9

The Role of Regional and Local Authorities in Developing a Regional Hydrogen Economy

Ceciel Nieuwenhout

9.1 INTRODUCTION

Academic and professional discussions on the development of a hydrogen economy often focus on the role of the industry and a national hydrogen pipeline infrastructure. What is frequently overlooked in these discussions, however, are important local and regional developments, which support the creation and development of a regional hydrogen economy. Some regions even declared themselves 'hydrogen valleys'.[1] This chapter deepens the understanding of the role of regions in the development of hydrogen markets. In practical terms, this is done by bringing parties together and positioning the specific region as a (green) hydrogen hotspot, but also by creating local demand. This chapter investigates the role of regional and local authorities in creating and developing a hydrogen market and the limits thereof. First, the ways in which regional and local authorities can influence the development of a local or regional hydrogen market is analysed (Section 9.2). Then, the policy and legal instruments for doing so are investigated in Section 9.3. This section is based on a functional comparative approach between two 'hydrogen regions', Groningen and Puglia. These regions are chosen as they are frontrunners in the development of hydrogen, but with a different approach.[2] The chapter closes with a conclusion and recommendations on the role of regions and regional authorities in the development of a hydrogen market.

9.2 THE ROLE OF REGIONS IN THE DEVELOPMENT OF HYDROGEN MARKETS AND INFRASTRUCTURE

Although the development of hydrogen infrastructure and hydrogen markets is mainly considered to be a national issue, there is a role for regional and local governments, especially in situations where no or only a limited national infrastructure or policy exists. Each country has a different

[1] For examples in Europe and around the world, see U. Weichenhain and others, 'Going Global – An Update on Hydrogen Valleys and Their Role in the New Hydrogen Economy', commissioned by Joint Undertaking Clean Hydrogen (EU), September 2022, p. 15 and further <https://clean-hydrogen.europa.eu/system/files/2022-09/Hydrogen_Valleys_online_2022.pdf> accessed on 8 February 2024 (Roland Berger report).

[2] It must be noted that there are many other regions that could be compared, but it lies beyond the scope of this chapter to provide a full overview of all hydrogen activities by all regions. The chapter focuses on the two selected regions as examples of how regions could develop hydrogen policy and regulations.

general division of competences between the national, regional and local governments, but even when certain issues are seen as a national competence, there may still be specific regional policies stimulating the development of hydrogen in that region in at least three respects.

Regional authorities may aspire to position themselves specifically as a 'hydrogen region' or 'hydrogen valley'.[3] They can bring together knowledge institutions and innovative companies, as well as specific industrial demand or supply of hydrogen. Moreover, as regional authorities are often in charge of the regional economic and industrial policy, they can focus on filling in specific gaps in the development of hydrogen chains. A further role that regional and local authorities may assume is related to the first role concerns help in creating local demand for hydrogen. Regional and local authorities can do so directly via the tender processes for public transportation[4] and/or maintenance vehicles,[5] and indirectly by stimulating industry in the region to transition to hydrogen usage rather than fossil fuels for industrial processes. With regard to the latter, local and regional authorities entrusted with environmental control over the local industry may also have to give specific environmental or spatial planning permits for such transitions. Finally, regional authorities in some countries, such as the Netherlands local authorities (*gemeentes*), are responsible for designing policy regarding the heat transition[6] and may use this role to stimulate system integration between heat, electricity and various gases in the transition to a fossil-free energy sector, for example by creating district heating networks for residential heating.[7] For this, they have to draft a heat transition plan in which they determine the source of heating in the future for each neighbourhood. This could be a (collective) heat network, individual heat pumps or a system based on a form of renewable gas.[8] If local governments decide that part of their neighbourhoods should be heated via district heating, this heat network should also be run on some form of renewable energy.[9] Next to geothermal, solar thermal and aquathermal energy (energy from surface water or sewage water),[10] waste heat can be an important source of heat for a low-carbon district heating network.[11]

[3] Cf Roland Berger report.

[4] Hydrogen trains (Coradia iLint) are used by Landesnahverkehrsgesellschaft Niedersachsen: J. Buckley, 'world's first hydrogen-powered passenger trains are here', CNN, 24 August 2022 <https://edition.cnn.com/travel/article/coradia-ilint-hydrogen-trains/index.html> accessed on 8 February 2024. There are currently 5,648 fuel cell buses in operation worldwide (2020 figures): R. Can Samsun, L. Antoni, M. Rex, D. Stolten, 'Deployment Status of Fuel Cells in Road Transport: 2021 Update', International Energy Agency (IEA) Advanced Fuel Cells Technology Collaboration Programme (AFC TCP). Forschungszentrum Jülich. The majority of these buses are located in China.

[5] With the HECTOR (Hydrogen Waste Collection Vehicles in Northwest Europe) project, waste collection vehicles on hydrogen are produced and tested in practice in seven cities around Europe: 'Project Summary' Interreg North-West Europe Hector <https://nweurope.eu/projects/project-search/hector-hydrogen-waste-collection-vehicles-in-north-west-europe/> accessed on 8 February 2024.

[6] Right now, this responsibility is not based on law but on the Climate Agreement, a form of soft law, signed by representatives from municipal and provincial governments as well as interest groups from different fields, such as the electricity sector, heavy industry, transportation sector and NGOs.

[7] Dutch Ministry of Economic Affairs and Climate, Kamerbrief DGKE-DE/22494404 on *Wet collectieve warmtevoorziening, besluit infrastructuur in publieke handen*, 21 October 2022.

[8] Such as biogas, syngas or hydrogen.

[9] Currently, however, only 8 per cent of heat in district heating is from renewable sources. IEA, Report: 'District Heating', IEA 2022, Paris <https://iea.org/reports/district-heating> accessed on 8 February 2024, Licence: CC BY 4.0.

[10] T. Pauschinger, 'Solar thermal energy for district heating' in R. Wiltshire (ed.) *Advanced District Heating and Cooling (DHC) Systems* (Woodhead Publishing 2016); for an analysis of the potential of aquathermia in the Netherlands: K. Kruit (CE Delft), B. Schepers (CE Delft), R. Roosjen (Deltares), P. Boderie (Deltares), 'Nationaal potentieel van aquathermie Analyse en review van de mogelijkheden', Delft, CE Delft, September 2018.

[11] The extent to which different sources of heat are used in a residential heat network depends on the local availability of these sources. Losses of heat during transportation over long distances is an important factor in this. However, the availability of waste heat can be steered by the (industrial) policy of the local authorities. This is especially relevant in cases where the (future) demand for heat exceeds the (existing or future) supply of heat.

In this context, a local government may also wish to incentivise hydrogen production facilities in the proximity of the district heat network. In this way, the waste heat from hydrogen production can serve a useful purpose[12] when a (residential) heat network is available nearby. As the process of electrolysis as well as the storage of hydrogen may not be allowed in the vicinity of residential buildings,[13] local governments do need to take into account the space necessary for such facilities in their spatial planning processes.

9.3 HYDROGEN POLICY AND LAW IN GRONINGEN AND PUGLIA

Different regions are developing their hydrogen law and policy in different ways. A comparison between regions is useful to gain insights into the different choices to be made and the consequences of those choices. This section compares the way policy and law are used to further the regional ambitions regarding a green hydrogen economy. The comparison focuses on the interplay between hydrogen policy and law, as well as on the interplay between regional and national governments.

Several regions are now developing hydrogen policy and law. For this comparison, the choice of regions was based on two elements: they need to be sufficiently advanced in the development of hydrogen law and/or policy, which ensures there is sufficient comparison material, and they must have a sufficiently distinct approach from each other, so the approaches can be compared. Finally, the actual availability of legal and policy documents also played a role. On the basis of these criteria, Puglia in Italy and Groningen in the Netherlands have been chosen for comparison. The lessons learned in these regions may serve other regions aspiring to develop hydrogen policy and law.

The comparison is made by first analysing the general objectives of the regions (why does this region aspire to be a hydrogen region?); then, the policy adopted to support this ambition, and finally the legal framework (as far as existent) applicable to the development of a regional hydrogen economy. After analysing these topics for both Puglia and Groningen (respectively Sections 9.3.2 and 9.3.3), the differences and similarities between the two regions are analysed in Section 9.3.4.

9.3.1 *Puglia*

The Italian region of Puglia, with its capital Bari, is very active in promoting hydrogen, via both policy and law. In 2019 Puglia adopted a regional Act on the promotion of the use of hydrogen,[14] and various interesting projects are being developed in the Puglia region. The reason why this region is specifically interested in hydrogen is due to the high potential of energy production from renewable sources,[15] with relatively low demand for electricity in the region.

[12] F. Jonsson, A. Miljanovic, 'Utilization of Waste Heat from Hydrogen Production – A Case Study on the Botnia Link H2 Project in Luleå, Sweden', MSc Thesis, Mälardalen University, August 2022; F. S. Le Coultre, 'Utilisation of Heat Released during the Production of Green Hydrogen Using Alkaline Electrolysis', MSc Thesis, Technical University Delft, June 2022.

[13] What the minimum distances to the nearest residential buildings should be depends on the size of the electrolyser and the method and capacity of storage. As an example, the forthcoming Decision on Activities in the Environment (Besluit Activiteiten Leefomgeving), Staatsblad 2018, 293, art. 4.1008(2), gives a distance of 15 metres for more than 1,000 litres of inflammable gases stored in gas cylinders. For underground gas storage, different rules apply.

[14] Regional Act No. 34-2019 (Legge Regionale Puglia del 23 luglio 2019, no. 34) <https://dait.interno.gov.it/territorio-e-autonomie-locali/legittimita-costituzionale/legge-regionale-puglia-del-23-luglio-2019> accessed on 8 February 2024.

[15] The region, located in the south of Italy, has high potential for solar energy. Moreover, the region also has wind resources. Terna, 'Provisional Data on Operation of the Italian Electricity System', 2020, p. 16 <https://download.terna.it/terna/2020_Provisional_data_operation_8d921d62b13a935.pdf> accessed on 29 June 2024. See also M.

Hence, hydrogen production infrastructure can facilitate the grid integration of fluctuating renewable energy sources.[16]

Policy

As a region, Puglia is devoted to developing a hydrogen economy. The regional authorities created a hydrogen policy, which has been codified in the abovementioned regional Hydrogen Act. With this Act, the region confirms that it aims to promote hydrogen and incentivize its usage and production, explicitly recognizing its roles in energy storage, as alternative fuel and especially as a means of integrating renewable energy into the electricity grid.[17] The Act is broader than only hydrogen, as it also includes provisions on the renewal of existing electricity production facilities as well as the general goal to contribute to greenhouse gas emissions reduction and tackling the dependency on fossil fuels.[18] The Act provides a comprehensive overview of the hydrogen policy for Puglia, based on four pillars.

First, the region stimulates projects on the production of hydrogen; hydrogen-based co-generation plants for the production of electricity and heat; a regional distribution network for hydrogen; increased demand for hydrogen as fuel for vehicles; aggregation and storage; and the development of R&D facilities with a view to expand knowledge and skills on hydrogen.[19] The instruments used for this purpose are agreements, conventions and memoranda of understanding with various partners, such as public bodies, research bodies, companies, trade associations and business consortia.[20]

Second, the Regional Council develops a regional hydrogen plan.[21] This plan, to be updated every three years, analyses the current state and development prospects of research and technical knowledge related to hydrogen; defines objectives for the upcoming three-year period; identifies regional measures for promotion and support of hydrogen production from renewable sources; lists the financial means for implementing the regional hydrogen plan; and provides tools for monitoring the implementation of the plan.[22]

A third aspect is the adoption of supporting measures to implement the hydrogen ambitions. For example, the region makes funding available for both the production and consumption of hydrogen.[23] It is specified that funding is also available for experimental projects and for specific groups, such as the operators of highways (for refuelling stations) and producers of biomethane

Pierro, D. Moser, R. Perez, C. Cornaro, 'The Value of PV Power Forecast and the Paradox of the "Single Pricing" Scheme: The Italian Case Study' Energies 13, 15 (2020), 3945, for the market impact of renewables on the Italian system (in this case solar resources). Finally, as a coastal area, Puglia may also be used as a landing point for offshore wind farms: A. Memija, 'New Joint Venture to Develop 525 MW Floating Offshore Wind Project in Italy', *Offshorewind.biz*, 29 September 2022.

[16] This objective is formulated explicitly in LR Puglia 2019–34, art. 1(2). Whether grid integration of renewables improves due to the presence of hydrogen production infrastructure depends on other parameters as well, such as the way the electricity market is organised (are hydrogen producers rewarded for providing flexibility?), the availability of subsidies that take grid integration into account (are electricity producers rewarded for contracting hydrogen production facilities?), the capacity of hydrogen production (is the capacity sufficient to shave the peaks of electricity surplus?) and finally the price of hydrogen compared to the price of electricity.

[17] Ibid., art. 1(2).

[18] Ibid., art. 1(1) and 1(3).

[19] Ibid., art. 2(2).

[20] Ibid., art. 2(3).

[21] Ibid., art. 3(1). The Regional Council does so in coherence with European and national plans on energy and transport. Moreover, coherence with the regional renewable energy plan is assured through art. 3(4) of the Act.

[22] Ibid., art. 3(2).

[23] Ibid., art. 5(1).

from green hydrogen.[24] In addition, the Regional Act targets public transportation as a source of hydrogen consumption: it promotes the renewal of the vehicle fleet with hydrogen fuel cell systems.[25] Moreover, the region uses tax measures to encourage investment in hydrogen fuel cell vehicles by companies and individuals: such vehicles are exempted from the regional car tax for a certain period.[26]

A fourth pillar in the hydrogen policy is the creation of a 'Regional Hydrogen Observatory' that collects and analyses data on the regional hydrogen economy and forecasts hydrogen trends. It also promotes meetings, studies and debates on hydrogen and assists the Regional Council in its decision-making on hydrogen-related topics.[27] The Regional Hydrogen Observatory consists of experts from various walks of life, such as representatives from the renewable energy sector, hydrogen production, academia and NGOs focusing on the energy and mobility sector.[28]

With these four pillars, Puglia covers the first two identified roles that regional authorities can take to stimulate a regional hydrogen economy, namely bringing different actors together and creating or stimulating local demand. The third, a role in the heat transition, is less relevant in a Mediterranean region like Puglia.

Law

As Italy is a republic, the regions have significant autonomy to develop their own policy and law in a wide variety of sectors.[29] This is the case for hydrogen. As both 'scientific and technological research and innovation support for productive sectors' and 'transport and distribution of energy' are listed as fields of concurring legislation, both the national government and the regions have legislative competences; lacking express coverage by state legislation, the hydrogen sector can be covered by regional legislation.[30] The regional government has made use of its competences by adopting the Regional Hydrogen Act that was elaborated in the preceding section. However, important aspects of the hydrogen economy, including safety of installations and transportation, are regulated at national level. Therefore, the national legal framework for hydrogen is also briefly described here.

There is no overarching hydrogen Act in Italy. Instead, hydrogen regulation is fragmented – based on the specific use and sector. An important aspect regulated at national level is permits and authorisations for hydrogen installations. At first, hydrogen was, from a legal point of view, considered to be a chemical. It was regulated like other (explosive) chemicals. Interestingly, already from 2006 onwards, a technical rule on hydrogen facilities for automotive vehicles was adopted.[31] This was renewed in 2018,[32] when omissions in the previous rule were

[24] Ibid., art. 5(2)b and c.
[25] Ibid., art. 5(3).
[26] Ibid., art. 5(5). Moreover, after the exemption period, the regional car tax remains reduced to 25 per cent for hydrogen fuel cell vehicles.
[27] Ibid., art. 4.
[28] Ibid., art. 4(4).
[29] Constituzione della Repubblica Italiana, art. 117.
[30] The Italian constitution states that in sectors of concurring legislation (between the republic and its regions), 'legislative powers are vested in the Regions, except for the determination of the fundamental principles, which are laid down in State legislation. The Regions have legislative powers in all subject matters that are not expressly covered by State legislation'. Senato della Repubblica, Constitution of the Italian Republic (Official English translation of the Constituzione della Repubblica Italiana).
[31] Technical Rule on Fire Prevention in Distribution of Hydrogen at Refuelling Stations 2006 (*Regola tecnica di prevenzione incendi per la progettazione, costruzione ed esercizio degli impianti di distribuzione di idrogeno per autotrazione*) DM 31 agosto 2006 (GU n. 213 del 13 settembre 2006).
[32] Technical Rule on Fire Prevention in Distribution of Hydrogen at Refuelling Stations 2018 (*Regola tecnica di prevenzione incendi per la progettazione, costruzione ed esercizio degli impianti di distribuzione di idrogeno per autotrazione*), DM 23 ottobre 2018, DM 23 ottobre 2018.

addressed.[33] The translated title of the instrument is: Ministerial Decree on Technical Rules of Fire Prevention for Design, Construction and Operation of Hydrogen Distribution Facilities for Automotive Vehicles. As the title suggests, the rule is narrow in scope as it concerns facilities for automotive vehicles, but it does in fact cover the entire chain including the production of hydrogen at locations relevant for automotive vehicles.

Other activities (not related to automotive uses) do not have such a specific regulation. For example, electrolysers are mainly treated as a form of industrial activity and not as a specific element of the energy chain. They do not have a specific status and they are regulated like other industrial activities of the same size and hazard category. The grid connection of electrolysers is based on general rules concerning grid connection of industrial installations.[34] This can be considered a missed opportunity, as this way of regulating does not take into account the specific added benefits that hydrogen production could have for the grid integration of renewable energy sources.[35] Especially in the context of the Puglian hydrogen economy, which is explicitly aiming at increased grid integration of renewable energy, a regulatory framework that rewards the benefits of hydrogen production would be an important addition.

Transportation of hydrogen by road, rail and inland waterways is regulated like every other form of transportation of dangerous or inflammable products, namely on the basis of the Legislative Decree on the Transport of Dangerous Goods,[36] a direct implementation of the European legal framework on the transportation of dangerous goods.[37] It includes standards for the transportation of dangerous goods (including hydrogen), classification of dangerous goods for road transport, shipping procedures, as well as provisions on the construction, testing and approval of packaging and tanks, use and requirements for means of transport and cases of exemption. However, this legal framework is not applicable to transportation by pipeline. As transportation by pipeline is expected to bring together hydrogen production and consumption within a region or between regions, it is important that the legal framework for transportation of hydrogen via pipeline is being developed. It is important that this issue is not only approached in the context of safety and permits, but also with regard to the issues of which actors should develop transmission infrastructure; whether or not a transmission system operator should be appointed and whether or not there should be third-party access to hydrogen pipeline infrastructure.

In conclusion, the legal framework for hydrogen in Italy is fragmented and there is no overarching national Act on hydrogen. This creates legal uncertainty regarding various hydrogen-related activities, especially when they are organised differently per region. Nevertheless, the Regional Act on Hydrogen, adopted by the Puglian Regional Council, does give legal certainty to project developers, companies and knowledge institutions on the direction

[33] An example of an omission is that the 2006 rule only considered hydrogen from fossil sources, whereas the 2018 rule also includes electrolysis. DM 23 ottobre 2018, art. 2.2.

[34] These rules are laid down in the 'TICA': ARERA (Italian regulatory authority), *Testo integrato delle condizioni tecniche ed economiche per la connessione alle reti elettriche con obbligo di connessione di terzi degli impianti di produzione di energia elettrica (Testo integrato delle connessioni attive – TICA).*

[35] M. Ciminelli, P. Cavasola, 'Hydrogen Law, Regulations & Strategy in Italy', CMS Law <https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/italy> accessed on 8 February 2024.

[36] Decreto legislativo – 27/01/2010 – n. 35 – Trasporto interno di merci pericolose. This Act has been amended several times Ministero Delle Infrastrutture e dei Trasporti, Decreto 12 maggio 2017. Recepimento della direttiva 2016/2309 della Commissione del 16 dicembre 2016 che adegua per la quarta volta al progresso scientifico e tecnico gli allegati della direttiva 2008/68/CE del Parlamento europeo e del Consiglio relativa al trasporto interno di merci pericolose.

[37] Directive 2008/68/EC of the European Parliament and of the Council of 24 September 2008 on the inland transport of dangerous goods, OJ L 260, 30.9.2008, and following Acts, specifically Commission Directive (EU) 2016/2309 of 16 December 2016 adapting for the fourth time the Annexes to Directive 2008/68/EC.

of hydrogen policy in Puglia in the coming years. Moreover, the Regional Act also provides sufficient instruments for the regional hydrogen policy. Finally, a danger to the implementation of the regional Hydrogen Act is dependency on the underdeveloped national legal framework for important matters such as permits, integration in the energy sector and transportation by pipeline: development of national overarching laws on this topic may be too slow for the regional ambitions, leaving project developers with legislative uncertainty. Moreover, in the absence of a national framework for the governance of hydrogen pipelines, the regions may all develop their own approaches, creating a patchwork of different systems. As long as all hydrogen developments take place within one region, this is not problematic, but as soon as pipelines cross regional borders, it may become so.

9.3.2 *Groningen*

The north of the Netherlands, with a key role for Groningen,[38] refers to itself as the first 'hydrogen valley' of Europe.[39] That is, inter alia, because over recent years many hydrogen-related projects have been or are currently being developed in this region.[40] There are three main reasons why Groningen as a region has an interest in the development of a hydrogen economy: first, Groningen is home to one of the largest natural gas fields in Europe.[41] The region traditionally focused on gas production, but due to earthquakes, and the resulting damage,[42] it was decided that the gas production should end.[43] However, Groningen is still home to significant amounts of knowledge and skilled workers in the gas industry, which could be used for the setting up of a more sustainable gas industry.[44] Thus, hydrogen can play a role in the transition from a natural gas industry region to a clean energy region. It must be noted in this context that the gas industry has played a large role in lobbying for hydrogen activities in the region.[45] A second reason for Groningen's interest in hydrogen is that it is currently one of the regions with the highest penetration of renewable energy in the Netherlands, and it has high ambitions with regard to the development of renewable energy (solar power plants and wind energy) in the years ahead. Hydrogen production could help facilitate grid integration of renewables.[46] A third reason is that hydrogen can be used as a feedstock for the industrial clusters of the region.[47]

[38] It is important to note that the name 'Groningen' refers to a province of the Netherlands as well as the capital thereof. In this chapter, it is indicated whether the city or the province of Groningen is meant in a specific context.

[39] Provincie Groningen, 'Waterstof' <https://provinciegroningen.nl/actueel/dossiers/energietransitie/waterstof/#:~:text=De%20provincie%20Groningen%20zet%20zich,Den%20Haag%20en%20in%20Europa> accessed on 8 February 2024.

[40] Provincie Groningen, 'The Northern Netherlands Hydrogen Investment Plan 2020 – Expanding the Northern Netherlands Hydrogen Valley', October 2020 <https://groningen.stateninformatie.nl/document/9479729/1/Investment_Plan_Hydrogen_Northern_Netherlands_2020> accessed on 8 February 2024, p. 38.

[41] Parliamentary Committee of Inquiry into Natural Gas Extraction in Groningen, 'Groningers before Gas', 24 February 2023, pp. 14 and 71.

[42] Ibid., pp. 16–17.

[43] Dutch Ministry of Economic Affairs and Climate, Kamerbrief 'Wetsvoorstel "Wat na nul" – wetswijzigingen in verband met de definitieve sluiting van het Groningenveld', DGKE-PDG/20243498, 24 November 2020.

[44] Provincie Groningen, 'The Northern Netherlands Hydrogen Investment Plan 2020', p. 16.

[45] B. Schohaus, B. van Beek, J. Mast, M. de Buck, A. Beunder, 'Shell beloofde Groningen ooit een 'goene' toekomst', *Follow the Money*, 17 June 2024 <www.ftm.nl/artikelen/shell-beloofde-groningen-groene-toekomst?share=JEtlrWdSM2%2F8bjT84tzIhKtQYOuaaG9MVxBKIuy4R%2FIGqkahQ6VG7CyA1u5bISw%3D> accessed on 21 June 2024.

[46] Provincie Groningen, 'The Northern Netherlands Hydrogen Investment Plan 2020', p. 16.

[47] Delfzijl, Eemshaven and, just outside Groningen province, Emmen. The HEAVENN project shows various ways in which the industry uses the produced hydrogen. HEAVENN, 'Projects' <https://heavenn.org/heaven-projects/> accessed on 8 February 2024.

Policy

The Province of Groningen has an active role in developing a hydrogen network. This policy has resulted from considerations related to strengthening the local economy and retaining sufficient employment possibilities while the fossil fuel production region was declining.[48] The policy was partially designed in close connection to the companies involved in the production of natural gas in the region.[49]

The role of the province in the development of a hydrogen region is twofold: on the one hand, the province creates a network of companies working together in the hydrogen chain, and on the other hand, together with its partners, it develops a pipeline of projects which it coordinates in terms of timing and funding.[50] This translates into an active lobby for hydrogen on the national and EU scale, and in a stimulus for companies to apply for funding for projects.[51] Moreover, the province developed an Investment Plan with concrete actions for the coming years. The Investment Plan can be compared to the Regional Hydrogen Plan that is to be developed in Puglia; it contains various projects, measures and a roadmap for future hydrogen expansion. With this Investment Plan, the Groningen Regional Council demonstrates the political will to invest in hydrogen, which will help to create investment certainty for project developers.

A recent update of the Investment Plan has shown a vast increase in hydrogen-related projects (from fifty to more than eighty), but at the same time it has become clear that no investment decisions have been made on large(r)-scale green hydrogen projects.[52] Compared to the 2020 ambitions, there is a serious delay, which also involves the hydrogen infrastructure projects that serve as a backbone for the other activities. This is due to the reluctance of parties to conclude long-term contracts, making the business case (too) uncertain to proceed to a final investment decision.[53] Higher energy costs and economic uncertainty, for example in the chemical industry, have also played a role in the delay of these projects.[54] Without these large projects, it is difficult to keep the 'hydrogen frontrunner' position that Groningen aims for.[55]

The efforts are coordinated via HyNorth, the Transformation and Coordination Office founded by the provincial hydrogen roadmap. This organisation is also responsible for monitoring the results and for bringing together partners that depend on each other in the 'hydrogen chain'.

Next to the provincial efforts, there are also other local entities active in the promotion of hydrogen. One of the ways in which the city of Groningen influences the demand for hydrogen is by experimenting with hydrogen as a fuel for public transportation,[56] and (heavy duty) vehicles owned by the municipality itself.[57] By doing so, a city or region can speed up the innovation process for fuelling heavy vehicles with hydrogen. Not only large cities are developing hydrogen projects: In Wagenborgen, a village in the rural area of East Groningen, thirty houses owned by

[48] Schohaus et al., 'Shell beloofde Groningen ooit een "goene" toekomst' (2024).
[49] Ibid.
[50] Provincie Groningen, 'The Northern Netherlands Hydrogen Investment Plan 2020', p. 41.
[51] See Provincie Groningen, 'Waterstof'.
[52] HyNorth, 'Samen aan de slag, Investeringsplan Waterstof Noord-Nederland 2024', Groningen, June 2024, 6.
[53] Ibid., 6.
[54] Ibid., 7.
[55] Ibid., 7.
[56] As part of OV-bureau Groningen-Drenthe, 'De Toekomst Is Groen' <https://ovbureau.nl/themas/de-toekomst-is-groen/#:~:text=van%20Nederlandse%20windparken.-,Waterstofbussen,te%20maken%2C%20de%20Hydrogen%20Valley> accessed on 8 February 2024.
[57] As of February 2023: three waste collection trucks as part of the H2Revive project (Horizon2020); two passenger cars, two vans, two waste collection vehicles and a hydrogen maintenance boat as part of the HyTrEc2 project (Interreg North Sea); one waste collection vehicle as part of the Hector project (Interreg North Sea); four waste collection trucks, eight hydrogen vans and a building heating system as part of HEAVENN (Horizon2020).

a social housing corporation are connected to a small hydrogen grid.[58] This allows the project partners to experiment with different components (such as residential hydrogen heating installations), new roles (the distribution system operator of the region, Enexis, which normally operates the electricity and gas network, will also develop the hydrogen network) and citizen engagement.[59]

However, it must be noted that, despite claims that these cases help to increase local demand for hydrogen and thereby boost the development of clean hydrogen production, critics claim that one should not use the (scarce) amounts of clean hydrogen for purposes in which other technologies or fuels are available (and sometimes better suited).[60] In fact, both views can be applicable at the same time, namely in a situation where hydrogen consumption and production are still at a low level. The weighing of different interests and alternatives for specific purposes may differ by region and vary over time. It helps if regions have a clear vision on what the purpose of a pilot is and how the resulting knowledge and infrastructure will be used in the future.

Of the three roles identified in Section 9.2, the province of Groningen is most active in the first role (bringing together various parties and completing the hydrogen chain), whereas various municipalities (together with the province of Groningen) are investing in the second role (increasing the demand for hydrogen via public transport and municipal vehicles and hydrogen usage in residential areas). Interestingly, even though there is significant heat demand in the Netherlands, and Groningen has a heat network based on waste heat, this has not yet been coupled to the hydrogen economy.

Law

The different hydrogen production and use activities in the northern Netherlands must fit within the existing legal framework. In the Netherlands, the regulation of hydrogen lies with the national authorities. As such, Groningen cannot adopt specific legislation on hydrogen, even though it wishes to be a frontrunner in the development of hydrogen. It should therefore seek support from other regions with similarly high hydrogen ambitions: the port areas of Rotterdam and Amsterdam,[61] as well as the chemical cluster of Zeeland, with the first Dutch hydrogen pipeline between Dow and Yara.[62] The various Dutch regions with hydrogen ambitions are at the same time competing and cooperating with each other: there is competition, for example, in

[58] Groninger Huis, 'WaterstofWijk Wagenborgen' <https://groningerhuis.nl/projecten/waterstofwijk-wagenborgen/> accessed on 8 February 2024.

[59] Citizen engagement in hydrogen heating trials is important, as is shown by events in Whitby, United Kingdom: A. Lawson, '"We've got no choice": Locals fear life as lab rats in UK hydrogen heating pilot', *The Guardian*, 21 November 2022; R. Parkes, 'Hundreds of residents vent anger over "entirely pointless" hydrogen heating trial during hostile public meeting', *Hydrogen Insight*, 2 March 2023.

[60] For example, in transportation, personal vehicles do not necessarily need to be fuelled by hydrogen: regular electric cars are an energy- (and cost-)efficient alternative. For heavy-duty vehicles, there may not be sufficient alternative options. F. Ueckerdt, C. Bauer, A. Dirnaichner, J. Everall, R. Sacchi, G. Luderer, 'Potential and risks of hydrogen-based e-fuels in climate change mitigation' *Nature Climate Change* 11 (2021) 384–393. For residential heating, electrical heat pumps and heat networks based on sustainable heat are also clean technologies, which may also have lower system costs than hydrogen-based residential heating. J. Rosenow, 'Is heating homes with hydrogen all but a pipe dream? An evidence review' *Joule* 6, 10, 19 October 2022, 2225–2228.

[61] Rotterdam Sea Port, 'Factsheet Waterstofeconomie in Rotterdam', April 2021; Port of Amsterdam, 'Hydrogen Hub Amsterdam North Sea Canal Area', October 2021.

[62] The pipeline has been operational since 2018. Hynetwork, 'Waterstofleiding Dow-Yara' <https://hynetwork.nl/over-hynetwork-services/waterstofleiding-dow-yara> accessed on 8 February 2024.

the application for national or EU-based funding for their projects, and cooperation takes place in joint efforts for the development of national policies and legislation on hydrogen.

Despite all the ambitious hydrogen regions in the Netherlands, the current legal framework for hydrogen is still under construction: the new Energy Act which is currently still in the parliamentary process, is the first Act to include hydrogen regulation. It proposes to include hydrogen in the rules on unbundling, making it in principle impossible for the same legal entity to be involved in both commercial activities (production, trade, sale) and transportation of hydrogen.[63] Infrastructure companies are allowed to develop hydrogen transmission infrastructure as well as to organise hydrogen trading platforms.[64] They are also allowed to develop hydrogen storage facilities, as well as terminals and interconnectors for export of hydrogen.[65] A major point of consideration is the re-use of the existing natural gas infrastructure for the creation of a hydrogen pipeline infrastructure 'backbone'. Moreover, an important highlight of this proposed Energy Act is that it puts an end to the long discussion on whether or not the hydrogen pipeline system should be owned by a party that is unbundled from the production, supply and storage of hydrogen.[66] An additional question is whether the entity responsible for natural gas (owning the gas pipeline structure that will partially be re-used), Gasunie Transport Services (GTS), should become the transmission system operator (TSO) of the hydrogen system.[67]

Next to the debate on the direction of the legal framework concerning the ownership of pipeline infrastructure, other relevant topics are the permitting and licensing regimes and the rules that are applicable to hydrogen transportation via road, rail and inland waterways. Permitting and licensing regimes, for example for hydrogen production and refuelling stations, are based on the legal framework for industrial activities, which is also undergoing a major legislative overhaul.[68] Regarding transportation of hydrogen via road, rail and waterways, the legal framework is based on the implementation of European legislation.[69] The regional experiments with hydrogen as a fuel for residential heating (Wagenborgen) are based on exemptions to the existing legislation, rather than on a solid legal framework. The Minister of Economic Affairs requested the Dutch State Supervision of Mines (Staatstoezicht op de Mijnen), which is also the authority for the safety of gas extraction activities, to supervise the safety of experiments with hydrogen in residential areas.[70]

9.3.3 *Comparison*

In this section, the 'hydrogen regions' of Groningen and Puglia are compared on both the policy and law related to hydrogen. Main points that stand out are a focus on the energy chain; the

[63] Energy Act (version as decided by the Second Chamber on 4 June), art. 3.10.
[64] Ibid., 3.19.
[65] Ibid., 3.19(4)
[66] The Dutch regulatory authority ACM has published a report on this topic, focused on the activities allowed under the current legal framework. ACM, 'Leidraad Netwerkbedrijven en Alternatieve Energiedragers', 14 September 2021, ACM/19/036168/Documentnr. ACM/UIT/555471.
[67] For details see Chapter 17 by Maaike Broersma, Philipp Jäger and Marijn Holwerda in this book.
[68] The '*Omgevingswet*' (Environmental Planning Act) will replace nineteen legal instruments on environmental permits and procedures. The envisaged end result is a simplified and more coherent legal framework for environmental permits and procedures.
[69] In the Netherlands, this is implemented in the Act on the Transportation of Dangerous Goods (*Wet Vervoer Gevaarlijke Stoffen*, WVGS). Instituut Fysieke Veiligheid, 'Kennisbundel transport van waterstof(dragers)', 2 March 2022.
[70] Dutch Ministry of Economic Affairs and Climate, Letter: 'Toezicht op waterstofpilots en demonstratieprojecten', 6 October 2022, Document No. DGKE-DE/22510896.

underlying policy goals of the ambition to develop a hydrogen region; the role of municipalities; the regional legal framework; and the relation to the national legal framework. These topics are treated in more detail below.

First, regarding the hydrogen chain, both Puglia and Groningen have applied for projects related to a combination of electrolysis, hydrogen storage and various forms of hydrogen use, in order to reach a 'hydrogen chain' rather than separate projects.[71] This could be explained as follows. For entities to benefit from the regional focus (contrary to a national focus), it is important that the region includes various parts of the chain, such as production, storage, transportation and use, within a geographically limited area. With isolated projects, there is less benefit from a regional approach compared to a national approach, as geographical proximity between projects is not exploited. As mentioned in the updated hydrogen investment plan for Groningen, this focus on a chain of projects has the downside that delays in one project influences the projects surrounding it and can affect the activities in the entire region.

A second point relates to the underlying goals of the hydrogen ambitions. There is a clear difference between Puglia and Groningen, at least in the communication about the goals. Puglia focuses mainly on the combination of renewable energy and green hydrogen production, driven by the need for better grid integration of the large potential for renewable energy in Puglia. This is also mentioned in the Groningen case, but in policy documents it becomes clear that Groningen focuses more on industrial policy and economic considerations, and specifically on the link between green hydrogen production, infrastructure and integration in industrial processes. A secondary goal is to use hydrogen as a replacement for the natural gas sector that is seeing its activities decline in Groningen.[72]

Whereas the goals and background of the ambition differ, the means to reach it are similar: both regions adopted specific policy instruments to this end, which focus not only on the energy installations as such, but also on other aspects such as expanding knowledge and skills in the hydrogen industry and collecting data and trends on the development of the regional hydrogen economy. In both cases, a coordinating and monitoring body is present.

The involvement of municipalities is different in Groningen and Puglia. Whereas they are essential to the policy framework in Groningen, this is less so (or at least less visible from the outside) in Puglia. In Groningen, some municipalities are actively promoting the use of hydrogen in municipal vehicles or in a 'hydrogen neighbourhood' in which hydrogen is used as a means of heating. A recommendation in this regard is to couple the development of a hydrogen economy to other municipal tasks, such as heating transition (in the Netherlands) or transportation policy (local public transport for example). This may deliver mutual benefits to the policy goals, such as the use of waste heat from hydrogen production that can be used in a municipal heat network.

The next point of comparison is the development of a regional legal framework. Puglia and Groningen differ significantly in their approaches. This difference stems from the constitutional and political differences between the regions: Italy is a republic, and regions in Italy are more accustomed to adopting their own legislation on a wide variety of topics. Thus, Puglia laid down

[71] In northern Netherlands, an example is the EU-funded HEAVENN project: HEAVENN is a large-scale programme of demo projects bringing together core elements: production, distribution, storage and local end use of hydrogen (H2) into a fully integrated and functioning 'H2 valley' (H2V) that can serve as a blueprint for replication across Europe and beyond. The Puglia green hydrogen valley project combines three hydrogen electrolysis plants (220 MW) with 400 MW of solar energy plants. This hydrogen will then be used in local industries as well as for injection in the local gas network and for transportation purposes.

[72] Provincie Groningen, 'The Northern Netherlands Hydrogen Investment Plan 2020', p. 7.

its policy in a Regional Act, whereas Groningen only has policy documents. Although the difference between the two regions can be explained, the outcome is that Puglia creates more legal certainty. The Regional Act explains the ambitions, instruments and scope of the hydrogen plans unambiguously and for the longer term. Groningen does not have a similar Act but did adopt a regional investment plan on hydrogen that lays down ambitions and projects as well as a development plan for the longer term. However, this document has less legal value than an Act.

Both regions rely on national legislation on hydrogen infrastructure and safety of installations. In the Netherlands, the legal framework is under development, after a long period of discussions on which entity should own and operate hydrogen infrastructure. In Italy, the lack of legislation on hydrogen transportation via pipeline is a legislative gap: pipelines are a logical mode of transportation to match production and consumption of hydrogen within a region. Both countries have legislation regarding transportation of hydrogen via road, rail and waterways, which is based on European law regarding dangerous goods.

Finally, a missed opportunity is that neither of the countries has specific legislation on the integration of hydrogen in the energy sector, whereas in both countries, a main reason for the development of a hydrogen economy is to relieve the stress put on the electricity system regarding the increased load and penetration of intermittent renewable energy sources.

9.4 CONCLUSION AND RECOMMENDATIONS

Hydrogen infrastructure is expected to develop as national infrastructure, but the role of regional and local authorities in the creation and development of the hydrogen market should not be underestimated. Regional and local authorities can have several roles in this respect. First, they can bring parties (companies, industrial associations, knowledge institutions) together and position the specific region as a hydrogen hotspot. Regions are often already in charge of industrial policy and employment policy, and the development of a hydrogen region fits with this competence. Secondly, regions can create local demand through the procurement of public transport services and/or maintenance for vehicles, also in areas where there is no industrial demand for hydrogen (yet). In doing so, they can also complete the 'hydrogen chain', when there is potential for hydrogen production. Third, local and regional authorities can play a role in system integration between electricity, hydrogen and heat by using the waste heat from hydrogen production in district heating. When creating a local demand for hydrogen, municipalities may want to steer towards *local* production of hydrogen, as the waste heat of this process can then be used in local district heating networks. Even though there is an identified potential for use of waste heat from hydrogen production, this chapter shows that possibility is currently not taken up by local or regional authorities in the investigated regions (Groningen and Puglia).

The comparison between these regions showed that there are differences in regional hydrogen policy and law either on the general purpose or on the approach and the translation into legal instruments. First, the purposes for the development of a regional hydrogen economy differ significantly. Whereas Puglia's main reason for the development of a hydrogen economy is the facilitation of the grid integration of renewables, Groningen developed its hydrogen policy in its search for a replacement for natural gas production and transportation in its regional economy, both the physical infrastructure and the socio-economic infrastructure, including knowledge and skills. The approach to hydrogen policy is also different: whereas Puglia has an overarching instrument, the Groningen approach is based more on projects. Nevertheless, both regions focus on the entire chain, from production to transportation and various types of consumption. In terms of the translation into legal instruments, Puglia adopted a specific legal instrument

on hydrogen. This is not the case in Groningen. Codifying the policy into legal instruments has an advantage in that it formalises the regional commitment to hydrogen, thereby providing a stable investment climate for project developers as well as R&D facilities. Both regions, however, struggle with a lack of coherent national legislation for hydrogen.

Based on this chapter, recommendations for regions wishing to create a regional hydrogen policy and legal framework are, first, to consider the purpose for which the hydrogen economy will be developed and to design the policy and legal framework in a way that fits with this purpose; second, to consider whether or not the policy should be based only on soft law instruments or whether a local legal instrument can be used; third, to involve local authorities, such as municipalities, which can also take up their own role in the development of a regional hydrogen economy; and fourth, in regions with district heating, whether or not system integration between hydrogen production and heat networks can be accomplished, as the potential value of waste heat from the hydrogen production process can only materialise if the facilities are located sufficiently close to the district heating network and if the use of waste heat is taken into account in the design of the production facilities. This requires a far-sighted policy that also considers future demand for low-carbon heat. Next to recommendations for local and regional authorities, a recommendation for national authorities is to develop a coherent legal framework on hydrogen that recognises the role(s) of regions in the development of a hydrogen economy.

FURTHER READING

R. Can Samsun, L. Antoni, M. Rex, D. Stolten, 'Deployment Status of Fuel Cells in Road Transport: 2021 Update', International Energy Agency (IEA) Advanced Fuel Cells Technology Collaboration Programme (AFC TCP), Forschungszentrum Jülich

M. Ciminelli, P. Cavasola (CMS Law): 'Expert Guide to Hydrogen – Italy', available at <https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/italy> accessed on 8 February 2024

F. Jonsson, A. Miljanovic, 'Utilization of Waste Heat from Hydrogen Production – A case study on the Botnia Link H2 Project in Luleå, Sweden' MSc Thesis, Mälardalen University, August 2022

Provincie Groningen, 'The Northern Netherlands Hydrogen Investment Plan 2020 – Expanding the Northern Netherlands Hydrogen Valley', October 2020, available at <https://groningen.stateninformatie.nl/document/9479729/1/Investment_Plan_Hydrogen_Northern_Netherlands_2020> accessed on 8 February 2024

J. Rosenow, 'Is heating homes with hydrogen all but a pipe dream? An evidence review' Joule 6, no. 10, 19 October 2022, 2225–2228]

F. Ueckerdt, C. Bauer, A. Dirnaichner, J. Everall, R. Sacchi, G. Luderer, 'Potential and risks of hydrogen-based e-fuels in climate change mitigation' Nature Climate Change 11 (2021) 384–393.

U. Weichenhain and others (Roland Berger), 'Going Global – An Update on Hydrogen Valleys and Their Role in the New Hydrogen Economy', commissioned by Joint Undertaking Clean Hydrogen (EU), September 2022, available at <https://clean-hydrogen.europa.eu/system/files/2022-09/Hydrogen_Valleys_online_2022.pdf> accessed on 8 February 2024