refills are planned at the Rouen Normandy metropolis H2 station.
- Actively monitoring national and European regulations.
- Analyzing ISO 17840 for hydrogen car labeling.
- Deciphering texts related to clean vehicles, recognizing retrofit as a viable low-emission solution.

2. Risks and Training Committee

- Developing a driver training program for safe and efficient operation, including understanding the vehicle, hydrogen production, safety procedures, and risk prevention.
- Two site visits in June and July 2021 to prepare training modules.
- Developing crisis management procedures and a disincarceration plan.

3. Environmental Studies Committee

- Collaborating with INSA Rouen Normandie and Certam to analyze emissions.
- Studying the benefits of low-carbon, locally sourced hydrogen production for the retrofitted car.

4. Retrofit and Reliability Committee (Key milestones)

- ◆ September 2021: Production of the retrofit kit meeting European standards.
- ◆ October 2021: Kit road testing over 1800 km.
- ◆ December 2021: Kit delivery from the Asian production facility.
- ◆ January/April 2022: Retrofit kit installation.
- ◆ May/June 2022: Reservoir installation, cabling, and seat placement.

The H2MA project is co-funded by the European Union through the Interreg Alpine Space programme

- ◆ July 2022: Refilling and road testing.
- ◆ Fourth quarter of 2022: Vehicle homologation by UTAC.
- ◆ June 2023: Completion of UTAC testing.
- ◆ July 2023: Presentation of the vehicle at CNRV.
- ◆ Summer 2023: Commencement of operation.

5. Acceptability Committee

- Engaging the public through workshops, questionnaires, and research.
- Addressing concerns, including costs, schedule impacts, comfort, vehicle operations, hydrogen sources, and safety.
- Assimilating diverse perspectives, including passengers, locals, and road users.

6. Valorization Committee

- Showcasing the project through publications and awards.
- A proud recipient of the France Hydrogène Public Choice Award in June 2023.

In summary, Nomad Car Hydrogen stands as a remarkable example of innovation and collaboration in Normandy, bringing an innovative solution for zero-emission mobility to the forefront of the region's transportation landscape. This pioneering project heralds the potential for sustainable retrofitting and the future of heavy vehicle mobility. For a more visual explanation, a 1.5-minute video is to be found here:

<https://www.youtube.com/watch?v=Ew0PiwEldIQ>

Photo 5. Nomad Car Hydrogen H2



9. SITE VISIT IN R-HYNOCA STATION AND R-HYFIE PLATFORM

The study visit culminated at the site visit of the at R-Hynoca station and R-Hyfie platform in the Zone d'activités de la Plaine des Bouchers. The R-Hynoca station in Strasbourg will soon produce clean hydrogen energy from locally sourced biomass. A joint venture between R-ENS and Haffner Energy, the project is expected to supply the local transport industry as it transitions from fossils fuels to clean energy. By deploying Haffner Energy's Hynoca technology, the station is hoped to play a key role in Strasbourg Council's mission for decarbonisation.

9.1 R-Hynoca station

Launched in August 2019, the first Hynoca industrial unit was delivered in February 2021. The station is expected to open for commercial refuelling by early 2024 and for hydrogen production by 2025. Once operational, the unit will produce up to 720kg/ day of H2 syngas called Hypergas.

Locally sourced biomass

The biomass used in the production of hydrogen comes from a variety of local agricultural sources. These include sawdust, bark and straw. To reach its targets, the station will require approximately 22 tonnes of biomass per day. Coming from sources within 50km of Strasbourg, they are an abundant energy source. The close proximity of resources reduces the need for long supply chains and further reduces the stations carbon footprint.

Photo 6. Photorealistic representation of the R-Hynoca station



The H2MA project is co-funded by the European Union through the Interreg Alpine Space programme

Equipment & Services

- 1 “Dual Pressure” refill station 350-750 bar high capacity 700 kg / day
- 1 “Hi-Flow” station for buses and trucks
- 1 refueling interface for pressurized hydrogen cylinders “tube trailers”

More specifically,

- ⇒ The station will include one Dual Pressure refill station, equipped with two terminals for recharging all types of hydrogen mobility: at terminal for light vehicles at 700 bar and a terminal for heavy duty vehicles and buses at 350 bar ('Hi-Flow').
- ⇒ This large-capacity station will deliver 700 kg of green hydrogen per day, allowing approximately the daily recharging a fleet of 30 buses, or 70 light commercial vehicles, or 150 light vehicles.
- ⇒ McPhy will also equip the production site with a refueling point for pressurized hydrogen cylinders (“tube trailers”) to be transported and used for mobility or industrial applications away from the hydrogen production site.

Innovative and scalable, the modular design of the R-Hynoca project will enable the distribution capacity to be increased at the same rate as the applications will be deployed on the territory.

9.2 R-Hyfie platform

R-hyfie is a hydrogen technical platform dedicated to training, experimentation, network distribution and risk management. After 3 years of studies and work, R-GDS inaugurated its new operational platform in summer 2023, dedicated to team training, innovation and experimentation, including fire drills carried out jointly with the Bas-Rhin Fire and Rescue Service. With a total surface area of 8,000 m², the R-hyfie platform comprises 6 workshops, the first of which, dedicated to gas storage, mixing and injection, is the starting point for supplying all the facilities with methane gas and hydrogen, either pure or mixed. Its underground network totals almost 600m of steel and polyethylene gas pipes to supply all the technical facilities.

The objectives of the R-hyfie programme

The R-hyfie platform meets all the technical and regulatory challenges associated with the role of the network operator: mastering the technical parameters of hydrogen injection and gas quality at every point in the network, training staff and improving their skills in the construction, operation, maintenance and monitoring of networks and pipelines, and developing operating procedures to guarantee the safety of people and property.

A Hynovator Lab to anticipate future domestic uses of hydrogen

Integrated into the R-hyfie platform the "Lab Hynovateur" is an experimentation area for the integration of future hydrogen equipment into homes and tertiary buildings. It houses a

wide variety of installations and equipment for long-term testing in real-life operating conditions.

9.3 Guided tour and discussions during the H2MA partnership's site-visit

During the guided tour at the R-Hynoca station, two groups of 20 people were formed and subsequently visited the two different platforms, the R-Hynoca station and the R-Hyfie risk management platform. This subsection outlines key points presented during the tour.

The station is scheduled to commence operations by the end of this year. The site is strategically located, boasting a substantial technical center and ample space for various hydrogen-related functions. Additionally, this street houses another facility, a natural gas distribution station for heavy vehicles, along with electric charging stations. The project had its kickoff on Monday morning (18 September 2023), including the building permit and construction activities. This particular site will begin operations next Monday, with the station we are about to visit set to be operational starting early next year.

The station already has its initial users lined up, most notably the European Parliament, which plans to refuel there 20 vehicles, consisting of 10 Mercedes and 10 Hyundai Nexo fuel cell vehicles. They eagerly await the station's opening, which is projected to occur around December 2023 or January 2024, and initial tests are planned, although without the Parliament's vehicles.

A brief technical overview of the site's components: Just behind where the H2MA group was standing, there were the cement corridors, which serve as parking spaces for trailers and also house hydrogen storage vessels. There are two storage tanks, enabling to store up to one ton of hydrogen on-site, with the potential for up to 2.5 tons. This storage can be both imported and exported as needed. The part of the station for vehicle refueling features dispensers, an enclosure for storage and compression, and interface pressure. The project is focused on biomass-based energy production at 350 bar, utilizing a McPhy compressor.

McPhy's Sales Manager, M. Nikolic, who also accompanied the H2MA site visit also offered valuable insights. He underlined, that the site also has areas earmarked for future storage expansion, facilitating the growth of hydrogen capacity. Presently, the site commences with storage of less than one ton, although we have authorization for up to 2.5 tons. As hydrogen development progresses, storage capacity can be increased accordingly.

According to M. Nikolic, this station is truly exceptional, as McPhy is located right next to RGDS. The station's modular and flexible solutions allow for various types of storage and distribution stations, all seamlessly integrated. This intrinsic modularity means that different storage types and distribution benches can be combined as needed, thanks to this adaptable system. The station will be able to distribute from 200 kilograms to 1 ton per day. For this capacity, no additional compression is necessary. Notably, the compact design requires only 10 square meters of ground space.

McPhy's technology is at the core of the system, acting as the 'brain' of the installation. It not only manages all aspects of the hydrogen station, including compression, storage, and distribution but also supervises the entire system and includes a cooling system generating temperatures as low as -40 degrees Celsius. This level of cooling is achieved directly at the dispenser, ensuring optimal hydrogen distribution to vehicles. The -40 degrees Celsius temperature is crucial for certain types of vehicles with lightweight composite reservoirs and a 700-bar pressure requirement. These lightweight composite reservoirs cannot tolerate temperatures exceeding 420 degrees Celsius, and hydrogen tends to heat up during compression, unlike most gases. As a result, the cooling system becomes indispensable to prevent overheating during the distribution process.

The on-site hydrogen storage and compression area is a safety measure, as hydrogen is extremely volatile. This area is prepared for the addition of more storage, depending on the increasing number of vehicles. McPhy's thermal-chemical compressor, McFeeling Dual, will be installed on this site, which will recover waste heat for additional energy savings. This compressor will be used for both 350-bar and 700-bar refueling.

The first storage tank, associated with the compressor, operates at 900 bar and stores hydrogen, which is then sent to the dispensers. McPhy's solution is both modular and flexible, and the McFeeling compressor alone can handle a daily distribution capacity ranging from 200 kilograms to 1 ton, eliminating the need for additional compression equipment.

It's worth noting that McPhy's technology acts as the central nervous system, providing real-time data on equipment performance, consumption, pressure, temperature, and faults. This centralized system simplifies operations and ensures the highest level of safety. The site's concrete platform provides structural integrity, and all walls are fire-resistant, a necessary feature for such an installation. Given the station's CPE (Order of Environmental and Operating Conditions) classification, the project required extensive environmental impact and safety assessments. These assessments confirmed that all storage components and equipment are safeguarded against mechanical impacts and light emissions. Such in-depth assessments are typically unnecessary for stations operating under CPE classification. However, this project remained below the maximum threshold of 2.5 tons of hydrogen and opted to proceed with an authorization allowing up to 5 tons, necessitating these rigorous assessments.

The approval process for an authorization application takes approximately 12 months, and all these safety measures were meticulously undertaken, including the commissioning of a third-party expert review. This thorough preparation and commitment allowed us to secure the required authorization, even though it wasn't a standard requirement for distribution stations of this size. The station has been designed for a hydrogen production capacity of 720 kilos per day, and McPhy has factored in the potential for higher throughput in the future.

10. LESSONS LEARNT AND POLICY RECOMMENDATIONS

The study visit was homophonously deemed a success due to the high-quality organisation by project partners EMS and PVF. Moreover, it yielded several results that were proven to be particularly useful for the H2MA consortium. Here are presented some of the lessons learnt that can feed into the update of national and regional hydrogen strategies.

10.1 Lessons Learnt

Strasbourg's Strategic Position

The Grand Est region emerges as a prime candidate for spearheading and consolidating the green transition, especially concerning hydrogen's integration into mobility applications. This is attributed to its favorable geographical and economic conditions for fostering a green hydrogen ecosystem but also and most importantly to the political commitment of its public authorities.

The role of political commitment is of outmost importance

At several moments during the workshop, it became evident that perhaps the most critical aspect for the green hydrogen roll-out is a robust political commitment. Sustainable hydrogen initiatives, especially those concerning public transportation and infrastructure development, rely heavily on unwavering support from local and national authorities. As experience from other hydrogen projects show, policymakers' commitment to green hydrogen projects ensures their long-term viability.

Challenges with Homologations

The lengthy homologation processes, particularly for retrofitting existing vehicles with hydrogen technology, have been recognized as a significant impediment to rapid project deployment. To facilitate faster adoption, authorities should explore streamlined and standardized homologation procedures for eco-friendly retrofitting, enabling quicker integration of green hydrogen buses into public fleets.

Timely Certification Frameworks

A persistent challenge is the protracted certification procedures. The study visit underlines the pressing need for a unified European framework for standards and certifications. By

establishing consistent, Europe-wide criteria for green hydrogen technologies, regulatory bodies can expedite approvals and bolster trust in the sector.

Variability in Construction Practices

The study noted substantial variability in construction methods within the green hydrogen sector. The approach taken often depends on the specific operator and constructor involved. This underscores the necessity for defining and disseminating standardized construction practices to ensure consistency and quality across hydrogen infrastructure projects.

Risk management in technical (not-hydrogen related) Works

A noteworthy observation during the site visit was that most hydrogen-related risks occur through technical procedures performed by technicians with expertise in other technologies. This suggests that meticulous risk management strategies are essential for maintaining safety within the sector. To mitigate these risks, organizations and governments should emphasize the criticality of proper training and compliance with safety protocols.

10.2 Policy recommendations

1. Strengthen political support

National and regional authorities should bolster their commitment to green hydrogen projects by enacting clear policies, long-term funding commitments, and incentives to promote the growth of green hydrogen mobility. A dedicated hydrogen strategy at the national and regional levels will ensure that green hydrogen remains a central focus.

2. Streamline homologation processes

Policymakers, in collaboration with relevant agencies, should establish expedited homologation procedures for retrofitting vehicles with hydrogen technology. This will encourage the rapid deployment of green hydrogen buses in public transportation fleets.

3. Unified certification Framework

Advocate for the establishment of a standardized, pan-European certification framework for green hydrogen technologies. Cooperation between European countries will ensure consistent standards and expedite certification procedures, ultimately boosting confidence in green hydrogen solutions.

4. Standardized construction guidelines

Develop and disseminate standardized construction practices for green hydrogen infrastructure, ensuring that all projects adhere to consistent quality and safety standards. These guidelines should address construction practices specific to the sector.

5. Enhance technical training

Prioritize safety and risk management training for technicians and workers involved in hydrogen-related technical works. Implement stringent certification requirements and on-the-job training programs to mitigate potential risks associated with green hydrogen technologies.

6. Collaborative standardization efforts and definition of common European standards

While the importance of common standards is acknowledged, there's an ongoing need to delineate comprehensive, pan-European regulations specific to the green hydrogen sector. Policy recommendations call for collaborative efforts among European Union member states to establish unified standards that harmonize the development of green hydrogen infrastructure.

7. Cross-border collaboration

Encourage cross-border collaboration among European Union member states and among Alpine Space countries to expedite the definition of common European standards for green hydrogen technologies. Such collaboration will pave the way for a cohesive European green hydrogen ecosystem, minimizing regulatory fragmentation and fostering the growth of the industry.

8. Prioritize Risk Management

Invest in comprehensive risk management strategies, including hazard identification, assessment, and mitigation. Promote a safety-first approach across the green hydrogen sector by enforcing strict safety protocols and best practices.

ANNEX 1 – STUDY VISIT AGENDA



H2MA

H2MA

"Green Hydrogen Mobility for Alpine Region Transportation"

Study Visit on Urban transportation Agenda

Document version : 07/09/2023

Date: 20th September 2023

Strasbourg, France

For any additional information, please contact us :

Jean Melounou / EMS
jean.melounou@strasbourg.eu
+ 33 3 68 98 65 68

Auriane Agard / PVF
aa@vehiculedefutur.com
+33 6 25 07 90 55

The H2MA project is co-funded by the European Union through the Interreg Alpine Space Programme



The H2MA project is co-funded by the European Union through the Interreg Alpine Space programme

Wednesday, 20th of September

8:30	Welcome Venue: <i>Centre Administratif Ville et Eurométropole de Strasbourg</i> 1 parc de l'étoile, 67000 Strasbourg	
9:00	Greetings and welcome Pia Imbs – President of the Eurometropole of Strasbourg Bruno Grandjean – Pôle Véhicule du futur	
9:15	Introduction and agenda Jean Melounou - Eurométropole de Strasbourg	
9:25	H2MA project presentation Matevž Šilc -KSENA	
9:40	Grand Est H2 corridor approach Sabine Goetz– Grand Est Region	
10:00	Feedback from the first deployments of hydrogen-powered electric buses in France Jan-Erik Starlander - France Hydrogène	
10:30	Coffee break and networking	
11:00	Roundtable discussion – local authorities testimonies Emmanuel Jobard– Communauté de l'Auxerrois Marc Rovigo – Syndicat mixte des transports en commun (Belfort)	 
11:45	Creation of a territorial hydrogen ecosystem at the Ports of Strasbourg Philippe Follet - Hynamics	
12:10	Nomad Car Hydrogen : retrofit of a diesel powered coach Amandine Allard - Transdev	
12:30	Lunch break and networking	
13:45	Departure, transfer Parc de l'étoile	
14:15	On-site visits R-HYNOCA : Green Hydrogen and distribution unit R-HYFIE : Hydrogen risk education platform	
16:00	Review of the day and closing	
16:30	Departure, transfer	
18:00	Visit of Historic Wine Cellar of Strasbourg Hospices 1 place de l'hôpital STRASBOURG	
20:15	Closure dinner (at own charge) Restaurant : Maison Kammerzell 16 place de la Cathédrale, Strasbourg	
	End of Visit	

The H2MA project is co-funded by the European Union through the Interreg Alpine Space programme

ANNEX 2 – PARTICIPANTS’ LIST

Participant's Surname	Participant's Name	Affiliation	Title
AGARD	Auriane	Pôle Véhicule du Futur	European project manager
ANDRE	Sandrine	Eurométropole de Strasbourg	Head of innovation
BALLARIN DENTI	Antonio	Lombardy Foundation for the Environment	President of the Scientific Committee
BENVENUTI	Matteo	Codognotto Italia	Public Finance Specialist
CONTA	Paolo	industrial Asociation of chivassesse	president industrial Asociation of chivassesse
DE LOTH	Wolfgang	PUNCH Group	New Business Development & Sales Manager PUNCH Group
ESTIVO	Giuseppe	Città Metropolitana di Torino	funzionario
FOLLET	Philippe	HYNAMICS	Responsable du développement
FRITSCH	Marjorie	Eurométropole de Strasbourg	
GALANTE	Silvia	Regione Lombardia	project manager for RL
GOETZ	Sabine	Région Grand Est	
GRANDJEAN	Bruno	Pôle Véhicule du Futur	General Manager
HAENN	Jacques	Pôle Véhicule du Futur	Chargé de Mission hydrogène
HERVE-BAZIN	Olivier	Eurométropole de Strasbourg	Chargé de mission Economie Verte
HUMMER	Evelyn	4ward Energy Research GmbH	Junior Researcher
IMBS	Pia	Eurométropole de Strasbourg	Présidente
JOBARD	Emmanuel	CA de l'Auxerrois	Chef de projet hydrogène
JOCHUM	Oliver	Klimapartner Oberrhein e.V.	Projectmanager
JOFFROY	Michael	CTS	Responsable Matériel roulant
KAMMILI	Trishna	R-GDS	Head of Innovation & Digital
KARAKOSTAKI	Charitini	Syncnify	rapporteure
KOVAČ	Lidija	BSC, Ltd, Kranj	Director of finances
KRAJNC	Boštjan	KSENA	Director
MARINO	Alessandro	Italian German Chamber of Commerce	Managing Director
MAYER	Ulrike	Messe Stuttgart	Head of Representation for France and Austria
MAZZA	Pasquale	Città Metropolitana di Torino	Deputy Councilor Città Metropolitana di Torino

Participant's Surname	Participant's Name	Affiliation	Title
MELOUNOU	Jean	Eurométropole de Strasbourg	Head of mission for innovative mobility
MOREL	François		Traducteur
NATEK	Niko	KSENA	Project Manager
ODLAZEK	Blanka	BSC, Ltd, Kranj	Project Manager
PAYRE	Henri		Traducteur
PICCOLI	Guido	Codognotto Austria - ALOT S.r.l.	External Expert Codognotto Austria
POL GILI	Gerard	Eurométropole de Strasbourg	Head of Renewable Energies
REY	Caroline	Grand E-NOV+	Responsable GET Environnement et transition énergétique
RICHTER	Alina	e-mobil BW GmbH	Referentin Projektmanagement Wasserstofftechnologien
ROVIGO	Marc	Syndicat Mixte des Transports du Territoire de Belfort	Directeur général
SCHIBER	Jean-Baptiste	Eurométropole de Strasbourg	International affairs officer
SIEGEL	Jennifer	Eurométropole de Strasbourg	
ŠILC	Matevž	KSENA	Project Manager
STARLANDER	Jan-Erik	France Hydrogène	Head of relations with territories and local authorities
TAŠLER	Mitja	Thermal Power Plant Šoštanj	Assistant Director
VITO	Domenico	Lombardy Foundation for the Environment	Collaborator
WEINLING	benoit	Eurométropole de Strasbourg	responsable parc automobile ville et eurométropole de strasbourg
ZERBI	Eleonora	Italian German Chamber of Commerce	Project Manager

ANNEX 3 – PHOTOS FROM THE 2-DAY STUDY VISIT IN STRASBOURG

Photo 1. Jean Melounou welcoming the study visit's participants in the 1st day, at the PH8.



Photo 2. H2MA project meeting during the 1st day of the study visit.



Photo 3. The H2MA consortium and their guests in a boat tour at the Ill River.



Photo 4 H2MA partners convening in 2nd Day of the workshop at the Strasbourg's Municipal Council Hall



Photo 5. Pia Imbs, President of the Eurometropole of Strasbourg and Bruno Grandjean from Pôle du Véhicule du Futur opening the 2nd day's thematic sessions



Photo 6. The H2MA consortium during the site visit at the R-Hynoca station



The H2MA project is co-funded by the European Union through the Interreg Alpine Space programme