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Alpine Space

H2MA

Deliverable D.1.1.1

METHODOLOGY AND TOOLS

for mapping green H2 mobility infrastructure gaps in Alpine space vis-à-vis planned territorial hydrogen strategies

Activity 1.1

March, 2023

DOCUMENT CONTROL SHEET

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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.

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GLOSSARY

IEA	International Energy Agency
OPEC	Organization of the Petroleum Exporting Countries
GHG	Green-house gas
FCEV	Fuel Cell Electric Vehicle
BEV	Battery Electric Vehicle
NUTS	Nomenclature of territorial units for statistics (Eurostat)
HRS	Hydrogen refuelling station
OEM	Original equipment manufacturer (OEM)
EUSALP	EU Strategy for the Alpine Region
TEN-T	Trans-European Transport Network

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ABSTRACT

In the context of Activity 1.1, titled "Mapping and analysis of Alpine space infrastructure gaps in green H2 mobility vis-à-vis upcoming plans for H2 roll-out in partnership territories", the present methodology aims at guiding H2MA partners in identifying H2 mobility infrastructure gaps across Alpine Space.

To that end, it provides:

- The aim and scope of the methodology (Introduction)
- Thematic background on i) the infrastructure requirements for the development of green H2 transalpine routes, and ii) hydrogen infrastructure targets set in European and national frameworks (Section 2)
- The survey design, including the research goals and guidelines for the data collection (Section 3)
- The task allocation, KPIs and the timeline for the data collection (Section 4)
- Resources to support partners in their research
- A data collection tool annexed at the end of this document (ANNEX).

1. INTRODUCTION

Climate change is one of the greatest challenges of our era, with already serious impacts on people and the environment. Committed to reducing greenhouse gas (GHG) emissions, the EU has set ambitious goals to achieve carbon neutrality by 2050, and become the first climate-neutral continent. This goal requires significant changes in the energy sector, including a shift away from fossil fuels and an increased use of renewable energy – something that has become all the more urgent due to the war in Ukraine and Europe's commitment to reduce dependency from Russian fossil fuels. In this respect, transitioning to a hydrogen economy has the potential to contribute to decarbonisation, mitigating negative climate change impacts, and improve energy security of European economies, drastically reducing dependence on fossil fuels.

1.1 The potential of green hydrogen

Hydrogen is an energy carrier that can be used to produce electricity, heat and power for a wide range of applications, including transportation, industrial processes, power generation and energy storage. When used in a fuel cell, hydrogen produces electricity with only water as by-product, making it a highly desirable source of energy for reducing greenhouse gas (GHG) emissions. Yet, as regards its production, not all hydrogen is zero-emission. Only green hydrogen, which is produced from water electrolysis using electricity from renewable energy sources such as wind and solar, has zero-emissions from production to consumption. For the purposes of this document, when we refer to hydrogen we only mean green hydrogen.

Green hydrogen represents the most promising decarbonisation pathway, especially in sectors where electrification is challenging, namely in road freight, shipping and aviation. In the case of long-haul, heavy-duty vehicles the heavy weight of the required batteries and the long time needed to charge them constitute important inhibiting factors for the adoption of electric mobility. On the contrary, hydrogen-powered fuel cell trucks, enjoy shorter refuelling times, greater range, and maintain their ability to carry very heavy loads.

While in recent years there has been progress in developing hydrogen infrastructure in some areas, there are still significant gaps that need to be addressed to support the widespread adoption of hydrogen as a clean energy source. Public authorities and stakeholders across the Alpine space need to mitigate the climate change impact of heavy-duty transport and collaborate to ensure that infrastructure is developed in a way that addresses the needs of the entire region and ensures economies of scale.

1.2 Addressing the problem of infrastructure gaps in green hydrogen mobility

Within Activity A1.1 of the H2MA project, titled "Mapping and analysis of Alpine space infrastructure gaps in green H2 mobility vis-à-vis upcoming plans for H2 roll-out in partnership territories", the present Methodology (D1.1.1) aims to help project partners to map green hydrogen mobility infrastructure gaps in the Alpine Space. To that end, it provides a three-step systematic approach, namely:

i) Identifying a) existent and b) planned hydrogen mobility infrastructure
ii) Identifying hydrogen mobility targets set in European, national and regional frameworks
iii) Identifying discrepancies between i) and ii)

This methodology as well as guidelines for the data collection process to be conducted by the project partners, are further explained in Section 3 of this document. The final outcome of the methodology implementation will be an essential set of data relevant to the development of hydrogen mobility infrastructure in the EUSALP area which will feed into the development of the Final report on green H2 mobility infrastructure gaps in the Alpine space (D.1.1.2). The structure of the methodology is based on the necessary infrastructure required for the development of a comprehensive hydrogen refuelling and supply network, as well as on the existing hydrogen mobility policy framework. The following section provides thematic background on the necessary infrastructure components of the H2 ecosystem as well as on key aspects of the European policy framework focusing on the TEN-T network infrastructural prerequisites.

2. THEMATIC BACKGROUND

The transition from one fuel supply system to another is a demanding and lengthy process that requires careful planning, coordination and stakeholders' engagement. In particular, promoting hydrogen mobility at the regional level requires both technical know-how as well as an understanding of the overarching strategies. The first part of this section presents the three main components of hydrogen mobility infrastructure, namely, i) hydrogen production, ii) hydrogen transport and iii) hydrogen storage and refuelling. The second part focuses on policy frameworks, with emphasis on European strategies and the European directive on supply in the TEN-t network.

2.1 Basic infrastructure components of hydrogen mobility

Hydrogen mobility infrastructure refers to the components that are necessary for the deployment and operation of hydrogen-powered fuel cell electric vehicles (FCEVs). These covers: i) Hydrogen production, ii) Hydrogen transport via pipeline infrastructure or other hydrogen transportation arrangements and) hydrogen storage and refuelling, namely, hydrogen refuelling stations (HRS). A better understanding of these three components will allow the identification of infrastructure gaps in the hydrogen supply chain.

- **Hydrogen production:** The production of hydrogen is the first pillar of hydrogen mobility. It is produced from water and electricity by means of electrolysis. Yet, the capital costs for electrolysers still remain very high. In order for electrolysis to be cost-effective, low-cost electricity from renewable energy sources needs to become widely available. This is the reason why, in some new hydrogen projects, such as the Puertollano Green Hydrogen Plant in Spain, renewable energy generation and hydrogen production are located in a joint facility. For existent small-scale projects however, hydrogen production is done through on-site electrolysis, since it is more practical to produce hydrogen directly at the HRS using an electrolyser. This eliminates transportation costs and also makes the adjustment to fluctuations in demand easier since hydrogen generation can be easily scaled up or down to meet demand. This however, cannot represent a long-term solution as the transition to a hydrogen economy will require a centralised production to reduce production costs.
- **Hydrogen transport**: Hydrogen can be transported from the production site to an HRS through different methods, depending on the distance and quantity. According to the 2020 Clean Hydrogen Monitor, around two thirds of hydrogen in the EU are produced on site for site specific production processes. In most cases, hydrogen is transported via compressed gas trailers or liquid hydrogen tankers. In the first case, hydrogen is compressed and stored in high-pressure containers which then can be transported to the HRS. In the second case, hydrogen is first liquified and stored in tankers which are then transported by truck or ship to the HRS. Transport via liquid hydrogen tankers have the ability to carry larger quantities, yet liquefying hydrogen requires a lot of energy and is most expensive. In the long term, the most viable

transport method remains the transmission via pipelines, but current infrastructure is insufficient. There are currently less than 1000 km of hydrogen pipelines (600 km in Belgium and 400 km in Germany), compared with more than 200,000 km of natural gas transmission pipelines. In order to enable the roll-out of hydrogen economies, one solution would be to transform the gas grid into hydrogen, significantly reducing the capital costs, but this presupposes a massive use of hydrogen in numerous sectors.

- **Hydrogen refuelling stations (HRS)**: HRS are the main stationary applications, equivalent to the traditional gas stations. An HRS includes storage and dispensing infrastructure, which can vary according to the vehicles it intends to serve. Hydrogen is dispensed at 700 bar pressure in passenger FCEVs and at 350 bar pressure in long-haul, heavy-duty trucks and commercial FCEVs. Consequently, not all HRS are suitable for all types of vehicles. The compressor size is particularly decisive. While passenger cars fuel 4kg on average, a commercial vehicle requires up to 20kg of hydrogen. Most HRS currently existing in the Alpine space and in Europe in general are designed to serve passenger cars, at 700 bar. Consequently, most HRS would need to be upgraded to serve both passenger and commercial vehicles, or new HRS prioritising heavy-duty vehicles would have to be built.

2.2 The European policy framework for the deployment of green hydrogen

The EU has established a policy framework to support the deployment of green hydrogen as part of its efforts to achieve the transition to a low-carbon economy. Yet, its uptake by the road transport sector still remains limited. For hydrogen to contribute to climate neutrality, it needs to achieve a much greater scale, both at the production and consumption level. Hereunder relevant EU policy initiatives and regulations are listed.

European Green Deal: The European Green Deal is a comprehensive plan to make the EU climate-neutral by 2050. It includes a number of initiatives to support the deployment of green hydrogen, such as the EU Hydrogen Strategy.

EU Hydrogen Strategy: This strategy sets out a roadmap for the development of a hydrogen economy in Europe, with a focus on green hydrogen. The strategy includes **a target of deploying at least 40 GW of electrolysers in the EU by 2030, and up to 100 GW by 2040**.

EU Clean Hydrogen Alliance: This is a platform that brings together stakeholders from across the hydrogen value chain, including industry, civil society and research organisations. The Alliance aims to support the deployment of clean hydrogen in Europe and promote cooperation between stakeholders.

REPowerEU: REPowerEU is the European Commission's plan to make Europe independent from Russian fossil fuels well before 2030, in light of Russia's invasion of Ukraine, while increasing the resilience of the EU-wide energy system.

The TEN-T regulation: The TEN-T regulation, including Regulation (EU) No 1315/2013 of the European Parliament and of the Council of 11 December 2013 on Union guidelines for the development of the trans-European transport network and its amendment Regulation (EU) 2021/1153, sets out the legal framework for the development of the TEN-T network. The Trans-European Transport Network (TEN-T) policy was established in 2013 with the aim of fostering the planning, development and operation of transnational European transport corridors of common interest. Besides roads, the network comprises railways, inland waterways, sea shipping routes, maritime and inland ports and airports. The concept relies on ensuring safe, efficient and multimodal transport that is in line with other EU key strategic policies on environment, energy and social integration. The network comprises two layers, the Core Network includes the most important connections, linking the most important nodes (to be completed by 2030) and the Comprehensive Network, which covers all European regions and is to be completed by 2050.

Fit for 55 in 2030 package: Fit for 55 in 2030 package is a set of legislative proposals by the EU to achieve the goal of reducing GHG emissions by at least 55% by 2030 compared to 1990 levels. The package includes hydrogen infrastructure targets as part of its broader efforts to decarbonize the EU economy. In particular, Article 6 "Targets for hydrogen refuelling infrastructure of road vehicles" includes the requirement to expand the charging/refuelling capacity along the main transport corridors. For hydrogen refuelling the target is to establish **HRS at regular intervals every 150 kilometres** on main roads (TEN-T) and more frequently in urban areas. It also sets the target to have sufficient HRS to enable the deployment of up to **1 million FCEVs on EU roads by 2030**. These two targets are based on a third one, regarding the deployment of green hydrogen, aiming for **40 GW of renewable electrolysers by 2030**.

2.3 National strategies for the deployment of green hydrogen

The above-mentioned policy instruments have a profound impact on the momentum and extent of the deployment of hydrogen technologies in transport applications. There are however, strategies and policy frameworks adopted by all EUSALP countries, which set their own hydrogen infrastructure targets for the years to come. Some of them are presented below.

German National Hydrogen Strategy: The strategy was adopted by the German government in June 2020 and sets out ambitious targets for the development of a hydrogen economy in Germany, including the installation of **5 GW of electrolyser capacity by 2030** and the production of **10 million tons (or 14 TWh) of green hydrogen per year**. The strategy also aims to establish a network of at least **400 HRS in Germany by 2025**, and up to **1000 HRS by 2030.**

National Strategy for the development of decarbonised hydrogen in France: The national hydrogen strategy of France includes a range of measures to support the deployment of hydrogen technologies in key sectors. Some of the infrastructure targets set out in the strategy foresee a production capacity of **10 TWh in 2023** and **20 TWh in 2030**, the deployment of **1000 HRS in France by 2030** and the existence of **6000 FCEVs and 200 hydrogen buses by 2023** and **up to 200,000 FCEVs and 5000 hydrogen buses by 2030**.

Italian National Hydrogen Strategy: The Italian Hydrogen Strategy aims to deploy at least **1 GW of electrolyser capacity by 2025 and at least 5 GW by 2030**, as well as to develop a network of HRS, in order to serve the **2,000 FCEVs (including buses and trucks) expected to circulate by 2025**, which then are expected to reach **30,000 by 2030**.

Austrian National Hydrogen Strategy: The strategy aims to deploy at least **1 GW of electrolyser capacity by 2030**. One of the important goals of the strategy is also to replace fossil-based hydrogen with climate neutral hydrogen in energy intensive industries: 80 % until 2030.

All of the above policy frameworks set out the methodological basis for acknowledging deficiencies and shortcomings and **will be used as the measurable benchmark against which hydrogen infrastructure gaps will be identified**. However, targets presented above are only **indicative** and their identification requires further investigation. Moreover, one must be particularly careful as to the existence of other relevant policy instruments, mechanisms and support structures which deal with the advancement of hydrogen **at a regional level**. Such an example is the Bavarian Hydrogen Strategy, under the name Hydrogen Roadmap Bavaria. The Hydrogen Roadmap Bavaria is a comprehensive plan for the development of a hydrogen economy in the region, which sets more ambitious targets than the German National Hydrogen Strategy. For example, regarding the deployment of HRS, the Roadmap aims to establish 100 public HRS in the region by 2023 (the target was set in 2019), with a further 50 HRS planned for the following years. In contrast, the German National Hydrogen Strategy sets a target of only 100 operational HRS throughout the entire country by 2023. This means that the threshold target for Bavaria is higher than the national target for the entire country. The next section explains how the target data should be collected and used.

3. SURVEY DESIGN

3.1 Research goals

The methodology addresses the subject of gaps in the development of hydrogen infrastructure for transport applications (mainly heavy-duty freight and passenger transport) across the Alpine space. Partners will collect data regarding a) existent and planned infrastructure and b) territorial targets for hydrogen deployment set in European, national and regional frameworks. The second set of data will be used as benchmark against which hydrogen infrastructure gaps will be identified.

3.1.1 Identifying existent and planned hydrogen infrastructure

Partners will map existent and planned hydrogen infrastructure in EUSALP territories. As planned infrastructure is defined any infrastructure that has already been announced, is under construction, on trial phase, or about to become operational. Data collection focuses on the three components presented in the previous section, namely:

i) Hydrogen refuelling stations (HRS)
ii) Hydrogen production units (hydrogen plants)
iii) Hydrogen transport arrangements (hydrogen gas trailers, liquid hydrogen tankers, transmission pipelines).

It is recommended to identify HRS first, as it is easier to locate them (especially by using the H2live tool, H2stations.org platform and the TEN-T (TENtec) network platform for renewables) and then look for the pathway back to hydrogen production and the way they are interconnected. Since hydrogen production from renewable energy sources (RES) is still expensive, in many cases the transition to a hydrogen economy has been attempted with other low-carbon methods. For example, purple hydrogen which is produced from biomethane, generated by the anaerobic digestion of organic matter such as waste biomass or agricultural waste represents such a low carbon solution. This is the case of the R-Hynoca project in Strasbourg, which uses syngas as feedstock for hydrogen production through a process called steam methane reforming (SMR) aiming to support the transition to hydrogen by refuelling the fleet of city buses to be purchased by the city of Strasbourg. Partners are invited to identify production facilities for these low-carbon forms of hydrogen if and when they exist, as well as hydrogen plants that may not yet be producing green hydrogen, but are planning (or have otherwise publicly announced their intention) to go green in the coming years.

3.1.2 Identifying infrastructure targets in policy frameworks

Partners will also identify **measurable hydrogen infrastructure targets by 2030** in regard with the above-mentioned infrastructure components, namely electrolyser capacity, refuelling and supply capacity, HRS, transmission infrastructure. **The EU sets a number of minimum targets** that can be found to be more or less ambitious compared to national

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action plans. For this reason, partners are also asked to identify such targets in national and regional plans and consider the more ambitious strategy as baseline for each regional case. In that way partners will be able to identify specific areas where infrastructure deployment is inadequate or fails to cover the necessary threshold that would enable a wider uptake of hydrogen powered vehicles.

3.2 Guidelines for data collection

Identifying infrastructure gaps is a complex task that requires a comprehensive understanding of existing infrastructure, planned infrastructure and the potential for future growth of hydrogen mobility, as stated in territorial deployment policies. To guarantee that all information is documented in a consistent and clearly structured manner, the methodology provides a common approach. To this end, a questionnaire has been developed and annexed at the end of this document.

The questionnaire aims to help project partners to gather data on three groups of questions:

A. Existent and planned infrastructure
B. Hydrogen infrastructure targets
C. Infrastructure gaps assessment

The first group of questions "Existent and planned infrastructure" will seek to collect data on the three infrastructural components, taking into account parameters such as quantity, interface and geography. More specifically, partners will need to collect information on hydrogen production capacity, HRS refueling capacity, HRS connection with hydrogen plants (if any), HRS location (e.g. along the TEN-T network).

The second group of questions "Hydrogen infrastructure targets" will seek to identify measurable targets in regard to the three infrastructural components. Even though EUSALP territories are all supposed to follow EU policy frameworks, there may be variations from country to country that need to be recorded. When national or regional action plans set higher targets, then these will be taken as the minimum target. Otherwise, the European target will be taken as the threshold. In any case, the lower target to be used as a benchmark for identifying gaps will be the highest declared target.

The third group of questions "Infrastructure gaps assessment" will seek to support a preliminary evaluation of the data collected in the previous two categories. This evaluation will be based on the quantification of the discrepancy between the first two categories (i.e. existing/planned infrastructure versus infrastructure targets). However, since it is an assessment, partners are only asked to evaluate information they have at hand, and not to provide a comprehensive evaluation, taking into account additional analytical parameters, which will be secondarily considered during the development of the Final report on green H2 mobility infrastructure gaps in the Alpine space (D.1.1.2).

4. KEY PERFORMANCE INDICATORS (KPIs) AND TASK ALLOCATION

Key Performance Indicators have been set to ensure the effectiveness of data collection effort. The aim of these KPIs is to track and monitor the data collection process and to make sure that the data gathered will be sufficient, consistent and accurate.

4.1 Action Plan and roadmap for data collection

All project partners are expected to answer all the questions in the groups B, C, D, E.1. In case there is no infrastructure to identify, please leave blank. Selected partners will **additionally** answer the questions in the groups E.2 and E.3, according to the task allocation presented in the following subsection. Providing answers for the group F, although strongly recommended, is optional, as some partners may have more information on the targets than others. In any case, the assessment asked at the group F should be based on the judgment of the person completing the questionnaire.

Considering the timeline of Activity A.1.1 as well as the executive capacities partners, the following timetable has been set. After project partners have received the Methodology developed by KSSENA, they have until 20 March to provide feedback (one week). Any comments and modifications will be then sent to all partners. The deadline for H2MA partners to provide territorial data by filling-in the questionnaire is April 13th 2023. KSSENA will review the collected data. All responses should be gathered and delivered in an integrated format.

Finally, the data gathered will be analysed and used for drafting the final deliverable of H2MA Activity A.1.1 – which is to be delivered by the KSSENA until May, 1st, 2023.

4.2 Task allocation

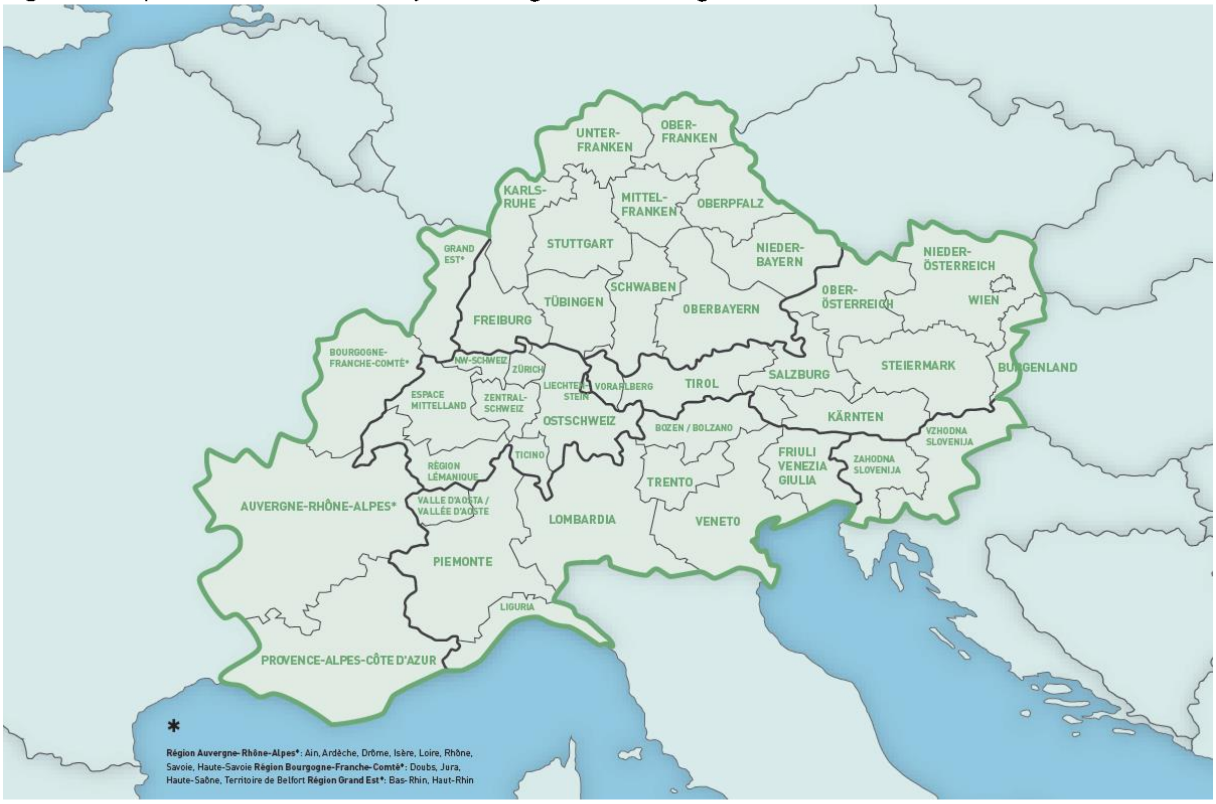
The methodology is provided for mapping the Alpine space in its entirety which includes all 42 regions (NUTS level 2) involved in the cooperation area of the programme. However, despite strong reliance on regional decision-making, several key strategic documents may be drafted only for the federal or national level. As a result, availability of data on targets for hydrogen deployment may be limited in some EUSALP regions. Consequently, even though the focus of data acquisition is primarily on the regional level, if this is not provided, focus will be on the national and European levels.

Partners will provide data for all Alpine countries, with the exception of Switzerland and Liechtenstein, since they are not Member States and it is difficult to include them in the plans for the future development of the green hydrogen mobility infrastructure, which are largely linked to the EU funding along the TEN-T corridors.

All partners will be tasked with data collection in one or more regions. Some partners will be additionally tasked with data collection on national level. One partner (KSSENA) will be tasked with data collection on European level. Finally, all partners are encouraged to provide an assessment on gaps infrastructure in the region(s) that was assigned to them.

The task allocation per partner and per region as well as per partner and per country is presented in the tables below.

Figure 1: Map of the: EUSALP territory – IASP regions, excluding Switzerland and Liechtenstein.



Number of regions falling under the Interreg Alpine space programme: 42

Number of regions investigated in the scope of activity A1.1: 34

List of regions to be investigated in the scope of activity A1.1 and their assignment to partners for the groups of questions B, C, D, E1 and F:

Nr.	Country/region	NUTS 2	Partners
Slovenia		**SI**	**BSC KRANJ, KSSENA**
1	Eastern Slovenia	SI03	KSSENA
2	Western Slovenia	SI04	BSC KRANJ
Austria		**AT**	**COD, 4ER**
3	Burgenland	AT11	COD
4	Lower Austria	AT12	COD
5	Vienna	AT13	COD
6	Carinthia	AT21	COD
7	Styria	AT22	4ER
8	Upper Austria	AT31	4ER
9	Salzburg	AT32	4ER
10	Tyrol	AT33	4ER

Nr.	Country/region	NUTS 2	Partners
11	Vorarlberg	AT34	4ER
Germany		**DE**	**ITALCAM, KPO**
12	Sttutgart	DE11	ITALCAM
13	Karlsruhe	DE12	ITALCAM
14	Freiburg	DE13	KPO
15	Tubingen	DE14	KPO
16	Oberbayern	DE21	ITALCAM
17	Niderbayern	DE22	ITALCAM
18	Oberpfalz	DE23	KPO
19	Oberfranken	DE24	KPO
20	Mittelfranken	DE25	KPO
21	Unterfranken	DE26	KPO
22	Schwaben	DE27	ITALCAM
France		**FR**	**EMS, PVF**
23	Franche-Comté	FRC2	EMS
24	Alsace	FRF1	EMS
25	Auvergne - Rhône-Alpes	FRK2	PVF
26	Provence-Alpes-Côte d'Azur	FRL0	PVF
Italy		**IT**	**LR, CMT, FLA**
27	Piemonte	ITC1	CMT
28	Valle d'Aosta	ITC2	CMT
29	Liguria	ITC3	LR
30	Lombardia	ITC4	LR
31	Bozen/Bolzano	ITH1	CMT
32	Trento	ITH2	LR
33	Veneto	ITH3	FLA
34	Friuli-Venezia Giulia	ITH4	FLA

List of countries to be investigated in the scope of activity A1.1 and their assignment to partners for the group of questions E.2

Country	Group of questions E.2	Partners conducting analysis
Slovenia	√	BSC KRANJ
Austria	√	COD
Germany	√	ITALCAM
France	√	EMS
Italy	√	LR

Partner to investigate targets at the EU-level in the scope of activity A1.1 for the group of questions E.3:

EU-LEVEL	**KSSENA**

5. SOURCES

[1] Regulation (EU) No 1315/2013 of the European Parliament and of the Council of 11 December 2013 on Union guidelines for the development of the trans-European transport network

Link: EUR-Lex - 32013R1315 - EN - EUR-Lex (europa.eu)

[2] Regulation of the European Parliament and of the Council of 7 July 2021 establishing the Connecting Europe Facility and repealing Regulations (EU) No 1316/2013 and (EU) No 283/2014 (Text with EEA relevance

Link: EUR-Lex-32021R1153-EN-EUR-Lex (europa.eu)

[3] H2 MOBILITY has created an on-line tool mapping all public HRS in Europe, allowing users to obtain information on the types of vehicle each station serves as well as real-time information on the current status of the station (e.g. when/how long ago was the last service, the hydrogen quantity that was refuelled). The same application allows to see how many HRS are open at any given moment across Europe, how many are in the planning, approval, execution or trial operation phase.

Link: https://h2.live

[4] TENtec Interactive Map Viewer developed by the European commission, is one of the "baseline" platforms for detecting various important infrastructure data related to the already existing and planned routes of the European transnational transport corridors, going through EU space.

Link: https://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/map/maps.html

[5] H2stations.org database has been operated by the German LBST company (Ludwig-Bölkow-Systemtechnik GmbH) since 2005, offering the most comprehensive information on hydrogen refuelling stations worldwide. Data is collected and updated continuously from multiple sources on a best effort basis. H2stations.org does not provide information on the current availability of a hydrogen station, but does provide a global overview of the existing, planned and completed infrastructure.

Link: https://www.h2stations.org/stations-map/?lat=49.139384&lng=11.190114&zoom=2

ANNEX – QUESTIONNAIRE

This questionnaire maps existent and planned hydrogen infrastructure and infrastructure targets in policy frameworks and assesses gaps between the two. Please repeat answer as many times as needed, and provide links when available.

	QUESTIONNAIRE FOR H2MA ACTIVITY A.1.1	
A	**CONTACT INFORMATION**	
A.1	Name and Surname of the person filling the questionnaire	
A.2	Affiliation (partner organisation):	
A.3	Email:	
A.4	Territory covered:	
B	**IDENTIFYING EXISTENT AND PLANNED H2 INFRASTRUCTURE**	
	Hydrogen Refuelling Stations (HRS)	
B.1	Could you please identify HRS in your own territory? (Please repeat answer as many times as needed)	
	Operator	
	Specific location (city, region, coordinates)	
	Storage capacity	
	Refuelling/dispensing capacity	
	Vehicles served (Please select all that apply)	☐ Passenger cars ☐ Heavy-duty trucks/Buses ☐ Trains
	Relevant resources (Please provide a link)	
	Is this HRS located on the TEN-T network?	☐ YES ☐ NO
	If you answered No, please specify distance	

	Does it have an on-site production unit?	☐ YES ☐NO
	Interface with hydrogen production unit	☐Via pipelines ☐Via hydrogen gas trailers ☐Liquid hydrogen tankers ☐Solely on-site production
B.2	Could you please identify any planned HRS in your assigned territory? (Please repeat answer as many times as needed)	
	Name/Operator	
	Specific location (city, region, coordinates)	
	Storage capacity (if disclosed)	
	Refuelling/dispensing capacity	
	Vehicles served (Please select all that apply)	☐ Passenger cars ☐ Heavy-duty trucks/Buses ☐ Trains
	Relevant resources (Please provide a link)	
	Is this HRS located on the TEN-T network?	
	Does it have an on-site production unit?	☐ YES ☐ NO
	Interface with hydrogen production unit	☐ Via pipelines ☐ Via hydrogen gas trailers ☐ Liquid hydrogen tanker ☐ Solely on-site production
	Which production plant(s) is it connected to?	
C.	**Hydrogen Production**	

C.1	Could you please identify hydrogen plants (for green hydrogen or other low-carbon forms) in your own territory? (Please repeat answer as many times as needed)	
	Name	
	Specific location (city, region, coordinates)	
	Type of hydrogen (e.g. green, or other)	
	Production capacity	
	Storage capacity	
	Uses of hydrogen	☐ Mobility sector ☐ Other industries
	Relevant resources (Please provide a link)	
	Is this plant connected to a pipeline grid?	☐ YES ☐ NO
	Is this plant connected to one or more HRS?	☐ YES ☐ NO
	If you answered yes in the previous question, please indicate which HRS	
C.2	Could you please identify any planned green hydrogen plants (or other types of hydrogen production units) in your own territory? (Please repeat answer as many times as needed)	
	Name:	
	Specific location (city, region, coordinates):	
	Production capacity:	
	Storage capacity:	
	Hydrogen applications:	☐ Mobility sector ☐ Other industries

	Relevant resources (Please provide a link):	
	Is this plant connected to a pipelines grid?	☐ YES ☐ NO
D.	**Hydrogen Transport Arrangements**	
D.2	Is there a hydrogen grid via pipelines in your own territory (including pilot tests)?	
	☐ YES	☐ NO
	If you answered yes, could you please identify the following characteristics?	
	Location:	
	Distance in km:	
	Please provide a link:	
D.2	Are there any plans for a hydrogen transmission system via pipelines in your own territory? Please provide relevant resources.	
	☐ YES	☐ NO
	If you answered yes, could you please identify the following characteristics?	
	Location:	
	Distance in km:	
D.3	Could you please identify other existent hydrogen transport arrangements (except for pipelines)?	
	Hydrogen Gas Trailers	☐ YES ☐ NO
	If you answered yes, could you please identify the following characteristics?	
	Operator:	
	Itinerary (from production to HRS):	
	Liquid Hydrogen Tankers	☐ YES ☐ NO
	If you answered yes, could you please identify the following characteristics?	
	Operator:	
	Itinerary (from production to HRS):	

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D.4	Are there any plans for hydrogen transport arrangements (except for pipelines) in your own territory?	
	Hydrogen Gas Trailers	☐ YES ☐ NO
	If you answered yes, please provide a link:	
	Liquid Hydrogen Tankers	☐ YES ☐ NO
	If you answered yes, please provide a link:	
E.	**INFRASTRUCTURE TARGETS IN EUROPEAN, NATIONAL AND REGIONAL FRAMEWORKS**	
	Regional level	
E.1	Does your assigned region has announced a strategy, policy or action plan?	
	☐ YES	☐ NO
	If you answered yes, please indicate the following information	
	Name (e.g. Hydrogen Roadmap Bavaria)	
	Target for HRS by 2030	
	Target for transmission system by 2030	
	Target for hydrogen production (electrolyser capacity) by 2030	
	Target for quantity of fuel cell passenger cars circulating by 2030	
	Target for quantity of fuel cell electric trucks by 2030	
	Target for hydrogen railroads	
	Target for hydrogen aviation	
	Other	
	National level	

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E.2	Could you please identify infrastructure targets for hydrogen deployment in your assigned country?	
	Target for HRS by 2030	
	Target for transmission system by 2030	
	Target for hydrogen production (electrolyser capacity) by 2030	
	Target for quantity of fuel cell passenger cars circulating by 2030	
	Target for quantity of fuel cell electric trucks by 2030	
	Target for hydrogen railroads	
	Target for hydrogen aviation	
	Other	
	European level	
E.3	Could you please identify infrastructure targets for hydrogen deployment in European frameworks?	
	Targets for HRS by 2030 (including HRS location allocation requirements)	
	Target for transmission system by 2030	
	Target for hydrogen production capacity by 2030	
	Target for electrolyser capacity for 2030	
	Target for quantity of fuel cell passenger cars circulating by 2030	
	Target for quantity of fuel cell electric trucks by 2030	
	Target for hydrogen railroads	
	Target for hydrogen aviation	
	Other	

F.	**INFRASTRUCTURE GAPS ASSESSMENT**
F.1	If you compare existent and planned HRS, could you assess how far is this number from target? (quantitative or qualitative assessment)
F.2	If you compare production capacity of existent and planned hydrogen plants, could you assess how far will be hydrogen supply from target? (quantitative or qualitative assessment)
F.3	If you compare existent and planned hydrogen transmission infrastructure (pipelines), could you assess how far transmission capacity will be from target? (quantitative or qualitative assessment)