Regional policies for promoting green Hydrogen

A Policy Brief from the Policy Learning Platform on Low-carbon economy

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Cover image: Isaure Suplisson

Summary

Green hydrogen produced with renewable energy is high on the policy agenda due to its potential to decarbonise those sectors of the economy that are hard to electrify, in line with Europe's obligations to become carbon neutral by 2050. Hydrogen can be stored, making it perfect for balancing out intermittent renewable energies, and it can also be transported over long distances. However, much more needs to be done to advance technologies along the entire value chain (from production, storage, and transportation to end-use) and make hydrogen both sustainable and cost-efficient. Public authorities can play an active role in development of the hydrogen industry, bringing together stakeholders, supporting training and awareness raising, co-funding pilot projects, and creating enabling frameworks and strategies. Regions that make an early move position themselves well to be frontrunners in future, and be in a position to export hydrogen, technology, and knowhow. This is especially true for regions which are already frontrunners in renewable energies, which are needed for green hydrogen production.

The Promise of Hydrogen

The European Union and its member states have committed to cutting carbon emissions to zero by 2050 under the European Green Deal. This means significantly reducing emissions, by making use of all available pathways. While renewables and electrification, combined with improved energy efficiency, will make a significant contribution, there are certain sectors that will need a different approach, especially long-distance transport, and heavy industry. For these sectors, one of the most promising solutions is the use of green hydrogen made with renewable energy, which is attracting a significant amount of political and business interest due to its high energy density and potential to become a clean energy carrier.

Hydrogen, in its pure form, can be combusted in a fuel cell with oxygen to release energy, producing only water as an emission at the point of use. If hydrogen can be used to replace fossil fuels in sectors such as transport and industry, the potential for cutting greenhouse gas emissions is huge. Additionally, hydrogen can be stored and transported long distances so can also be used for balancing out intermittent renewables and enabling flexibility in the grid and therefore contributing to full system sustainability.

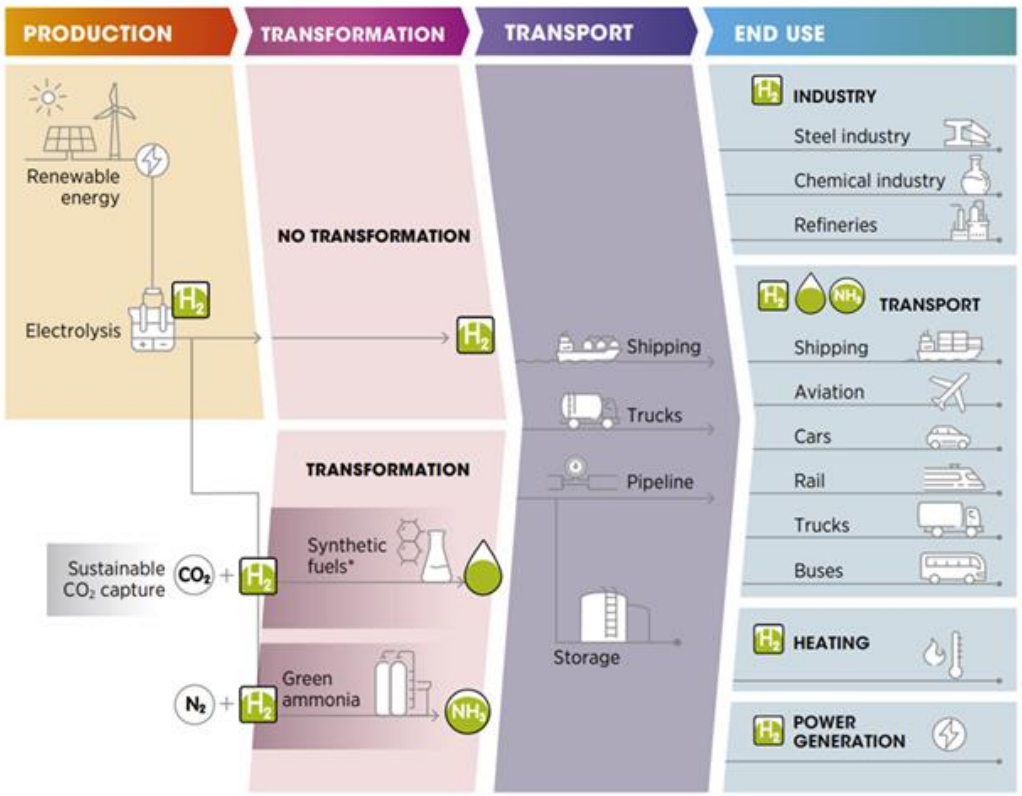
However, the use of hydrogen as a sustainable energy carrier relies on it being widely available, and sustainably produced. While hydrogen is the most abundant element in the universe, it is scarce in a pure gas form on Earth. Instead, it must be produced from other, more available compounds. Since it is not abundantly available, unlike oil and natural gas, and energy needs to be used to produce it, it is referred to as an 'energy carrier' (just like electricity) rather than an 'energy resource'. Most currently widespread production routes are unsustainable, being reliant on carbon intensive industries, with the hydrogen used in chemical production and other industries. While clean production routes using renewable energies are proven, they are costly, and prices need to be brought down. Enabling hydrogen's disruptive role in the energy sector also relies on further developments in storage, distribution, and combustion technologies.

Hydrogen is produced via various routes and conversion processes. The environmental impact of using hydrogen as an energy carrier is dependent on the primary resource used, as well as

the gas conversion process. Those that use fossil fuels as a feedstock are the cheapest, but do not contribute to a sustainable economy. A colour coding scheme is used to differentiate the production routes of hydrogen and highlight the sustainability of the process.[1]

Name	Source and Production Method
White	White hydrogen is used to describe scarce, naturally-occurring hydrogen found in underground deposits.
Green	Green hydrogen is produced using renewable energy resources to electrolyse water, splitting it into oxygen and hydrogen, with no greenhouse gas emissions. It is converted back to water, releasing energy, when combusted in a fuel cell.
Blue	Blue hydrogen is made through steam reforming of natural gas, producing hydrogen and carbon dioxide, with carbon capture and storage.
Turquoise	Turquoise hydrogen is made via pyrolysis of methane, splitting it into hydrogen and solid carbon, with no emissions. This method of production has not yet been proven at scale.
Grey	Grey hydrogen is the most common form at present, using steam methane reformation but without capturing resulting greenhouse gas emissions.
Brown	Brown (or black) hydrogen is made by gasification of coal or lignite. This process is highly polluting.

As of the end of 2021, around 95% of hydrogen is produced from fossil fuels, while only 5% is green hydrogen, produced by water electrolysis. Ramping up this production will be the key challenge in enabling hydrogen as an energy carrier.



Green Hydrogen Production, Conversion and End-Use. Source: IRENA.[2]

[1] Hydrogen Europe – Enabling a zero-emission society
[2] https://www.irena.org/Energy-Transition/Technology/Hydrogen

If this can be achieved though, hydrogen has high potential as a versatile energy carrier with multiple possible applications. It is particularly recognised as having high potential to cut emissions in transport, including in public transport – with many hydrogen buses already in operation, and hydrogen trains now being put into use – as well as in heavy-duty vehicles, including municipal service vehicles. Such applications are the main users of green hydrogen today. As well as direct use in fuel cells, hydrogen can also be used for creation of synthetic fuels which could be used in future for long-distance aviation and shipping, though these are not yet commercially available. There is also significant potential in heavy industry, such as cement, steel, and chemicals production, and in heat and power applications.

Investments in research and development, and in pilot projects, are growing considerably as countries and regions seek to take a leading role in the hydrogen economy. This will have high potential for economic development and job creation, from highly-skilled experts to blue-collar workers alike. Therefore, public authorities across the continent are looking to establish support policies and initiatives for hydrogen development, from research programmes to development strategies, awareness-raising schemes, and pilot investments.

European Legislation and Support

A number of barriers are in place to market development of green hydrogen, including availability and cost of renewable electricity for production, low-demand amongst end-users for green hydrogen thanks to high production costs, and limited infrastructure for hydrogen distribution, refuelling and storage.[3] While the first issue can be overcome by increasing renewable electricity production and also applying a price to carbon emissions (which is already covered in a number of legislative files), the second two require specific political intervention to overcome them with measures at international, national and regional levels. Another barrier is the lack of a clear and complete regulatory framework at national levels.

Hydrogen's potential has been recognised by European governments and EU Institutions for many years, being included in research and innovation funding from the 1990s, and institutionalised with the Fuel Cells and Hydrogen (FCH) Joint Undertaking in 2008. Since then, the European Union has invested in research and innovation for hydrogen and developed the EU Hydrogen Strategy of 2020 as part of the European Green Deal, implementing the Paris Agreement.

The Hydrogen Strategy has set out ambitious targets to support deployment of hydrogen and bring it to market scale, establishing twenty key actions which were to be implemented by 2022. With these in place, the strategy aims to accelerate and support the development of Europe's hydrogen economy, and looks to boost clean hydrogen production with a three-step pathway:

- Up to 2024 – The strategy will support the installation of at least 6GW of renewable hydrogen electrolysers and the production of 1 million tonnes of renewable hydrogen;
- 2025-2030 – Hydrogen will become an intrinsic part of the integrated energy system, with at least 40GW of renewable hydrogen electrolysers and production of up to 10 million tonnes of renewable hydrogen;

[3] https://single-market-economy.ec.europa.eu/system/files/2021-11/ECH2A%20RTs%20reports%20on%20barriers%20and%20mitigation%20measures_FINAL.pdf

- 2030 onwards – Renewable hydrogen will be deployed at scale across all hard to decarbonise sectors.

The twenty actions set out in the strategy included a mixture of **legislative measures**, creation of new **platforms and initiatives**, and provision of **financial support**.

Legislative Measures

In the framework of the strategy, the Commission has put forward proposals to integrate hydrogen into relevant policy areas. Firstly, the Sustainable and Smart Mobility Strategy includes proposals to facilitate the use of hydrogen in transport, including the flagship area of 'boosting uptake of zero-emission vehicles, renewable and low-carbon fuels, and related infrastructure'. To reach 40GW of installed electrolysers by 2030, the Commission has also proposed an amendment to the Renewable Energy Directive with a new sub-target for renewable fuels of non-biological origin of 2.6% in transport by 2030, and for a 50% share of renewable hydrogen consumption in industry (including non-energy uses).

On the distribution side, in December 2021, the European Commission published its Hydrogen and Decarbonised Gas Market Package, comprised of revisions to the Gas Directive and the Gas Regulation to enable a shift from fossil natural gas to renewable and low-carbon gas, especially biomethane and hydrogen. This entails the creation of the European Network of Network Operators for Hydrogen (ENNOH), to promote dedicated hydrogen infrastructure, as well supporting national network planning with an EU-wide network development plan. It also proposes a new certification scheme for renewable and low-carbon hydrogen. Hydrogen infrastructure will also be supported by the Alternative Fuels Infrastructure Directive and Trans-European Transport Network regulation include support for rolling-out hydrogen refuelling stations.

Platforms & Initiatives

As well as setting legislative frameworks, the Commission is enabling knowledge sharing and collaboration amongst actors in the hydrogen sector via clustering activities and platforms. The first of these, as already mentioned, was the Fuel Cells and Hydrogen (FCH) Joint Undertaking, which became the Clean Hydrogen Joint Undertaking in 2021 (also known as the Clean Hydrogen Partnership). This Public-Private Partnership supports research and innovation to scale up clean hydrogen technologies and value chains. The partnership is comprised of the European Commission, industry group Hydrogen Europe, and research group Hydrogen Europe Research, and is responsible for programming Horizon Europe calls related to hydrogen (see Funding, below).

At the international level, the European Union is a co-leader of the Clean Hydrogen Mission of Mission Innovation, the global initiative launched alongside the Paris Agreement to co-ordinate and catalyse investment in research for clean energy. The Mission aims to reduce the cost of clean hydrogen to 2 USD/kg by 2030 by stimulating research, integrating production, storage, distribution and end-use in 100 hydrogen valleys by 2030, and preparing for the scale-up of the hydrogen economy through codes, certifications, regulations, and standards. This includes an upcoming 'Hydrogen Exchange', to allow peer-learning amongst policy-makers.

In the framework of the Hydrogen Strategy, the Commission has also established the European Clean Hydrogen Alliance, bringing together actors in hydrogen production, industry and mobility, and transmission and distribution. It aims to promote investments in hydrogen and operates working groups on production, transmission and distribution, industrial applications, mobility, energy, and residential applications. The CHA has also established a Hydrogen Project Pipeline which has collected more than 750 viable investment projects, looking for funding, and provides the Hydrogen Public Funding Compass, an online guide for identifying project funding opportunities at European and national levels.

European Funding

A significant number of European programmes provide funding for hydrogen development, including the European Structural and Investment Funds, the Connecting Europe Facility, NextGenerationEU, InvestEU, the Emission Trading Scheme's Innovation Fund, and Horizon Europe.

At the planning stage of hydrogen projects, support is available via the European Investment Bank's ELENA, European Local Energy Assistance, Facility, which can fund technical studies, business plans, provision of legal advice, tender preparation and project bundling. Also under the EIB, the JASPERS, Joint Assistance to Support Projects in European Regions, Facility can support development of strategies and plans, project preparation, project appraisal, and capacity building in energy and transport.

Implementation of projects can also be supported with funding from the European Regional Development Fund (ERDF), the Cohesion Fund (CF) and the Connecting Europe Facility (CEF). The ERDF and CF can support direct investments for hydrogen projects at regional and local level under the priorities of 'a greener, low-carbon Europe' and ' a more connected Europe.' The CEF funds infrastructure at European level for European networks. It has a specific funding strand, CEF for Energy, to support implementation of the Trans-European Networks for Energy (TEN-E), including cross-border hydrogen fuel infrastructure. The Innovation Fund, funded from the Emissions Trading Scheme, can also fund highly innovative technologies.

For coal regions, which have been reliant of the fuel in the past for energy, but also jobs and growth, the European Commission supports transition via the Just Transition Fund and the Just Transition Platform, as well as the Initiative for Coal Regions in Transition, which can connect stakeholders and provide technical assistance for reaching a clean energy future.

Several new funding channels have opened in recent years in answer to the challenges of COVID and the war in Ukraine. The Recovery and Resilience Facility, part of NextGenerationEU, provides scope for hydrogen investments. An assessment by the Commission showed that fifteen countries included hydrogen in their Recovery Plan, allocating 9.3 billion EUR.[4] Member States can also intervene directly and set up schemes for investment in renewable energy and hydrogen projects, under revisions made to the State Aid rules implemented under the Temporary Crisis Framework.

[4] https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/assets/thematic_analysis/1_Clean.pdf

Finally, European research and innovation funding is playing a key role in the development of hydrogen technologies. The Strategic Energy Technologies (SET) Plan, which aims to accelerate the deployment of green technologies and co-ordinate European and national funding, has been amended to integrate hydrogen into the Working Group on Renewable fuels. This document sets the EU's Research & Innovation agenda, outlining the areas where research funding and collaboration is meant to be focused. Significant funding is available under Horizon Europe (2021-2027) for hydrogen projects, including two billion EUR for proposals under the Clean Hydrogen Partnership, with topics covering everything from production to transport, storage and distribution. This follows the Horizon 2020 European Green Deal calls in which three 100MW renewable hydrogen electrolysers were funded in Germany, the Netherlands and Portugal.

Hydrogen in Interreg Europe

Hydrogen, as an emerging policy topic, has not been a mainstream theme in many Interreg Europe projects (2014-2020), but is present in a select few. In particular, these have been the e-mobility focused projects and also the three projects presented below.

SMART HY AWARE Interreg Europe	**Smart solutions for hydrogen potential awareness enhancing** **Duration**: 2019-2023 **Website**: interregeurope.eu/smarthyaware
POTEnT Interreg Europe	**Public Organisations Transform Energy Transition** **Duration**: 2019-2023 **Website**: interregeurope.eu/potent
DeCarb Interreg Europe	**Supporting the clean energy transition of coal-intensive EU regions** **Duration**: 2018-2023 **Website**: interregeurope.eu/decarb

As hydrogen has become increasingly prominent, the Policy Learning Platform has implemented actions to provide bespoke advice via a peer review (Achievement 1) and a webinar to explore the hydrogen strategy and available good practices (Achievement 2).

Achievement 1 – Peer Review on deriving local value from green hydrogen

On 8-9 November 2022, the Interreg Europe Policy Learning Platform organised a Peer Review for the district of Barnim, in Brandenburg, Germany, on the topic of, 'Deriving local value from renewable energy capacity and creating a green hydrogen value chain for the benefit of the local territory'.

The challenge for the region is that is has ample renewable energy resources, but the local population does not benefit from them, with electricity fed into the national grid and financial benefits going to investors. The aim of the region is now to use excess electricity generated from wind farms for the onsite production of green hydrogen, and the creation of a green hydrogen value chain, working with local companies and organisations. The Peer Review gave the public administrations an opportunity to discuss their draft hydrogen strategy with experts from other regions, and learn about business models and legal frameworks, resulting in a set of recommendations for the region on governance structures, skills, funding opportunities and international collaboration.

Click here to find out more about the Peer Review.

Achievement 2 – Webinar on building a regional hydrogen economy

On 8 February 2022, the Interreg Europe Policy Learning Platform organised a webinar on the topic of 'Building a regional hydrogen economy'. The webinar featured a keynote from European Commission DG Internal Market Industry, Entrepreneurship and SMEs (DG GROW) on the EU's Hydrogen Strategy for a Climate Neutral Europe, setting out the overall European framework for hydrogen development. This was followed by three examples of local hydrogen approaches, taken from Interreg Europe projects, and including experiences from Aberdeen, Aragon, and Western Macedonia. The slides and webinar recording are available via the link below.

Click here to access the webinar resources.

The projects mentioned above, their good practices, and these Policy Learning activities have informed the conclusions and lessons of this brief, enabling identification of replicable actions and recommendations for other regions.

Regional Interventions for Supporting Hydrogen

With frameworks established at the European level indicating long-term political direction, there is scope for regions and municipalities in steering local development. This can be achieved by defining strategies and roadmaps, establishing new governance structures and collaboration platforms, supporting establishment of hydrogen valleys and clusters to boost production, increasing demand by supporting hydrogen use through public procurement, and making use of European funds, which are often programmed at sub-national level.

Strategies and Governance

Developing hydrogen strategies helps to set a long-term vision for hydrogen in the energy system, illustrate political motivation and commitment, and encourage co-operation by bringing actors to the same table. Strategies should be embedded in, and aligned with, broader energy, mobility and industrial strategies at national and regional levels. They should set realistic, but ambitious, targets for production, and in some cases end-use, and must be developed with the

involvement of stakeholders. This requires the establishment of consultative bodies and governance structures to enable open discussions, co-design activities, and support long-term trust building. These stakeholder groupings will have an active role to place in implementation and monitoring of the strategy.

Two such examples include the approach of Aragon in Spain, and Aberdeen in Scotland. Aragon, one of Europe's leading hydrogen regions, established a Foundation with dedicated resources and staff to steer hydrogen development (Good Practice 1), which also assisted the Government to define its Hydrogen Master Plan (Good Practice 2). In operation since 2003, the practices demonstrate the value of co-operation and having a clear vision, and can be taken as inspiration by many other regions.

Good Practice 1 – Foundation for the Development of New Hydrogen Technologies in Aragon

The Government of Aragon (Spain) has taken an active approach to promoting hydrogen as an energy carrier, establishing the Foundation for the Development of New Hydrogen Technologies in Aragon (FHa) in 2003, to steer the region's development. FHa is a not-for-profit entity supported at launch by 28 members covering public administration, corporations, associations, energy companies and research centres, amongst others, growing now to more than 90 members. Working with these organisations from along the value chain, the foundation works to organise, manage and implement activities to develop the local hydrogen economy. In this way, the FHa will contribute to boosting the industry, raising investment and creating jobs. FHa is currently staff by a team of 25. They have participated in more than 30 projects, and also participate in providing a Masters Degree with several universities, as well as organising online training, technical visits and dissemination activities. Additionally, the FHa has played a leading role in the elaboration of the Hydrogen Master Plan (see Good Practice 2).

Interesting features: This practice represents an excellent case of clustering industries, research and public sector to contribute to industrial development. It covers the full value chain and all technologies, and brings together a number of support services from strategy development to dissemination and training.

Click here to find out more about this practice.

Good Practice 2 – Aragon's Hydrogen Master Plan

The Autonomous Community of Aragon, under the leadership of FHa (see Good Practice 1) and the Department of Industry, Competitiveness and Business Development, has developed a Hydrogen Master Plan to steer development of the hydrogen industry and define the main lines of work regarding hydrogen technologies. Four editions of the plan have been developed so far, each covering a four year period. The methodology for updating the plan involves review of performance in the previous plan, an assessment of the current state of the art, identification of main lines of work (in production, storage, distribution, applications, technology transfer, protection and economic impact), and training and awareness raising. This is followed by a participatory process with the stakeholders via a questionnaire, online survey and two rounds of working groups. The first round, at national level, involved discussion with public and private sectors, while the second involved roundtables at regional level. More than 300 people participated in the process, from local, regional, national and European levels.

Interesting features: Strategies need broad engagement from all relevant stakeholders. The involvement of an organisation such as FHa, which already gathers them, as well as participatory co-planning can ensure the relevance of the action plan for the region.

Click here to find out more about this practice.

In Aberdeen, the City Council established a Strategy and Action Plan via European project funding (Good Practice 3) and set up a Steering Committee (Good Practice 4), which both informed and monitored the strategy, and supports capacity building for regional actors. The region has implemented a comprehensive set of policy actions to boost production, and more Good Practices can be found at the SMART HY AWARE website.

Good Practice 3 – Aberdeen's Hydrogen Strategy and Action Plan

The Scottish Government aims to develop its hydrogen industry, recognising that it could contribute an estimated 25 billion GBP to the economy per year, and create hundreds of thousands of new jobs. As such, it has established a national policy and action plan to install 25GW of production capacity by 2045. Within this framework, the Scottish city of Aberdeen has come to the forefront of hydrogen development in the country. The city has a number of existing benefits that made it a natural frontrunner region, including infrastructure and a highly skilled workforce with expertise in energy, from the city's history of offshore oil, gas and wind industries. The City developed a Hydrogen Strategy and Action Plan for 2015-2025 as part of the HyTrec project, funded by Interreg North Sea Region, and so far more than 35 million GBP has been invested into hydrogen projects including the acquisition of 85 hydrogen-powered buses, municipal service vehicles and cargo bikes. After these successful pilots, the Aberdeen Hydrogen Hub was established in 2022, in partnership with bp, with the aim of deploying hydrogen at a larger scale and becoming a hydrogen exporter. It will connect to large scale renewable technologies to produce green hydrogen and seek to provide it for new applications including domestic heat, industry, maritime and rail.

Interesting features: This practice demonstrates a comprehensive approach to hydrogen development and has a high degree of ambition to make the city a global frontrunner. It also illustrates the need to build on regional strengths and the value of long-term political ambition and commitment.

Click here to find out more about this practice.

Good Practice 4 – North East Hydrogen Ambition Steering Committee

Accompanying Aberdeen's Hydrogen Strategy and Action Plan (Good Practice 3), Aberdeen City Council helped to establish the North East Hydrogen Ambition Steering Committee, to bring together stakeholders from private and public sector organisations in the wider region. The Committee co-ordinates and ensures implementation of hydrogen projects planned in the 'Hydrogen Ambition Narrative', which promotes a vision of North East Scotland as leader in the hydrogen industry. On another front in stakeholder engagement, Aberdeen City Council has also make specific efforts to work with policy makers to inform the Strategy and ensure that policy frameworks and regulations support hydrogen development. ACC has brought departments together for training and education on hydrogen technologies.

Interesting features: This practice demonstrates strong stakeholder engagement at all relevant levels to promote hydrogen development, enabling co-operation, but also ensuring that each stakeholder understands their role in the hydrogen transition.

Click here to find out more about this practice.

Hydrogen Front-Runner Regions

Three groups of regions can be discerned amongst the front-runners in hydrogen development. The good practices from Aberdeen and Aragon show that it is often **renewable energy regions with substantial wind energy capacity and generation** that recognise the potential of hydrogen to contribute to regional development first. At the same time, high wind regions often suffer from public rejection of wind energy as turbines are mostly owned by few (foreign) investors with little regional value retention. Developing a regional hydrogen economy for the benefit of local companies represents an opportunity to create value locally, thus increasing acceptance of wind power.

A second group is made up of regions with **important heavy industry clusters** that see hydrogen as the only viable option to decarbonise these sites, or that want to make use of their strong industrial base as comparative advantage. Examples of such regions can be found in the German Ruhr-area, the northern Netherlands, the Manchester area, UK and Lombardy, Italy.

The third group are (former) **coal regions in transition** that have a strong traditional skills base and infrastructure for energy generation but face high socio-economic disruptions due to closing of coal mines and phasing out of coal-fired power generation. With special funding from the Just Transition Fund, regions such as Western Macedonia in Greece, Usti in Czechia, and Stara Zagora District, Bulgaria, are turning to hydrogen to innovate their way out of the transition-induced crisis.

Hydrogen Valleys

Strategies and policies should seek to develop multiple projects that can support the whole value chain, not only in production, but also in use across sectors from mobility, households and industry. To do so, there is a need support cross-sectoral co-operation, going further than advisory platforms and steering committees. *Hydrogen Valleys* are industrial clusters that combine multiple hydrogen applications together, often covering renewable energy generation, green hydrogen production, storage, distribution and end-use. By building such an integrated ecosystem, supply and demand can become mutually supporting, creating a market by improving economic feasibility.

Hydrogen Valleys need to have large scale, going beyond demonstration projects, and representing a comprehensive project portfolio, as well as operating in a defined geographic area, for example being built around an existing port (as in Aberdeen), transport corridors (as in Lombardy, below), or waterways. Many examples already exist in Europe of Hydrogen Valleys, including the H2iseO Hydrogen Valley in Lombardy, Italy (Good Practice 5), GetHyGA in Aragon, emerging under the Hydrogen Master Plan (Good Practice 2) and Ostrava, Czechia (Good Practice 6). The Clean Hydrogen Partnership has identified 37 Hydrogen Valleys worldwide, of which 23 are in the European Union.

Good Practice 5 – H2iseO Hydrogen Valley

The H2iseO Hydrogen Valley in Lombardy, Italy, is a project established by Ferrovie Nord Milano, Ferrovienord, and Trenord to establish a hydrogen industrial value-chain for sustainable mobility, along the Brescia-Iseo-Edolo railway line. The project will replace the entire fleet of fourteen trains with hydrogen-powered trains, introduce 40 hydrogen-powered buses, and create a hydrogen production plant to power the vehicles, as well as distribution and storage facilities. It is partly funded under Italy's Recovery and Resilience Plan.

Interesting features: Hydrogen-powered trains are still a novelty with very few in operation, (for another example, see the Elbe-Weser Railroad Company in Germany which is already operating hydrogen trains). This practice can demonstrate the potential of the technology, kick-start the development of a local hydrogen economy, and provide inspiration to other regions on the benefits of the hydrogen economy.

Click here to find out more about this practice.

Good Practice 6 – Ostrava's Hydrogen Cluster

The City of Ostrava, Czechia, is aiming to take the lead as the country's most innovative hydrogen ecosystem. In 2018, the city signed a Memorandum of Understanding on developing hydrogen technologies in transportation with the Moravian-Silesian region, a Memorandum of Co-operation, with the Technical University of Ostrava, as well as public subjects and private investors, with plans to establish a Hydrogen Valley. In particular, the city and region are looking to reduce emissions in transport, with a transition to hydrogen buses. At first, hydrogen will be produced from wastes such as coal sludge and coke oven gases, but with the intention of transitioning to green hydrogen produced from renewable energy.

Interesting features: This practice demonstrates the establishment of a hydrogen valley, bringing together the relevant partners and organisations from academia, as well as public and private sectors, with a common goal.

Click here to find out more about this practice.

Funding, Procurement & Promotion

As already presented, there is significant financial support available from the European level, but there is also scope for support projects at national and regional level. Public authorities can provide **grants, tax or loan incentives** to mitigate the risks for private investors to support hydrogen projects at low Technology Readiness Level, where demand is low and risks are highest. This can also empower multiple actors in a region, rather than leaving development only to those with the deepest pockets.

Public authorities can also support hydrogen by investing in hydrogen transport, such as buses, to make use of generated hydrogen; **public procurement** is a powerful tool to generate new markets[5]. Making use of hydrogen vehicles in public fleets has an added bonus of familiarising people with end-use technologies, and authorities can also implement dedicated training and educational events.

Good Practice 7 – Climate Leap Local Investment Programme

Climate Leap is a local investment programme organised by the Swedish Environmental Protection Agency to fund projects for reducing greenhouse gas emissions, including clean hydrogen

[5] See the Interreg Europe Policy brief "Innovation procurement"

development. The programme was introduced in 2015, and provides funding to companies, municipalities, regions and other organisations throughout Sweden. The programme has provided funding to more than 3,200 projects, with significant reduction in carbon emissions. One such project includes funding for an enterprise which is producing electricity from wind power, and will now invest in producing green hydrogen from the sustainable electricity being generated, with onsite storage units. The facility is expected to produce around 100kg per day, and Climate Leap provided 70% of the investment (1.6 million out of 2.3 million EUR).

Interesting features: This practice demonstrates the impact that public financial support can have, enabling small scale, bottom-up projects, that can contribute to reduction in carbon emissions. Such schemes enable public and private actors to implement innovative projects with reduced risk to themselves, contributing to environmental and climate objectives.

Click here to find out more about this practice.

DeCarb
Interreg Europe

Good Practice 8 – Promoting hydrogen-based transportation among the public

Building acceptance of new technologies takes time, with efforts needed to promote their benefits compared to existing solutions, and overcome scepticism and unfamiliarity. In Stare Zagora, Bulgaria, a public hydrogen fuel and hydrogen day was organised for the tenth anniversary of the European Fuel Cells and Hydrogen Joint Undertaking. The event started with a forum where participants were taught about hydrogen, targeting young people in particular. Then, any member of the public with a valid driving licence was invited to drive a hydrogen car and test it on a stretch of road in front of the conference centre. As well as those who actively participated on the day, others learnt about hydrogen from the media cover generated. Citizen engagement approaches have also been taken in Aberdeen (SMART-HY-AWARE), which has sought to develop greater understanding of the technology by integrating hydrogen vehicles into car sharing schemes, running hydrogen tours, and setting up educational challenges for schools.

Interesting features: Citizen acceptance will be vital for the development of the hydrogen industry

Click here to find out more about this practice.

Recommendations & Key Learnings

The experiences shared by the Interreg Europe community in co-funded projects or during Policy Learning Platform activities lead to some interesting considerations to take into account when policy makers investigate ways to plan a local or regional strategy around hydrogen:

- Regions are very important in the development of a hydrogen economy. Whilst frameworks can be set at the European level, implementation is at the regional level, with new clusters and initiatives forming. Regions should focus on what they are strong

at, with hydrogen production not being suitable for all regions, but rather based in those with existing resources, skills and industries.

- Hydrogen strategies must be embedded in, and aligned with, other relevant strategies, such as energy, industry, transport, or coal-transition strategies.
- Before embarking on hydrogen development, regions need to assess whether they are well placed to develop the technology. For example, do they have excess renewable energy available for green production (as in Barnim, Achievement 1), or a well-trained workforce and infrastructure (as in Aberdeen).
- Clustering and co-ordination actions are essential for developing the hydrogen industry, The approaches of Aberdeen and Aragon (Good Practices 1-4) demonstrate the importance of such advisory boards and groups. At the European level, the European Clean Hydrogen Alliance will provide support to project developers.
- Dedicated governance structures to drive hydrogen strategy development and continuously monitor and update it based on performance, are essential. Stakeholder involvement, participatory planning and implementation are very helpful and foster local ownership of the strategy and future projects.
- Communication of a hydrogen strategy is essential to build awareness and acceptance, emphasising the regional benefits, including job creation, and that the region is at the forefront of technological development which will have a positive impact, worldwide.
- As private investors are still shying away from hydrogen due to immature technology and markets, as well as regulatory uncertainties, political incentives and public funding can play an essential role.
- Significant levels of funding are available at the European level for investing in hydrogen development, even for 'beginner' regions, where support is available for project development and feasibility studies. Project funding can be used for establishing action plans and strategies (as in Aberdeen), though EIB funding can also be accessed. New funds under the Recovery and Resilience Facility are being used in fifteen counties to develop hydrogen, including in Italy (Lombardy, Good Practice 5);
- Public procurement of hydrogen vehicles provides a regional end-use for hydrogen, helping to develop a local market and scale-up hydrogen production facilities, while also acting as a demonstrator of the technology.
- Education and training activities will be needed to develop the necessary skills for hydrogen development. The Masters offered by Aragon's Hydrogen Foundation (Good Practice 1) is a promising development. Education does not only need to target future practitioners though; the training and education for policy makers being implemented in Aberdeen (Good Practice 4) also recognises the need for training those already in the workforce, and responsible for setting frameworks.

The results of the project Smart HY AWARE can provide further inspiring input, as described in the box below.

Achievement 3 – SMART HY AWARE Recommendations for innovative models for energy production and storage from hydrogen

The SMART-HY-AWARE project aims to promote hydrogen-electric mobility by tackling infrastructure, technology and market barriers to improve regional and local strategies for hydrogen development. The project has developed Action Plans for its six participating regions (Arágon, Lazio, South Holland, Delphi, Aberdeen and West Hungary), and has also developed a recommendations report highlighting the technical and commercial barriers to the hydrogen transition.

Barriers include **high costs** due to low efficiency and small-scale production, a **lack of dedicated infrastructure** as hydrogen has typically been used close to the site of production, **low demand** and a **lack of international co-operation and standards**. The project has made recommendations in its Action Plans for measures to implement that can overcome these barriers. These include **public procurement** of hydrogen vehicles to stimulate the market, developing **networks of hydrogen refuelling points**, providing **funding for investments** in hydrogen projects, and developing **stakeholder networks**.

Click here to access the publication, 'Recommendation report for innovative models for energy production and storage from hydrogen' or to read the SMART-HY-AWARE Action Plans.

Does your region need support in defining new instruments and strategies?

The Policy Learning Platform, provides several services to the regional policy community, including on-demand Expert Support via a helpdesk, matchmaking service and peer reviews:

- At the Policy Helpdesk, Policy-makers may submit their questions to our helpdesk to receive a set of resources ranging from inspiring good practices from across Europe, policy briefs, webinar recordings, information about upcoming events, available European support and contacts of relevant people, as well as recommendations on matchmaking and peer review opportunities.
- A Matchmaking session is a thematic discussion hosted and moderated by the Policy Learning Platform and designed around the policy needs and questions put forward by the requesting public authority or agency. It brings together peers from other regions in Europe to present their experiences and successes to provide inspiration on overcoming regional challenges.
- Peer Reviews are the most deep and intensive of the on-demand services, bringing together peers from several organisations for a two-day working session to examine the specific territorial and thematic context of the requesting public authority of agency, discuss with stakeholders, and devise recommendations. The Platform has recently organised a peer review for the Autonomous Province of Trento on Green Communities, very closely linked to the concept of Energy communities

Sources and further information

European Commission Documents

- European Commission – Recovery and Resilience Scoreboard: Thematic Analysis on Clean Power (2021)
- European Commission – Implementing the REPowerEU Action Plan: Investment needs, hydrogen accelerator and achieving the bio-methane targets (2022)
- European Commission - The role of renewable H_2 import & storage to scale up the EU deployment of renewable H_2 (2022)
- European Commission – REPowerEU Plan (2022)
- Clean Hydrogen Joint Undertaking – Going Global: An update on Hydrogen Valleys and their role in the new hydrogen economy (2022)
- European Clean Hydrogen Alliance – Reports of the Alliance Roundtables on Barriers and Mitigation Measures (2021)
- Fuel Cells and Hydrogen Joint Undertaking – Public Summary Report: Project Development Assistance for Cities and Regions (2021)

Policy Learning Platform Resources

- Webinar recording: Building a regional hydrogen economy
- Peer Review: Deriving local value from green hydrogen
- Story: Preparing for the hydrogen economy
- Story: Finding synergies between renewable energy and ecosystem services

Other Resources

- Hydrogen Europe: Hydrogen – Enabling a Zero-Emission Society (2022)
- International Energy Agency – The Future of Hydrogen: Seizing today's opportunities (2019)
- International Energy Agency – Global Hydrogen Review 2022
- International Renewable Energy Agency – Creating a Global Hydrogen Market: Certification to Enable Trade (2023)

#LowCarbon #Hydrogen
#RenewableEnergy
#EnergyTransition

Interreg Europe Policy Learning Platform on Low-carbon economy

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