

POLICY-PLANNING INITIATIVES AND HYDROGEN APPLICATION FACILITATION PROJECTS IN LATVIA

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Abstract. The European Union Green Deal agenda calls for cleaner and more environmentally friendly energy sources for future development. One of the most promising renewable fuels that has the potential to replace fossil energy sources in the next few decades is hydrogen. The aim of the research is to determine the main directions of Latvian policy for hydrogen utilisation in the economy and discover the nature of hydrogen projects. Research provides a review of the Latvian policy initiatives regarding hydrogen, analyses hydrogen projects, and determines common pathways between projects and policy planning documents. Many projects within the research framework can be described as multidimensional and are pilot projects examining possible scenarios for developing some elements of the overall hydrogen industry. More than two of the largest initiatives concerning green hydrogen production and hydrogen application in civil aviation are in the research phase. While renewable resources are often included in major Latvian policy planning documents, hydrogen is often neglected in the policy-building process. However, current and future hydrogen projects are associated with two main sectoral policy planning documents: Transport Development Guidelines 2021-2027 and Latvia's National Energy and Climate Plan 2021-2030. According to existing policy and projects, transport, along with storage and refilling infrastructure, will be the first beneficiaries of hydrogen. Finally, the Latvian government must adopt an overall policy roadmap on the hydrogen agenda.

Key words: green hydrogen, policy planning, hydrogen projects, renewable energy.

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Introduction

The EU Green Agenda establishes the need for cleaner and more sustainable energy sources for further economic development. One of the most promising renewable energy sources that can already be produced in large amounts is hydrogen. Moreover, hydrogen obtained from renewable resources like wind and solar power is one of the most promising energy sources for replacing fossil fuels in the next few decades. According to this paradigm, the policies of every EU member state serve as crucial pillars for the growth of the hydrogen sector.

The EU hydrogen policy reflects an idea about the government's importance for new industry development within a particular area. Currently, these initiatives are offering significant funding for various green and low-carbon hydrogen-related projects. This financial support must encourage EU member states to create their own visions and policy planning documents about the use of hydrogen in their local economies, thereby assisting in the energy transition from fossil fuels to carbon-neutral energy sources. Of the 27 EU member states, 16 have adopted hydrogen roadmaps for their economies. At this moment, Latvia is one of the 11 countries within the Union without that kind of policy-planning document. However, since last year, some projects in the field of hydrogen production and application have been on their way in Latvia.

Discourse regarding hydrogen uses widely accepted three-colour typology. Hydrogen retrieved from renewable sources is marked as green hydrogen; blue (low-carbon) hydrogen is produced from fossil fuels, and emissions from this process are captured, stored, or used in other industrial processes; grey hydrogen is retrieved from fossil fuels without absorption of emission gases from the production process (International Energy Agency, 2023). With respect to the EU energy transition initiative, this paper analyses policies and projects regarding green and blue hydrogen.

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The hypothesis of the study suggests that, despite the insufficiency of hydrogen policy guidelines in Latvia, projects are aimed at hydrogen application in the transport sector. The object of the research is Latvian policy-planning initiatives in the area of hydrogen application in the economy. The subject of this study is hydrogen-related projects reflecting policy initiatives along local or regional boundaries.

The aim of the research is to determine the main directions of Latvian policy for hydrogen utilisation in the economy and discover the nature of hydrogen projects. The specified aim is accompanied by the following tasks: to review the Latvian policy documents and initiatives mentioning hydrogen research and application scenarios; assess hydrogen-related projects, and determine common pathways between projects and policy planning documents in Latvia.

The authors employed the monographic study method and quantitative content analysis to complete the tasks that were stated in the study. Policy planning documents and normative acts across different fields of the economy, press releases, presentations, project assessments, and other sources are the foundation of the study's information base. The information basis for the study topic corresponds to the time period until March 2024. The authors emphasise the high dynamism of the hydrogen field and possible rapid changes in different aspects of the researched topic.

Research provides novelty by bringing forth analyses of Latvian policy and projects in the field of hydrogen application within the economy. These topics haven't been highlighted in previous papers concerning the hydrogen agenda in Latvia.

Research results and discussion

This section of the study is divided into three parts. The first part represents the analysis of Latvian policy planning documents and normative acts concerning hydrogen application within the economy. The second part describes and assesses different hydrogen-related projects in Latvia. And the final part is designed for discussion corresponding to policy initiatives and characteristics of hydrogen projects within Latvia.

1. Hydrogen-related initiatives in Latvian policy planning

Throughout the history of theoretical thought, a wide list of authors has emphasised the importance of the government in economic affairs. Proponents of larger government involvement highlight the importance of public administration actions promoting demand, employment, investments, and other building blocks of economic growth (Keynes, 2018; Myrdal, 1957; Thirlwall, 2002; Stiglitz, 2021). In this perspective, it is obvious that government policy planning documents with large field priorities and tasks are present for the purpose of the development of different parts of the economy.

Policy-planning initiatives of individual member states of the EU derive from policy patterns within EU institutions, especially the European Commission. Moreover, national policy planning is derived not only from the guidelines of EU planning documents but also from EU budget priorities and programmes (Wolff, 2015; Economidou et al., 2022; Teixeira, Tavares-Lehmann, 2022; Wappler et al., 2022). This is the case for the implementation of new frameworks for the energy transition process from fossil fuels to carbon-neutral energy sources.

Discussion concerning the further economic development of EU member states is impossible without the 17 sustainable development objectives set by the United Nations in 2015, which are considered the cornerstones of further policy-planning patterns in the EU (European Commission, 2023). Moreover, the seventh aim of the Paris agreement calls for a significantly increased share of renewables in the global energy mix and requires large amounts of investment in clean energy technologies and infrastructure

(United Nations, 2015). As might be expected, hydrogen derived from renewable energy sources such as hydropower, biomass, solar, wind, and other forms of energy should also be perceived as the foundation for new energy initiatives among EU member states (2023a).

At the beginning, it must be highlighted that since the Latvian government doesn't have a particular hydrogen strategy or roadmap, hydrogen policy planning issues in Latvia have been very limited and mostly integrated into the general term of renewable energy. Despite this fact, some direct measures and goals can be spotted in different fields of policy planning agendas. According to the main Latvian government planning document, Sustainable Development Strategy of Latvia until 2030, hydrogen is mentioned as a possible source of renewable energy in the transport sector (Saeima of the Republic of Latvia, 2010).

If policy documents with particular actions are observed, it must be noted that there is no mention of hydrogen of any kind in the major Latvian policy planning action plan, the National Development Plan of Latvia for 2021–2027. According to this document, the replacement of fossil fuels in the economy is outlined by using local renewable sources like wind and solar power for electricity production (Cross-Sectoral Coordination Centre, 2020). However, there are some hydrogen references and specific actions inside specific action plans concerning particular areas of public policy or the economy itself.

The main policy-planning documents of Latvia highlight renewable energy application in the transport sector, and transport is often viewed as the primary area of application of hydrogen (Singh et al., 2015; Zemite et al., 2023; Le gouvernement luxembourgeois, 2021; Danish Ministry of Climate, Energy and Utilities, 2021). In the absence of industries like refining, mineral fertiliser, and steel production where hydrogen can be applied in relative short terms, transportation is another attractive area for its utilisation. By constructing hydrogen filling stations and investigating applications for this gas in major commercial or public transportation (trucks, trains, buses, ships etc.), the transportation industry may reduce its carbon footprint.

The implementation plan of the Transport Development Guidelines 2021-2027 sets out a number of measures in the area of hydrogen application. Firstly, the development and maintenance of alternative fuel infrastructure, including refuelling stations. Secondly, the research of scenarios for the development of hydrogen fuel use in Latvia, the most cost-effective solutions for the provision of renewable hydrogen in the transport sector, and evaluating the most appropriate types of hydrogen production, refuelling, and supply possibilities. Finally, it assesses the feasibility of using hydrogen cell technology in trains (Ministry of Transport..., 2021). As can be noted, these policy guidelines until 2027 provide a more ground-level, project-oriented approach that is focused on research, scenario building for hydrogen utilisation, and pilot projects for commercialization.

Moreover, the importance of defossilization of the transport sector is promoted in Latvia's Air Pollution Reduction Action Plan 2020–2030. It states that transport policy should focus on promoting the long-term transition towards more environmentally friendly vehicles, including through hydrogen fuel transport (Cabinet of Ministers, 2020). Furthermore, within Latvia's Strategic Plan for the Common Agricultural Policy 2023-2027 there is one general assumption about the possibility of hydrogen utilisation in machinery (Ministry of Agriculture..., 2023).

According to Latvia's National Energy and Climate Plan 2021–2030, hydrogen is perceived as an alternative power source instead of fossil fuels in the transportation sector in the long term. Moreover, the government is committed to supporting research into alternative fuels, including hydrogen, production, infrastructure development, and the integration of innovative solutions in the energy system, transport, and logistics sectors. Three clear actions can be identified within the document. First, there is a plan to implement transnational projects for the construction of offshore wind farms in cooperation with Lithuania

and Estonia, as well as to evaluate the possibility of installing equipment for producing hydrogen from wind energy. Second, as part of the modernization of energy infrastructure, it was planned to carry out a study on the possibilities of adapting the local natural gas transmission system for hydrogen transportation by the end of 2023. Third, it is intended to develop an action plan for the development of hydrogen infrastructure and market conditions (Ministry of Economics..., 2021).

While the domination of hydrogen initiatives in the transport sector is obvious in the policy planning agenda, evident at the same time is the commitment to creating green hydrogen production and developing transmission infrastructure for this fuel. Since Latvia lacks industry capable of hydrogen utilisation in large amounts, another major hydrogen application area could be the local energy sector. It must be mentioned that the National Industrial Policy Guidelines 2021-2027 don't provide any reference to hydrogen but declare the role of renewables in the efficient use of energy sources, reduction of energy consumption, and transition to the use of renewable energy sources in manufacturing through the transition to a clean circular economy in the EU (Ministry of Economics..., 2023).

It must be noted that the current government, within its Action Plan for the Implementation of the Declaration on the Planned Activities of the Cabinet of Ministers, has included an action providing development of the Latvian Hydrogen and Green Fuels Industrial Development Plan and setting out infrastructure development projects in Latvia, including main pipelines, ports, storage infrastructure, and industrial parks for hydrogen (Cabinet of Ministers..., 2024).

2. Hydrogen-related projects with Latvia participation

In the last couple of years, there has been a notable increase in project numbers dealing with hydrogen agendas in different sectors of the economy. The majority of the projects are in the framework of international cooperation within EU financial support schemes, but there are some initiatives designed by local market participants aimed at increasing hydrogen utilisation.

The Freeport of Ventspils authority has signed a contract with PurpleGreen Energy Ltd. for the research stage of building the green hydrogen plant in Ventspils. The project aims to develop Ventspils into a hub for future energy production and export, providing a competitive advantage for companies. The project initiators are planning to produce different products and fuels from green hydrogen. For example, the hydrogen plant will use existing Ventspils Freeport infrastructure and collaborate with local companies to export energy in the form of e-methanol or "green" ammonia (Freeport of Ventspils Authority, 2023).

The Latvian Hydrogen Association and Riga Airport are partnering to promote hydrogen solutions in the Latvian aviation sector in support of Hamburg Airport's initiative BSR HyAirport. The project, initiated by Hamburg Airport, aims to connect rural regions of the Baltic Sea with existing aviation routes using small hydrogen-powered planes. The project, which began in November 2023 and will take about three years, involves 16 partners, including Riga Airport, Latvia University of Life Sciences and Technologies, aviation fuel supplier Gulfsteram Oil, and 24 associated organizations. The project has a budget of around 4.8 million euros, with 20% of the sum going to Hamburg Airport and 80% EU funding for the remaining partners. The project aims to revive regional air travel and develop a green, gaseous hydrogen supply chain from production to refuelling of aircraft or airport ground equipment. The project also pursued to develop preconditions for airport infrastructure designed to hydrogen-powered planes (Riga Airport, 2023).

The first interregional green hydrogen value chain project (H₂Value) since the end of 2022 is taking place in South Estonia, Tartu region, and Northern Latvia, Vidzeme region, with nine partners from Estonia, Latvia, and the Netherlands. It will be implemented for three years, and it aims to establish two pilot projects in the Tartu and Vidzeme regions, including setting up a small-scale green hydrogen production

plant, establishing a green hydrogen refuelling station, testing hydrogen transportation via road, and using this gas as a zero-emissions fuel source. The project partners will focus on developing an interregional business and investment plan. The total budget of the project is almost 4.3 million euros. Among the participants in the project is one of the largest waste management companies in Latvia, SIA "ZAAO" (H₂Value, 2023).

HyTruck is a project focusing on designing a network of hydrogen refuelling stations for large trucks, aiming to reduce emissions in road freight transport. The initiative aims to help public authorities develop a transnational network of green hydrogen refuelling stations for large trucks. The network would provide refuelling possibilities for trucks travelling from Poznan to Tartu. HyTruck is developing solutions to equip public authorities with the capacity to elaborate spatial development concepts, provide a regulatory framework, ensure common standards, and design public co-funding programmes. The total budget of the project is a little less than 2.6 million euros and will continue from 2023 to 2025. The project partner from Latvia, Vidzeme Planning Region, will receive 274 thousand euros (Interreg Baltic Sea Region, 2023).

The Green Tech Cluster from Latvia is participating in the BalticSeaH2 project, which intends to create a large-scale, cross-border hydrogen valley around the Baltic Sea and an integrated hydrogen economy within the region. The project includes 40 partners from nine Baltic Sea area countries. The goal of the project is to create an integrated hydrogen economy to ensure the self-sufficiency of energy resources and minimise carbon emissions from different sectors of the economy. The main hydrogen valley is planned between southern Finland and Estonia. This area is an optimal location for a cross-border hydrogen market and is equipped with necessary infrastructure like gas pipelines, electricity grids, and marine traffic. The BalticSeaH2 initiative enables 25 demonstration and investment cases to emphasise the different sectors of the hydrogen economy. The total volume of the project is 33 million euros; 25 million of the funding is from the EU. It started in 2023 and will last for five years. The Green Tech Cluster in this project will focus on the studies for the use cases of green ammonia and will contribute to other work aimed at facilitating and supporting the hydrogen valleys in Latvia (Green Tech Cluster, 2023).

The Latvian gas transmission system operator Conexus Baltic Grid is participating in the Nordic-Baltic Hydrogen Corridor project, which has the status of being of common interest to the European Commission. The goal of the project is to create a connection between green energy production regions in Northern Europe and the major consumers in Central Europe. It is expected to be implemented in 2030. At the end of 2022, the six partners—gas transmission system operators—within the project signed a cooperation agreement on project promotion (Conexus Baltic Grid, 2023). At the end of 2023, Conexus conducted a market study on hydrogen infrastructure development in Latvia. The research assessed the level of interest of potential hydrogen producers and consumers in the development of hydrogen transmission initiatives, including their readiness to use the pipeline and storage services for hydrogen (Conexus Baltic Grid, 2023a).

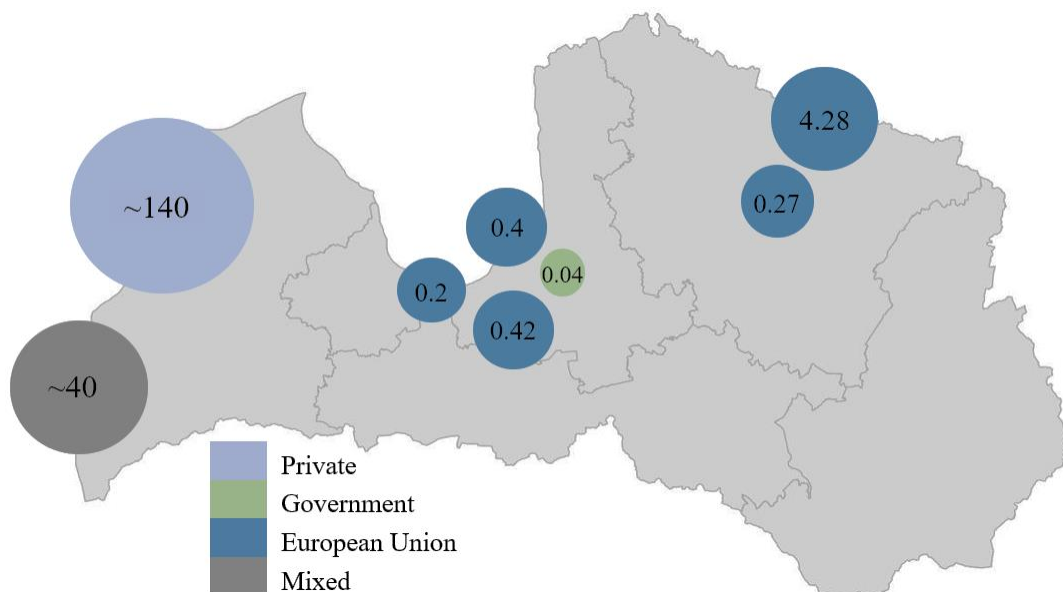
Apart from projects that focus on hydrogen production and infrastructure, there are initiatives that include the production of hydrogen-powered transport. For example, the Dutch company "Fokker Next Gena" has signed a memorandum of cooperation with the Ministry of Economics, the Liepaja Special Economic Zone Authority, and Riga Technical University and plans to develop a hydrogen plane project in the territory of Liepaja International Airport. The company intends to develop a hydrogen-powered passenger jet model that could hold up to 150 passenger seats, cover a distance of up to 2,500 kilometres, and build a final assembly line in Liepaja. Alongside, the company is committed to creating a hydrogen aircraft operations excellence centre in Latvia focused on the ground handling of aircraft and maintenance. This activity could create up to 100 new jobs in Latvia during the initial phase of the project in the next three years (Liepaja, 2023).

Furthermore, the Latvian company AS "Electrify H₂," which produces electric buses, is in the process of developing cutting-edge boats that use hydrogen power. This motor boat is intended to meet the expected demand for that type of vessel in the various areas of service, freight, and passenger transport sectors across Europe (CrowdedHero, 2023).

Within the discussion concerning hydrogen-powered transport, it must be noted that, at the time of writing this paper, the only hydrogen refilling station in the Baltic States is located in Riga. The refilling station is equipped with a steam methane reformation system, which is able to produce 300 kg of this fuel per day (H₂NODES, 2024). For example, the hydrogen-powered passenger car Toyota Mirai fuel tank capacity is 5.6 kg (Toyota UK Media site, 2023). In this way, the station can fully refill 53 such vehicles in 24 hours.

In recent years, there has been a focus on hydrogen research within the scientific community. For example, projects aiming to develop an innovative solution for compressing gaseous hydrogen, the assessment of possibilities for hydrogen production from biogas, the usage of artificial technology for automatic monitoring and optimisation of these renewable fuel production processes, and others are ongoing or are being implemented. Meanwhile, in order to prepare the industry for the hydrogen economy, the Institute of Solid State Physics at the University of Latvia has developed a unique training programme for hydrogen technologies and their application to energy companies. In the fall of 2023, specialists from the state-owned energy company Latvenergo graduated from this course (Labs of Latvia, 2023).

The hydrogen projects cover different regions of Latvia and can potentially positively influence the local economy and encourage the energy transition process (Figure 1). At the same time, Latgale region doesn't benefit as much from hydrogen projects as other parts of the country. However, it must be assessed that two large projects in Kurzeme region are only in the exploration phase, and there is no estimated amount of investment or time frame for the project to begin. Possible amounts of investment are calculated based on similar projects in Europe and other parts of the world. For example, a green hydrogen power plant with a capacity of 10,000 metric tonnes per year of produced hydrogen will require approximately 140 million euros in investment.



Source: official project information and author's estimates according to similar projects in the aviation industry (plane assembly lines of Boeing, Airbus, and Bombardier) and green hydrogen production (hydrogen plant projects of Shell, Plug Power, Masdar, and Verbund)

Fig. 1. Ongoing and potential projects concerning hydrogen application in the Latvian economy in 2024, according to their financing amount in millions of euros

The above-mentioned projects can be divided into four major groups within the hydrogen issue: production, infrastructure, equipment, and knowledge. Production is reflecting issues concerning hydrogen derived from renewable energy sources or fossil fuels and nature of these power sources (wind, solar, natural gas, hydro etc.). Whereas infrastructure group deals with hydrogen transmission, storage, and distribution networks issues. In turn, equipment projects focus on a wide range of means of hydrogen utilisation, for example, divergent transport (land, sea, air), different kinds of hydrogen pressuring or cooling techniques etc. Finally, knowledge aspect includes not only scientific research but also overall knowledge of different specialists working in distinct fields.

Furthermore, it must be pointed out that not all projects are aimed at using only green hydrogen for their declared purposes. It must be admitted that hydrogen infrastructure development focuses on using all types of this fuel, but in light of the EU fuel transmission process, refiling, and storage capacities, these are notable catalysts for a wider usage of green hydrogen. Moreover, the development of wind farms is a major facilitating factor for the production of green hydrogen in larger amounts. At this period of time, the big success for Latvia's energy transition from fossil fuels would be a green hydrogen production plant and distribution network for this fuel to start a notable inflow of this fuel in the local transport sector and facilitate possible export opportunities.

Many projects within the research framework can be described as multimodal or multidimensional in the view of the fact that many of them are pilot projects and are examining possible scenarios of developing some element of the overall hydrogen industry. These elements are building blocks for hydrogen valleys that are seen as facilitators of the energy transmission process towards renewable energy sources (European Commission, 2023; Clean Hydrogen Partnership, 2023; Capurso et al., 2022; Majka, et al., 2023).

3. Hydrogen projects within corresponding policy initiatives

For the research to be successful, it must be identified how many times green hydrogen and hydrogen are mentioned in different policy documents. Content analysis can shed light on the actuality of this energy source in the discussion about the energy transformation of the economy of Latvia. In this paper, a summary of the content analyses of eight major Latvia's policy planning documents is presented (Table 1).

Table 1

The overview of how many times hydrogen and other renewables are mentioned in Latvia's major policy planning documents

Policy planning document	Hydrogen	Green or renewable hydrogen	Renewable resources, fuels or energy	Wind power, energy or utilities	Solar power, energy or utilities
Sustainable Development Strategy of Latvia until 2030	1	0	52	9	7
National Development Plan of Latvia for 2021–2027	0	0	8	1	1
Transport Development Guidelines 2021–2027	31	8	26	1	2
National Energy and Climate Plan 2021–2030	20	0	468	97	42
National Industrial Policy Guidelines 2021–2027	0	0	14	0	0
Air Pollution Reduction Action Plan 2020–2030	2	0	64	3	2
Regional Policy Guidelines 2021–2027	0	0	4	0	0
Strategic Plan for the Common Agricultural Policy 2023–2027	2	0	32	8	10

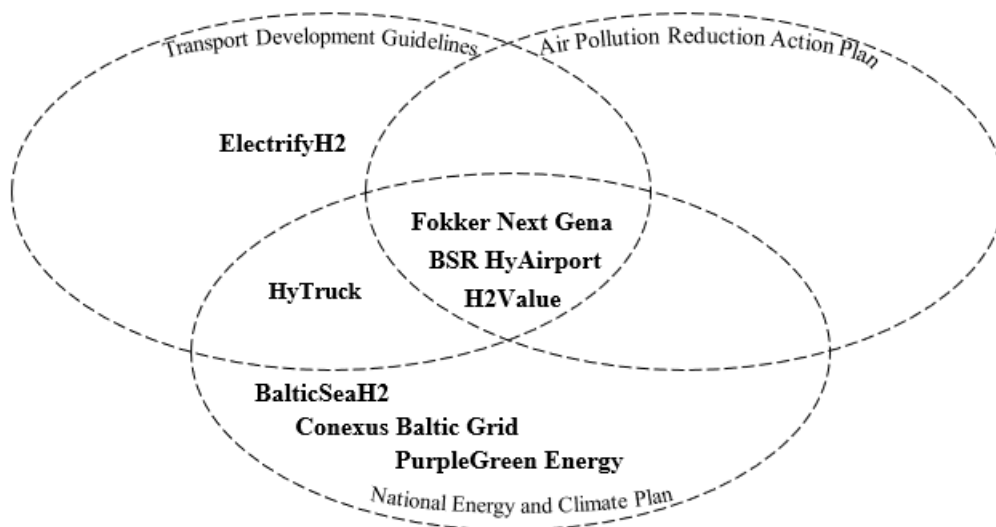
Source: author's content analyses of corresponding policy planning documents

The acquired results support the assumption that renewable energy resources are an important point of interest within major Latvia's policy planning documents, while specifying renewable energy sources is less common. Hydrogen is mentioned in five main policy planning documents but is more detailed discussed in Transport Development Guidelines 2021–2027 and the National Energy and Climate Plan 2021–2030. It must be noted that the National Industrial Policy Guidelines 2021–2027 do not provide a clear indication of how hydrogen can be beneficial for local industry development in light of the EU Green Deal framework.

It should be emphasised that the most important document in Latvia's policy planning concerning regional development (Regional Policy Guidelines 2021–2027 of Latvia) has only a few references to renewable energy and not to hydrogen, any sort, or other types of renewable energy sources. Moreover, within Latvia's Strategic Plan for the Common Agricultural Policy 2023–2027, there is only one general assumption about the hypothetical use of hydrogen. This can lead to the perception that regional economic development issues and the agricultural sector policy evolution at this moment are not based on the premise of hydrogen as a fundamental source of energy.

Finally, despite the fact that the Sustainable Development Strategy of Latvia was adopted in 2010, renewables are widely mentioned in this document, indicating that renewable energy has been on the table for a long time. Unfortunately, green hydrogen is not included in the national planning documents. To facilitate the hydrogen agenda in all the connected fields of policy planning, the Latvian government must adopt an overall policy roadmap for hydrogen utilisation in the economy.

Furthermore, the study tries to answer the question of what hydrogen policy initiatives are evolving alongside practical actions and what is different in the national policy agenda and direction of hydrogen projects. For that purpose, the research provided a comparative scheme with policy documents and corresponding hydrogen projects (Figure 2). Currently, major projects are linked with three national policy planning documents. Particularly two of them, Transport Development Guidelines 2021–2027 and Latvia's National Energy and Climate Plan 2021–2030, include the activities within their action plans that correspond to some current projects.



Source: author's analyses of corresponding policy planning documents within the hydrogen issue

Fig. 2. The synergy of Latvia's policy planning documents and hydrogen projects in 2024

After the analysis of these policy documents' guidelines, it can be confirmed that the majority of the large projects have a multisectoral nature and they are designed to contribute to the transport and energy sectors of the economy in the process of energy transition from fossil fuels to renewable sources. The important catalysts for hydrogen application are initiatives for local hydrogen production, which are linked with the manufacturing of equipment and utilities for hydrogen utilisation in Latvia.

The results of the research indicate that the current framework for policy planning and project realisation, along with developed policy guidelines, suggests that within the coming decades Latvia could develop green hydrogen production and ensure hydrogen refilling infrastructure and utilisation for large-scale transport (ships, planes, trucks, and different types of public transport).

Conclusions, proposals, recommendations

- 1) Regardless of the fact that renewable energy has been within the Latvian policy planning workframe for a long time and practical actions concerning these energy resources are often included in major Latvian policy planning documents, hydrogen is largely neglected in this process. At present, current and potential hydrogen projects are associated with two main sectoral policy planning documents: Transport Development Guidelines 2021–2027 and Latvia's National Energy and Climate Plan 2021–2030.
- 2) To facilitate the hydrogen agenda in all connected fields of policy planning, the Latvian government must adopt a common policy roadmap for hydrogen application in the local economy. Moreover, the study identified the probability that, at present, Latvian policies regarding major areas of the economy, including industry, regional development, and the agricultural sector, are not based on the assumption that hydrogen will be an important source of energy in the coming decades. This premise must be tested in further studies regarding these spheres of economic development.
- 3) The analysed projects within the research can be described as multidimensional in view of the fact that many of them are pilot projects and are examining possible scenarios of developing different elements of the whole hydrogen industry. These components serve as the basis for the hydrogen valley's evolution and are facilitators of the entire energy transmission process.
- 4) Gathered evidence supports the hypothesis that potential and current projects, along with existing policy guidelines in the transport and energy sectors, reveal Latvia's capacity for green hydrogen

production, the development of refilling infrastructure, and hydrogen utilisation in large-scale transport, including public transportation. At this moment, policy recommendations are about this renewable fuel application in the industry sector are not clearly formulated.

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