

Executive summary

Hydrogen Valleys

Insights into the emerging hydrogen economies around the world



Executive summary

Hydrogen is universally considered an important energy vector for combating climate change. It enables the decarbonisation of hard-to-abate sectors such as fuel or feedstock and, moreover, holds vast potential for industrial development and job creation. Its benefits are also acknowledged through the many dedicated national hydrogen strategies that have been published globally in recent years. Simultaneously, the emergence of a hydrogen market economically stimulates regions where hydrogen is produced and associated technologies are deployed by creating new jobs and showcasing the regions as environmental forerunners.

Hydrogen Valleys have started to form first regional "hydrogen economies", as bottom-up stepping stones in the development of the new hydrogen economy overall. Over the past several years, the Fuel Cells and Hydrogen Joint Undertaking (FCH JU) has been setting up, in collaboration with European cities and regions, so-called Hydrogen Valleys – a concept that aims to enable the emergence of locally integrated hydrogen ecosystems for climate change mitigation and regional economic development. Hydrogen Valleys typically comprise a multi-million EUR investment, spread across a defined geographic scope and covering a substantial part of the value chain, from hydrogen production, storage and transport to its end use in various sectors (industry, mobility, energy). Over the past few years, Hydrogen Valleys have gone global, with new projects emerging worldwide.

This report provides insights into the most advanced Hydrogen Valleys globally. The findings are based on data gathered during the development of the Mission Innovation Hydrogen Valley Platform (www.h2v.eu) by the FCH JU, a global information sharing platform set up under

the Innovation Challenge 8 'Renewable and Clean Hydrogen' of Mission Innovation and funded by the European Commission. The data on the platform and in this report comes out of a comprehensive survey conducted among 30+ Hydrogen Valleys globally providing cumulatively more than 2,500 datapoints on their projects. Complemented by best practice interviews with selected Hydrogen Valleys, the platform and this report provide a first-of-its-kind look into these projects.

The Hydrogen Valley landscape is growing, is increasingly driven by the private sector and gravitates towards archetypical project setups. Hydrogen Valleys will significantly mature over the 2020s, due to an increasing number of projects overall and because announced projects themselves grow in size and complexity (e.g. by hydrogen production volume, planned investment). While in the earlier phases of hydrogen deployment, projects were mostly driven by public authorities or public-private initiatives, today more than 50% of projects are led by the private sector, which views projects as strategic investments in a new business area. In addition to that, Hydrogen Valleys are gravitating towards archetypical value chain setups where different foci promise near-term commercial business cases. Three typical setups observed are (i) local, smaller-scale and mobility-focused projects, (ii) local, medium-scale and industry-focused projects, as well as (iii) large-scale and international export-focused projects.

Five factors are particularly key for the successful project development of Hydrogen Valleys. A Hydrogen Valley not only needs a convincing project concept with a hydrogen value chain coverage that leverages local assets (e.g. abundant renewable energy sources) and addresses local needs (e.g. the decarbonisation of local industrial production),

1) The IC8 is co-led by Australia, Germany and the European Commission. <http://mission-innovation.net/our-work/innovation-challenges/renewable-and-clean-hydrogen/>

it also needs to develop a viable business case that links competitive clean hydrogen production with the off-takers' willingness to pay. Here, obtaining public support and/or funding (potentially from multiple sources) that closes any remaining funding gaps is still vital. During project development, effective partnering and stakeholder cooperation that ensures continuous commitment from all parties involved is essential, as is getting political backing from policy makers and support by the general public.

There are four prominent barriers to the development of Hydrogen Valleys – yet they're not insurmountable. The first and most prominent barrier is securing funding. Among the methods used by Hydrogen Valleys to overcome this challenge, creating awareness about the technology at funding entities, initiating proactive dialogues about funding criteria and remaining flexible regarding the potential adaptation of the project concept to tailor it to public funding requirements proved to be particularly successful. Second, Hydrogen Valleys also see securing off-take commitments for clean hydrogen as a key barrier. Investing time in credible investment plans complemented by talks with as many potential off-takers from various sectors as possible are among the best practices mentioned to reach the required off-take quantities. Third, in order to secure private funding, Hydrogen Valleys relied on a structured development approach, early involvement of off-takers and equity partners that de-risk the project as well as early feedback from the lending community. Involving local private investors might additionally be attractive for locally anchored Hydrogen Valleys. Lastly, to mitigate technological readiness and technological performance barriers, it proved to be essential for Hydrogen Valleys to remain flexible regarding the project's general direction. This could also lead to adding other applications into the project's portfolio. Moreover, best practices also involve ensuring efficient operation and maintenance, for exam-

ple by procuring maintenance services directly from the equipment supplier or trusted third parties.

A fifth barrier is still regulatory provisions: Four recommendations for policy makers. The policy landscape is growing increasingly favourable for Hydrogen Valleys globally, but barriers still exist regarding permitting and regulation affecting Hydrogen Valleys directly as well as indirectly, for example as the respective policy affects conventional competitors or off-takers. Almost 40% of Hydrogen Valleys still see regulatory provisions as a challenge. In order to facilitate their emergence further, policy makers should focus on the following priorities: (i) having a clear vision of the country's future hydrogen economy in a national hydrogen strategy that sets the framework for Hydrogen Valley development, (ii) creating a regulatory environment conducive to their development, (iii) closing the gaps in permitting procedures and (iv) acting as local matchmakers to enable the setup of Hydrogen Valleys.

Hydrogen Valleys will unfold their full potential globally towards the middle of the decade and the Mission Innovation Hydrogen Valley Platform seeks to contribute to this effort. In the years to come, all Hydrogen Valleys currently featured on the Mission Innovation Hydrogen Valley Platform will reach the implementation phase and ultimately go into operation. In addition, 70% of Hydrogen Valleys also indicated that they intend to expand their activities beyond the current scope. Moreover, Hydrogen Valleys will continue to move towards commercial maturity and thus remain beacons of the hydrogen economy that pave the way for the full roll-out of a global market by showcasing its potential on an increasing scale. The Mission Innovation Hydrogen Valley Platform will support these activities by being the go-to website for up-to-date information on Hydrogen Valleys' project development globally and by serving as a project incubator as well as collaboration enabler between mature Hydrogen Valleys.

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