Regulatory Framework: Legal Challenges and Incentives for the Development of Hydrogen Infrastructure in Port Areas

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1. Introduction

In the 'Government Strategy on Hydrogen', the Dutch government has elaborated on the necessity to develop a clean hydrogen economy,[1] on the role of hydrogen in the energy transition, and on its policy agenda in respect to the hydrogen market.[2] The hydrogen strategy (and its policy agenda) is in line with the ambitious targets for zero-carbon hydrogen, which were introduced in the National Climate Agreement.[3] The government has emphasised that the Netherlands is in a unique position to develop large-scale hydrogen infrastructure, particularly through the production and consumption of hydrogen in port areas and their industrial clusters.[4] Currently, regional hydrogen clusters are being developed in Dutch ports, and in the north of the Netherlands.[5] Parties in the Port of Rotterdam[6] and the Port of Amsterdam (in collaboration with the North Sea Canal region and parties such as Tata Steel),[7] and clusters in Zeeland/Flanders[8] and in the northern Netherlands,[9] have indicated that, in the short term, they will prepare for an economy in which hydrogen has a greater role. In the run up to 2030, there is a desire from the industry to connect hydrogen clusters to allow for the industry to be scaled up further.[10] Ports and industrial clusters therefore consider hydrogen an indispensable part of their future sustainability strategy.

Against this background, Dutch ports intend to facilitate the development of large-scale hydrogen infrastructure. The aim of the 'Havenschets project' is, therefore, to gain insight into the future role of ports regarding conversion, transportation, storage and use of hydrogen.[11] The project proposes the delivery of large quantities of the electricity generated by offshore wind turbines to the selected port regions[12] – the Port of Amsterdam, the Port of Den Helder and Groningen Seaports – and to utilise a portion of this renewable electricity for the production of hydrogen.[13] The efficient use of port regions for this purpose requires planning, coordination and the active use of policy frameworks. The integration of power-to-gas (PtG) in port areas further requires a regulatory framework that facilitates such a development. This report therefore identifies obstacles in the current regulatory framework for the planning, production, transport and supply of hydrogen in the selected Dutch ports and provides insight into future necessary changes to the current regulatory framework.

1.1 Power-to-Gas Technology

Hydrogen can be produced from a large number of primary energy sources and through various technical processes.[14] The classification of hydrogen is dependent on the primary sources and the

[1] The use of hydrogen as a low carbon fuel for heat, vehicles and vessels, and seasonal storage and long-distance transport of energy, see further IEA, *'The Future of Hydrogen'*, 2019, p. 13.
[2] Government Strategy on Hydrogen of 6 April 2020, available at <https://www.government.nl/ministries/ministry-of-economic-affairs-and-climate-policy/documents/publications/2020/04/06/government-strategy-on-hydrogen>
[3] Climate Agreement of 28 June 2019, available at <https://www.government.nl/documents/reports/2019/06/28/climate-agreement>
[4] Climate Agreement of 28 June 2019, paragraph C3.3.3, p. 96 – 101.
[5] Government Strategy on Hydrogen of 6 April 2020, Section 3, p. 9 – 12.
[6] CE Delft, *'Waterstofroutes Nederland – Blauw, groen en import'*, 2018, available in Dutch at <https://www.ce.nl/publicaties/2127/waterstofroutes-nederland-blauw-groen-en-import>
[7] Gemeente Amsterdam, *'Routekaart Amsterdam, Klimaatneutral 2050',* 2020, available in Dutch at <https://www.amsterdam.nl/bestuur-organisatie/volg-beleid/ambities/gezonde-duurzame-stad/klimaatneutraal/>
[8] CE Delft, *'Roadmap towards a climate neutral industry in the Delta region'*, 2018, available at <https://www.ce.nl/publicaties/2098/roadmap-towards-a-climate-neutral-industry-in-the-delta-region>
[9] '*Investeringsagenda waterstof Noord Nederland - Op weg naar emissievrije waterstof op commerciële schaal'*, 2019, available in Dutch at <https://www.provinciegroningen.nl/fileadmin/user_upload/Documenten/Beleid_en_documenten/Documentenzoeker/Klimaat_en_energie/Energie_transitie/Investeringsagenda_waterstof_Noord-Nederland.pdf>
[10] Government Strategy on Hydrogen of 6 April 2020, Section 3, p. 10.
[11] See the main report of the Havenschets project *'Harbours: the heart of a hydrogen hub - the role of Northern harbours in the energy transition'.*
[12] The terms 'port area' and 'port region' are used interchangeably in this report.
[13] See the main report of the Havenschets project *'Harbours: the heart of a hydrogen hub - the role of Northern harbours in the energy transition'.*
[14] Gigler, J., Weeda, M., *'Contouren van een Routekaart Waterstof'*, TKI Nieuw Gas (2018), available in Dutch at <https://www.topsectorenergie.nl/sites/default/files/uploads/TKI%20Gas/publicaties/20180307%20Routekaart%20Waterstof%20TKI%20Nieuw%20Gas%20maart%202018.pdf>

technical process used for its production, which is presented in the following section. The following sections further outline how the application of Power-to-Gas (PtG) in the energy sector can contribute to the energy transition, and why ports are ideal locations for the development of this technology.

1.1.1 Production and Classification of Hydrogen

Hydrogen is classified in different 'colours' (*grey*, *blue* or *green*), with the classification dependent on the method of production and the sources used for its production. *Grey hydrogen* is produced using electricity generated by fossil fuels (*e.g.* natural gas reforming).[15] If the CO_2 – which is a by-product of producing hydrogen from fossil fuels – is captured and permanently stored, the hydrogen produced is classified as *blue hydrogen*.[16] When hydrogen is produced from renewable energy sources, it is classified as *green hydrogen.*[17]

This report focusses on the production of green hydrogen using PtG technology, in which electricity is used as an input for the production of hydrogen through the decomposition of water molecules by electrolysis.[18] PtG is generally considered a 'green technology' but the hydrogen produced is only as green as the source of the electricity used to power the electrolyser that produces the hydrogen. This means that when hydrogen is produced from natural gas reforming or from non-renewable electricity in a PtG process, it is classified as *grey hydrogen.* In contrast, when hydrogen is produced in a PtG process from renewable electricity or other renewable sources, such as biomass-based hydrogen production,[19] it is classified as *green hydrogen*.[20]

1.1.2 Hydrogen in the Energy Sector

As countries attempt to reduce the impact of global climate change, decarbonisation of the energy sector has become a mainstream topic. Decarbonisation efforts were initially focused on the power generation sector, and the 'greening' of molecules has so far lagged behind that of electrons.[21] Although there is a rising trend of electrification, the European Commission (EC) expects a 22% share of gas in the EU's final energy consumption in 2050.[22] Given that this share was 24% in 2010, the decline in gas consumption is expected to be modest.[23] There is a consensus that an equal share of green molecules and green electrons is an acceptable ballpark figure for the 2050 EU scenario.[24] Methods of ensuring the involvement of green energy molecules in the future energy mix is therefore sought within the EU. Against this backdrop, the Dutch Government is seeking to incorporate large shares of green hydrogen in the energy sector, primarily based on electrolysis using sustainably-sourced electricity, but also

[15] On a large industrial scale most hydrogen is produced through the steam reforming of natural gas. In this process methane reacts with steam under pressure in the presence of a catalyst to produce hydrogen, carbon monoxide and carbon dioxide (CO_2); see further International Energy Agency, *'Energy Technology Essentials Hydrogen Production and Distribution',* 2007, no. 4, table 1.
[16] For a more comprehensive understanding see Andreasson, L.M., Roggenkamp, M.M., *'Regulatory Framework: Legal Challenges and Incentives for Developing Hydrogen Offshore*', North Sea Energy, Deliverable 2.2, 2.2, p. 8.
[17] HyLaw, *'Hydrogen production from renewables'*, available at <https://www.hydrogeneurope.eu/node/459>
[18] The by-product of this process is oxygen, which can be released into the atmosphere, see further the Oxford Institute for Energy Studies, *'Power-to-gas: Linking Electricity and Gas in a Decarbonising World?',* 2018, p. 3, available at <https://www.oxfordenergy.org/wpcms/wp-content/uploads/2018/10/Power-to-Gas-Linking-Electricity-and-Gas-in-a-Decarbonising-World-Insight-39.pdf>
[19] Biomass is classified as a renewable energy source since its inherit energy comes from the sun with the possibility to regrow in a relatively short time. Biomass is defined as "plant material and animal waste used especially as a source of fuel" in Merriam-Webster Dictionary, available at <https://www.merriam-webster.com/dictionary/biomass>
[20] For a more comprehensive understanding of the technical specifics of hydrogen production from renewable electricity and the energy losses (efficiency) of hydrogen production, see the main report of the Havenschets project *'Harbours: the heart of a hydrogen hub - the role of Northern harbours in the energy transition'.*
[21] The Oxford Institute for Energy Studies, *'Power-to-gas: Linking Electricity and Gas in a Decarbonising World?',* 2018, p. 1, available at <https://www.oxfordenergy.org/wpcms/wp-content/uploads/2018/10/Power-to-Gas-Linking-Electricity-and-Gas-in-a-Decarbonising-World-Insight-39.pdf>
[22] European Commission, '*EU Reference Scenario 2016: Energy, transport and GHG emissions Trends to 2050',* (2016).
[23] European Commission, '*EU Reference Scenario 2016: Energy, transport and GHG emissions Trends to 2050',* (2016).
[24] Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank on 'a European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy' COM(2018) 773 final.

through biogenic feedstocks (provided they have been produced sustainably).[25] One example of particular importance in achieving the desired amounts of green energy molecules in the Dutch energy mix is the production of hydrogen using electricity generated from offshore wind.[26]

One particularly challenging task in the future design of the energy sector is the integration of high volumes of variable renewable energy sources (RES), such as wind and solar, as technical challenges arise from the need to maintain the balance between load and generation at all timescales.[27] For renewable sources of electricity, solutions must be sought to successfully offset the discrepancy between electricity generation from wind and solar, and the levels of electricity demand.[28] Furthermore, the need to transport large amounts of electricity through the grid during peak load is expected to present further challenges to the reliable operation of the grid, especially when considering network congestion and network stability.[29] PtG has been identified by the Dutch Government as one possible solution to overcome some of these technical challenges, as it can aid in the balancing of the grid,[30] provide large-scale and long-term energy storage,[31] and allow for the integration of hybrid grid infrastructure.[32,33]

1.2 Development of Hydrogen Infrastructure in Port Areas

Hydrogen has the potential to become a globally traded commodity. The Dutch government therefore emphasises in its hydrogen strategy that it is crucial from a strategic perspective that Dutch ports retain their current hub function within international energy flows.[34] Furthermore, the demand for sustainable hydrogen in industry in northwest Europe is expected to grow significantly, and it would be advantageous for Dutch ports to become the linchpin in that supply chain, using the existing infrastructure to this end. The 'Havenschets project' proposes that the Port of Amsterdam, the Port of Den Helder and Groningen Seaports collectively develop into a major future hydrogen (energy) hub,[35] where large quantities of offshore generated wind energy can be converted, stored and tuned to the current needs as a means of optimising the timing of sales.[36] This is supported by the following facts: (i) the demand for hydrogen in these ports will increase significantly (especially in the Amsterdam and IJmuiden port regions, including Schiphol, and the Groningen Seaport region, including the chemical cluster in Delfzijl); (ii) these ports already have well-connected energy infrastructure; and (iii) these ports have great potential for expansion of their energy activities (individually and collectively) due to the availability of geographical space at strategic locations within the port regions.[37]

[25] Climate Agreement of 28 June 2019, p. 181.
[26] Government Strategy on Hydrogen of 6 April 2020, p. 7.
[27] Kroposki, B., *'Integrating high levels of variable renewable energy into electric power systems',* Journal of Modern Power Systems and Clean Energy (2017) 5, p. 831-837.
[28] For a comprehensive understanding see International Energy Agency, *'The Future of Hydrogen: Seizing today's opportunities'*, report prepared by the IEA for the G20, Japan, 2019.
[29] Huber, M., Dimkova, D., Hamacher, T., '*Integration of Wind and Solar power in Europe: Assessment of Flexibility Requirements'*, Energy (2014) 69, p. 236-246.
[30] Dynamic operation of an electrolyser can provide ancillary services to the transmission and distribution system; see further Climate Agreement of 28 June 2019, p. 176 – 178.
[31] In times of excess supply of electricity, the conversion of electrons into molecules allows for the large-scale and long-term storage of energy; see further Climate Agreement of 28 June 2019, p. 176 – 178.
[32] An alternative to transporting electricity from generation to production locations is to transport the energy as hydrogen through the existing natural gas infrastructure; see further Climate Agreement of 28 June 2019, p. 176 – 178.
[33] For a more comprehensive understanding see Andreasson, L.M., Roggenkamp, M.M., *'Regulatory Framework: Legal Challenges and Incentives for Developing Hydrogen Offshore'*, North Sea Energy, Deliverable 2.2, 2.2.
[34] Government Strategy on Hydrogen of 6 April 2020, p. 4.
[35] "An energy hub is a multi-carrier energy system consisting of multiple energy conversion, storage and/or network technologies, and characterised by some degree of local control", see SCCER, *'Energy Hub',* available at <https://www.sccer-feebd.ch/research/energy-hub-definition-advantages-and-challenges/>
[36] For a more comprehensive understanding see the main report of the Havenschets project *'Harbours: the heart of a hydrogen hub - the role of Northern harbours in the energy transition'.*
[37] For a more comprehensive understanding see the main report of the Havenschets project *'Harbours: the heart of a hydrogen hub - the role of Northern harbours in the energy transition'.*

In addition to these ports having easy access to the North Sea, they already benefit from the presence of local energy intensive industrial activities and significant (petro-)chemical activities.[38] Together with their industrial clusters, these port regions offer suitable locations for the realisation of various societal value streams, such as, *inter alia*, the delivery of electricity generated by offshore wind turbines and the conversion thereof into hydrogen. This will help accelerate the energy transition. Large quantities of offshore generated wind energy will thus be distributed to end users within these ports or be supplied via these ports to regions further inland. If there is no direct electricity demand, conversion installations can absorb large quantities of this wind energy and convert it into hydrogen. The hydrogen produced can be supplied to end users within or outside these ports. These port regions are thus ideal for serving the transportation, supply and distribution of electricity and hydrogen due to their favourable location, large local energy needs and availability of extensive gas networks.[39]

The aim of the Dutch government, and of the Dutch ports, is thus to contribute to the energy transition by engaging in the conversion of renewable energy into hydrogen, and the transport and supply of green hydrogen. The following projects demonstrate some of the attempts by Dutch ports to take the position as key players in the future hydrogen market: (i) the Port of Amsterdam's participation in the installation of a 100MW electrolyser at Tata Steel;[40] and (ii) Groningen Seaports' installation of a 100MW electrolyser.[41] Alongside this, the Port of Amsterdam, the Port of Den Helder and Groningen Seaports entered into a partnership in 2019 under the 'Hydroports' name.[42] This long-term cooperation is anticipated to lead to the development of an extensive hydrogen infrastructure in the northwest of the Netherlands, with the ambition of becoming the 'hydrogen hub' of Europe.[43] Dozens of hydrogen projects are therefore being developed at the ports working together as Hydroports.[44] Initiatives include research and pilot projects, and the development of hydrogen pipelines and hydrogen filling stations.[45]

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[38] See further Port of Amsterdam, *'Who we are',* available at < https://www.portofamsterdam.com/en/port-amsterdam/who-we-are>; Port of Den Helder, *'Over ons',* available at <https://www.portofdenhelder.eu/nl/nv-port-den-helder>; Groningen Seaports, *'Ports and sites',* available at <https://www.groningen-seaports.com/en/groningen-seaports/>

[39] See the main report of the Havenschets project *'Harbours: the heart of a hydrogen hub - the role of Northern harbours in the energy transition'.*

[40] Port of Amsterdam, *'Nouryon, Tata Steel en Port of Amsterdam werken samen aan project H2ermes: groene waterstof voor de regio Amsterdam'*, 2019, available in Dutch at <https://www.portofamsterdam.com/nl/nieuws/h2ermes-groene-waterstof>

[41] Groningen Seaports, *'Investment Agenda Hydrogen Northern Netherlands: Heading for emission-free hydrogen at commercial scale',* 2019, available at <https://www.groningen-seaports.com/en/nieuws/northern-netherlands-presents-investment-agenda-for-large-scale-emission-free-hydrogen/>

[42] Port of Amsterdam, *'Meerjarige samenwerking voor CO2 neutrale toekomst',* 2019, available in Dutch at <https://www.portofamsterdam.com/nl/persbericht/meerjarige-samenwerking-voor-co2-neutrale-toekomst>; Port of Den Helder, *'Havens lanceren hydroports voor* CO_2 *neutrale toekomst',* 2019, available in Dutch at <https://www.portofdenhelder.eu/nl/news/havens-lanceren-hydroports-voor-co2-neutrale-toekomst>; Groningen Seaports, *'Long-term cooperation for a carbon neutral future',* 2019, available at <https://www.groningen-seaports.com/en/nieuws/long-term-cooperation-for-a-carbon-neutral-future/>

[43] Het Ontwikkelingsbedrijf Noord-Holland Noord (NHN), *'Havens lanceren 'Hydroports' voor CO2 neutrale toekomst',* 2019, available at <https://nhn.nl/nieuws/havens-lanceren-hydroports-voor-co2-neutrale-toekomst/>

[44] The Dutch Ports of Amsterdam, Den Helder and Groningen have presented a joint position paper to the Ministry of Economic Affairs and Climate Policy on their plans to become Europe's leading hydrogen hub.

[45] SWZ Maritime, *'Three Dutch Ports to Become European Hydrogen Hub',* 2019, available at <https://www.swzmaritime.nl/news/2019/09/18/three-dutch-ports-to-become-european-hydrogen-hub/?gdpr=accept>

1.3 Objectives and Scope

This report focuses on the development of hydrogen infrastructure in port areas. It is therefore necessary to analyse the rules applicable to the development of PtG installations and the production of (green) hydrogen. The successful production, transport and supply of hydrogen in port areas, requires access to the necessary hydrogen infrastructure and/or existing electricity and gas infrastructure. This is to ensure that electrolysers are supplied with requisite electric power to produce hydrogen, and that the hydrogen produced can be transported to end-users. The following two scenarios form the basis for this analysis:

I. Ensure the supply of electricity to the electrolyser for the conversion process.

This requires that a connection be established between the electrolyser and either the electricity grid or a generation asset. This report focuses on the two following scenarios: (i) establishing a connection between an electrolyser (located at a port) and the transmission grid; and (ii) establishing a connection between an electrolyser (located at a port) and an offshore wind farm. The latter option involves laying down a direct electricity cable.

II. Ensure the transport of hydrogen from electrolyser to end-users.

Although there are various formats available for transporting hydrogen (*e.g.* pipelines, gas cylinders, cryogenic liquid tankers), this report focuses on pipeline transport.[46] The two scenarios subject to analysis are: (i) establishing a connection between an electrolyser (located at a port) and the existing natural gas transmission network – blending hydrogen into the natural gas pipeline network; and (ii) establishing a direct connection between an electrolyser (located at a port) and the end-users, which would involve constructing a dedicated hydrogen pipeline. The latter option also considers repurposing a natural gas pipeline for dedicated hydrogen transport.

The aim of this report is therefore to provide an overview of the Dutch law pertaining to the deployment of PtG installations and the development and re-use of the aforementioned electricity and gas infrastructure in port areas. This can aid in future legislative improvements, as it provides policymakers with both an overview of the existing legal framework in which they can enact legislation and the general objectives (stemming from the EU law) to be followed. For stakeholders in hydrogen projects taking place in port areas, this report seeks to provide guidance on the existence of licensing obligations, permitting requirements and notification systems, including the procedures to be followed. Thus, from a regulatory perspective, this report identifies some of the most urgent legal uncertainties and challenges impacting the development of PtG and the production and transport of green hydrogen in port areas. It seeks to address necessary amendments to the existing laws and regulations, including licensing and permitting regimes.

Clarification of the legal framework applicable to any technology is important from economic, technological, and policy-making perspectives. Legal certainty allows for the promotion of research and development of the technology, as well as opening the door to significant investment for business purposes. Given the benefits associated with PtG technology, it is important to expand the base of legal research regarding the use of hydrogen in the energy sector. Depending on the technology used (and the steps involved in the production of hydrogen), a multitude of potential legal issues may arise. This report focuses specifically on the legislation applicable to green hydrogen.

It should be emphasised that although hydrogen storage is an important step in the PtG chain, there is very limited storage potential for hydrogen in the Port of Amsterdam, the Port of Den Helder and Groningen Seaports. This is because large-scale seasonal storage of hydrogen is envisaged in salt

[46] The Ports of Amsterdam, Den Helder and Groningen, together with Gasunie, are committed to the realisation of a national hydrogen backbone, supplying the important industrial clusters in the Netherlands with hydrogen.

caverns and the surface of these port areas is not suitable for the establishment of salt caverns.[47] The regulation of hydrogen storage is therefore not subject to analysis and falls outside the scope of this report.

1.4 Structure of Deliverable

This chapter provided an introduction to the report as well as an outline of its objectives and scope. The subsequent chapter, chapter two, examines the legal structure and governance of the Port of Amsterdam, the Port of Den Helder and Groningen Seaports. This involves an analysis of what constitutes a port; which parties are responsible for infrastructure development in port regions; what responsibility falls on the actors who are active in port regions, and; who owns the land and the infrastructure located in port regions. Chapter three provides an analysis of the EU and national legislation pertaining to the development and operation of PtG installations, particularly focusing on the authorisation procedures applicable to the production of green hydrogen through electrolysis. Chapter four analyses whether EU and national legislation facilitates the supply of electricity to onshore electrolysers from either the onshore transmission grid or an offshore wind farm. Chapter five focusses on pipeline transportation of hydrogen, scrutinising EU and national laws and regulations pertaining to the admixture of hydrogen into the existing natural gas network, the repurposing of existing natural gas pipelines for hydrogen transport and the construction and management of new hydrogen pipelines. Each chapter analyses the degree to which the current legal regimes create barriers to the development of (green) hydrogen infrastructure and activities at ports and provides potential drivers in realising the production and transport of green hydrogen in port regions. Lastly, the conclusions are provided in chapter six.

[47] See further Juez-Larré, J., Van Gessel, S., Dalman, R., Remmelts, G., Groenenberg, R., 'Assessment of underground energy storage potential to support the energy transition in the Netherlands', *First Break*, 37(7), (2019), p. 57 – 66.

2. Legal Structure and Governance of Ports

2.1 Introduction

This report focuses on the development of hydrogen infrastructure in port areas. It is therefore necessary to decide what constitutes a 'port'. This is explored in Section 2.2, which provides an overview of the general and legal definitions of a port. In addition, the difference between a port and a harbour is provided, as these terms are often confused. To determine who is responsible for developments in port areas, Section 2.3 provides a simplified overview of the governance structure of the Port of Amsterdam, the Port of Den Helder and Groningen Seaports. Furthermore, this section introduces the actors active in port areas and their responsibilities. In addition, the ownership structure, in terms of land and infrastructure located within port areas, is explained. Finally, Section 2.4 examines the rules applicable to investment in ports. As the port authorities have expressed an intention to contribute to the development of hydrogen infrastructure, the rules governing their participation in such projects are given particular focus.

2.2 The Definition of a 'Port'

There is no uniform definition of a 'port'. Table 1 therefore provides a list of the definitions given by recognised sources:

Oxford Dictionary	- "a town or city with a harbour, especially one where ships load and unload goods"[48] - "a place where ships load and unload goods or shelter from storms"[49]
Cambridge Dictionary	- "a town by the sea or by a river that has a harbour, or the harbour itself"[50]
Merriam-Webster Dictionary	- "a place where ships may ride secure from storms"[51] - "a harbour town or city where ships may take on or discharge cargo"[52]

Table 1. List of definitions of a 'port'

The definitions of a port, listed in Table 1, indicates that a port consists of a harbour. Table 2 therefore provides some examples on the definitions of a harbour:

Oxford Dictionary	- "an area of water on the coast, protected from the open sea by strong walls, where ships can shelter"[53]
Cambridge Dictionary	- "an area of water next to the coast, often protected from the sea by a thick wall, where ships and boats can shelter"[54]
Merriam-Webster Dictionary	- "a part of a body of water protected and deep enough to furnish anchorage *especially*: one with port facilities"[55]

Table 2. List of definitions of a 'harbour'

Based on the general definitions of a port, it can be concluded that a port is a city/town or a delimited area (port area), consisting of one or several harbour(s), in which vessels can load and unload cargo.

[48] Oxford Dictionary, 'Port', definition 1, available at <https://www.oxfordlearnersdictionaries.com/definition/english/port_1?q=port>
[49] Oxford Dictionary, 'Port', definition 2, available at <https://www.oxfordlearnersdictionaries.com/definition/english/port_1?q=port>
[50] Cambridge Dictionary, 'Port', available at <https://dictionary.cambridge.org/dictionary/english/port>
[51] Merriam-Webster, 'Port', definition 1, available at <https://www.merriam-webster.com/dictionary/port>
[52] Merriam-Webster, 'Port', definition 2a, available at <https://www.merriam-webster.com/dictionary/port>
[53] Oxford Dictionary, 'Harbour', available at <https://www.oxfordlearnersdictionaries.com/definition/english/harbour_1?q=harbour>
[54] Cambridge Dictionary, 'Harbour', available at <https://dictionary.cambridge.org/dictionary/english/harbour>
[55] Merriam-Webster, 'Harbour', definition 2, available at <https://www.merriam-webster.com/dictionary/harbor>

Guidance must also be sought in legal documents to determine the definition of a port. Article 3(1) of Directive 2005/65/EC (the Port Security Directive) defines a port as: "any specified area of land and water, with boundaries defined by the Member State in which the port is situated, containing works and equipment designed to facilitate commercial maritime transport operations".[56] In accordance with EU law, the port area is thus defined by the country in which the port is situated. The Netherlands provide various definitions of a port in its legal documents. Although the following legal documents are not relevant to the research in this report, they do provide a definition of what constitutes a port. Firstly, in Article 1(d) of the Port State Control Act (*Wet havenstaatcontrole*), a port is defined as: "an anchorage or berth for ships, whether or not at sea, under the jurisdiction of a port located, unless otherwise provided, in the Netherlands".[57] Secondly, in Article 1(b) of the Foreign Ships Act (*Wet buitenlandse schepen*), a port is defined as: "an anchorage or berth under Dutch jurisdiction for ships, whether or not at sea".[58] Lastly, Article 1(f) of the Port Security Act (*Havenbeveiligingswet*) prescribes that a port is: "any area consisting of land and water, with works and facilities for the purpose of commercial transport by sea, designated pursuant to Article 1a, second paragraph".[59] Article 1(a) specifies that the Minister shall designate ports by decree.

Based on the general definitions of a port and the definitions provided by Dutch legal documents, a port may be seen as encompassing an area on both land and water, which provides facilities for shipping vessels to load and unload their cargo. However, since ports are the interface between various maritime and land-based activities, activities beyond the loading and unloading of cargo occur. Ports are increasingly used for other offshore activities than mooring of ships. Such activities include, among other things, landing of pipelines and cables. Even if other activities take place at a port, it does not necessarily change the concept of a port. However, it can be questioned whether the definitions in the existing legal documents are broad enough to encompass ports where other offshore activities dominate. Delimitation of port areas – within which port activities or other port related activities take place ('port limits') – is determined by the national government or the designated authority in accordance with the provisions in the aforementioned legal frameworks. For every Dutch port, such port limits will have been established over the years.[60] Since a harbour is considered an area where a sheltered bay exists on the coastline, there may be several harbours within the port limits.

2.3 Institutional and Organisational Structure of the Selected Ports

The institutional and organisational structure of ports must be considered to determine who is responsible for different types of developments and operations in port areas. This section therefore examines the governance structure of the selected Dutch ports, the main actors involved in port developments and operations, and the actors who own and manage the land and infrastructure within port limits.

2.3.1 Governance Structure of Ports

The Netherlands has devolved the responsibility for port development to port authorities.[61] Traditionally, port authorities in the Netherlands were agencies of the municipal government of the city or town in which the port is located.[62] As part of the wider trend towards privatisation, the Dutch national

[56] Directive 2005/65/EC of the European parliament and of the council of 26 October 2005 on enhancing port security, [2005] OJ L310/28.
[57] Port State Control Act (*Wet havenstaatcontrole*) of 6 November 1997.
[58] Foreign Ships Act (*Wet buitenlandse schepen*) of 6 July 2004.
[59] Port Security Act (*Havenbeveiligingswet*) of 6 july 2004.
[60] For a more comprehensive understanding see Barnes, M., *'Port, harbour or terminal: What's the difference?'*, Shipping Guides Ltd, 2013, available at <https://www.portinfo.co.uk/port-information/our-blog/247-what-s-the-difference-between-a-port-harbour-and-terminal>
[61] Key competencies of the port authority are predominately related to the operational side of the port; it manages the port affairs, provides port facilities and logistic services, and sells or leases land in the port area, see Section 2.3.2.1.
[62] De Langen, P.W., van der Lugt, L.M., 'Governance Structures of Port Authorities in the Netherlands', *Elsevier*, Research in Transportation Economics 17 (2006), p. 118; see also Kreukels, T., Wever, E., (eds.) *North Sea ports in transition: Changing tide* (Van Gorcum, 1998).

government and local governments retreated from performing port related activities themselves.[63] In general privatisation means that a public undertaking is wholly or partly removed from the control or ownership of the State or public authorities and transferred to the private sector. One method for such removal is corporatisation (or commercialisation) of state undertakings, *i.e.* the conversion of a state undertaking into a limited company. [64] The corporatisation of Dutch port authorities means that public tasks are now carried out by private law companies. Although these private law companies may be partially government-owned, government influence is limited.

The Port of Amsterdam became a corporate entity on 1 April 2013 and is now a public limited company. It thus falls under the rules of private law,[65] with all shares held by the municipality of Amsterdam.[66] After the corporatisation, discussions were initiated to assess the value and feasibility of granting the national government a minority share, but there has yet to be any progress in this regard.[67]

The Port of Den Helder was created through the corporatisation of the municipal port authority on 1 January 2013.[68] It is now a public limited company governed by private law, with all shares held by the municipality of Den Helder.[69]

Groningen Seaports has been a public limited company since 14 June 2013, and is therefore governed by private law.[70] The sole shareholder is 'Gemeenschappelijke Regeling Havenschap' (common ports alliance) in which the province of Groningen and the municipalities of Delfzijl and Eemsmond are involved.[71]

The division of responsibilities in these ports is in line with Dutch corporate governance law.[72] Public limited companies are regulated by Section 2.4 of the Dutch Civil Code (DCC).[73] In contrast to the previous governance structure, which was subject to public law,[74] the corporate governance is now comprised of an Executive Board, a Board of Commissioners and shareholders.[75]

- The Executive Board is responsible for the daily management of the port authority.[76]
- The Board of Commissioners is responsible for monitoring and supervising the activities undertaken by the Executive Board. Furthermore, it ensures that the strategic goals of the port are achieved, and that the performance of the port meets expectations.
- The shareholders are responsible for appointing members of the Executive Board either directly or based on proposals from a supervisory board.

[63] Van Steenderen, A., van Steenderen, C, *'Ports & Terminals in the Netherlands'*, Lexology, 2019.
[64] For a more comprehensive understanding see Roggenkamp M.M., 'Implications of Privatisation, Liberalisation and Integration of Networkbound Energy Systems' (1997) 15(1) *Journal of Energy and Natural Resources Law*, p. 52.
[65] Port of Amsterdam, *'Port of Amsterdam corporatised',* 2016, available at <https://www.portofamsterdam.com/en/news-item/port-amsterdam-corporatised>
[66] De Langen, P.W., van der Lugt, L.M., 'Institutional reforms of port authorities in the Netherlands; the establishment of port development companies', *Elsevier*, Research in Transportation Economics 22 (2017), p. 110.
[67] Port of Amsterdam, *'Port of Amsterdam corporatised',* 2016, available at <https://www.portofamsterdam.com/en/news-item/port-amsterdam-corporatised>; see also De Langen, P.W., van der Lugt, L.M., 'Institutional reforms of port authorities in the Netherlands; the establishment of port development companies', *Elsevier*, Research in Transportation Economics 22 (2017), p. 110.
[68] Port of Den Helder, *'Organisatie'*, available in Dutch at <https://www.portofdenhelder.eu/nl/organisatie>
[69] Port of Den Helder, *'Organisatie'*, available in Dutch at <https://www.portofdenhelder.eu/nl/organisatie>
[70] Groningen Seaports, *'Organisatiestructuur,* available in Dutch at <https://www.groningen-seaports.com/groningen-seaports/organisatiestructuur/>
[71] Groningen Seaports, *'Organisation',* available at <https://www.groningen-seaports.com/en/groningen-seaports/>
[72] Dutch corporate law is primarily found in the Dutch Civil Code (*Burgerlijk Wetboek*).
[73] Topics covered in the DCC for public limited companies are *inter alia* (i) the shares, (ii) the capital of the company, (iii) the general meeting of shareholders, and (iv) the management board and supervision of the management board. Public limited companies are specifically regulated by Book 2 on Legal Persons of the DCC, see Section 2.4 Public Limited Companies.
[74] Developed for public administrations for instance on transparency of decisions, public availability of documents and open purchasing procedures.
[75] For a more comprehensive understanding see De Langen, P.W., van der Lugt, L.M., 'Institutional reforms of port authorities in the Netherlands; the establishment of port development companies', *Elsevier*, Research in Transportation Economics 22 (2017), p. 110.
[76] Port Authority is explained in more detail in Section 2.3.2.1

2.3.2 Main Actors in Ports and their Responsibilities

Several public and private actors/bodies participate in port operations. The subsequent sections provide an overview of who these actors are, as well as their functions and responsibilities in terms of port operations.

2.3.2.1 Port Authorities

As presented previously, the institutional reform of port authorities in the Netherlands has followed a common path towards corporatisation.[77] The 'landlord port model' is now the dominant model in large and medium-sized Dutch ports. It is thus the model applied by the Port of Amsterdam, the Port of Den Helder and Groningen Seaports.[78] This means that the port authority of the respective port is a separate legal entity and no longer a government agency, and has the capacity to enter into agreements (including concession agreements) and the responsibility to maintain standards.[79,80]

Although the legal title to the land in ports still rests with the municipal government (or the 'gemeenschappelijk regeling'), the port authorities have leased this land from the municipal governments in perpetuity. The lease agreement with the municipal government allocates the economic ownership of the land.[81] The port authority has thus been authorised by the municipality to perform all management, and other activities in relation to the land located within the port area, as if the port authority itself had the freehold.[82] As such, the port authority can sublease plots of land to third parties wishing to establish their business within the port. Furthermore, the port authority manages the basic port infrastructure,[83] leasing it out to third parties (mostly on a long-term concession basis) while retaining all regulatory functions.[84] Hence, port authorities generate revenue through subleases and concessions with third parties.[85]

Key competencies of the port authority are predominately related to the operational side of the port; it manages the port affairs, provides port facilities and logistic services, and subleases land in the port area.[86] Port authorities thus control all access to their area – though in certain instances they need an approval from the municipality before concluding a land lease agreement. This is the case, for example, for non-port-related activities in the Port of Amsterdam such as, *inter alia*, businesses that do not

[77] De Langen, P.W., van der Lugt, L.M., 'Institutional reforms of port authorities in the Netherlands; the establishment of port development companies', *Elsevier*, Research in Transportation Economics 22 (2017), p. 110.
[78] Nijdam, M., de Jong, O., et al, *'Level Playing Field: Study on distorted cross-border competition between seaports'*, RHV-Erasmus University and the Ministry of Infrastructure and the Environment, 2014, p. 10 – 13.
[79] The term authority is often used for an agency or body created by a government to perform a specific function, such as environmental management or tax collection. However, none of these authorities provide commercial services in competitive environments. Some of them may charge users for services (think of inspection authorities), but they all operate based on power that is delegated formally and they do not 'negotiate' prices or other agreements. In contrast, Dutch port authorities operate in a competitive environment and have limited or no authority. De Langen and van der Lugt therefore criticise the use of the term 'port authority' by illustrating the transition in Dutch ports from 'authority' to a model of state-owned port development companies. They argue that it is more appropriate to consider a port authority as a 'port development company'. For a more comprehensive understanding see De Langen, P.W., van der Lugt, L.M., 'Institutional reforms of port authorities in the Netherlands; the establishment of port development companies', *Elsevier*, Research in Transportation Economics 22 (2017).
[80] Van Hooydonk, E., 'The regime of port authorities under European law' in van Hooydonk, E. (ed.) *European Seaports Law – EU Law of Ports and Port Services and the Ports Package* (Maklu, 2003); Meersman, H., Van de Voorde, E., Vanelslander, T., 'Future Challenges for Port and Shipping Sector (Informa, 2009); see further for Port of Den Helder Article 1.1. of 'NV Port of Den Helder General Terms and Conditions for Port and Quay Dues of 2020', available at <https://portofdenhelder.nl>
[81] The City of Amsterdam transferred the economic ownership of the land to the Port of Amsterdam, see further Port of Amsterdam, *'Land policy',* available at <https://www.portofamsterdam.com/en/business/port-amsterdam-land-policy>
[82] See for instance the Port of Amsterdam, 'Decision regarding Economist's Authorisation' by the City of Amsterdam available at <https://www.portofamsterdam.com/sites/poa/files/media/pdf-nl/besluit-volmacht-econoom.pdf>
[83] The port infrastructure is the base for port operations to serve the vessel, cargo and passengers which pass through ports.
[84] Ferrari, C., Parola F., 'Governance models and port concessions in Europe: Commonalities, critical issues and policy perspectives', *Elsevier*, Transport policy 41 (2015), p. 60.
[85] Van Steenderen, A., van Steenderen, C*, 'Ports & Terminals in the Netherlands'*, Lexology, 2019.
[86] See for instance Groningen Seaports, *'Vestigingsbeleid Eemshaven/Delfzijl', available* at <https://www.groningen-seaports.com/wp-content/uploads/Delfzijl_Eemshaven_Business_Location_Policy-1.pdf>

necessarily need to be located within the port.[87] Some sites in ports may even be available for purchase, but the options are generally very limited. In Groningen Seaports, for example, smaller land areas (which are owned by the municipalities of Delfzijl, Eemsmond, Appingedam and Loppersum) are allocated either through a long-term lease or purchase.[88] The latter option is, however, greatly limited.[89] Although it is a general perception that port authorities do not carry out commercial activities themselves, leasing and granting concessions can be regarded as commercial activities. Furthermore, port authorities may well invest in operations and facilitate the development of activities in the port area.[90]

2.3.2.2 Third Parties

Any third party – individual or company – looking to settle its business within a port must approach the port authority, as the port authority subleases plots of land and basic infrastructure located within the port area. In principle, port authorities are free to agree on a transfer agreement with third parties on a case-by-case basis.[91] Based on the agreement, the port authority provides assets and port related services. In turn, third parties pay charges and fees, which are based on the commercial value of the obtained assets and received services.[92] Whereas some individuals and companies rent office spaces, industrial premises, warehouses and other real estate, others lease previously allocated plots of land or specific locations within the port area.[93] The rental of real estate and the allocation of land – as part of a sublease under the main ground lease – are subject to a time limit.[94]

Many sublease contracts often include a provision requiring the lessee (individual or company leasing a plot of land) to return the land in the same condition as it was handed over to the lessee at the start of the lease period.[95] Consequently, the lessee is under an obligation to restore the land to its original state and, thus, remove any facilities owned by it on the land.[96] Should the government or port authority wish to acquire any of these facilities, it may negotiate with the third party over whether any compensation ought to be paid for this transfer.[97] The establishment of individuals or companies in the port area must not cause any inconvenience or nuisance to the public space or to the adjacent plots of land.[98] Specific conditions for third parties are therefore included in the lease agreement between the port authority and the lessee.[99] Third parties establishing their business within port areas are also responsible for ensuring that they have acquired all the necessary licenses and permits pertaining to their specific business.[100]

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[87] For a more comprehensive understanding see Port of Amsterdam, *'Land policy',* available at <https://www.portofamsterdam.com/en/business/port-amsterdam-land-policy>
[88] Groningen Seaports, *'Vestigingsbeleid Eemshaven/Delfzijl',* p. 20, available at <https://www.groningen-seaports.com/wp-content/uploads/Delfzijl_Eemshaven_Business_Location_Policy-1.pdf>
[89] Especially since these sites are intended for SMEs and ancillary services.
[90] See Section 2.4.
[91] Government of the Netherlands, 'Development of Dutch Seaports', available at <https://www.government.nl/topics/maritime-transport-and-seaports/seaport-development>; Van Steenderen, A., van Steenderen, C*, 'Ports & Terminals in the Netherlands'*, Lexology, 2019.
[92] De Langen, P.W., van der Lugt, L.M., 'Institutional reforms of port authorities in the Netherlands; the establishment of port development companies', *Elsevier*, Research in Transportation Economics 22 (2017), p. 109.
[93] For a more comprehensive understanding see Port of Amsterdam, *'Land policy',* available at <https://www.portofamsterdam.com/en/business/port-amsterdam-land-policy>
[94] See for instance Groningen Seaports, *'Vestigingsbeleid Eemshaven/Delfzijl',* p. 20 – 21, available at <https://www.groningen-seaports.com/wp-content/uploads/Delfzijl_Eemshaven_Business_Location_Policy-1.pdf>
[95] For Groningen Seaports see Article 34 on transfer of leased property in the 'General Conditions of Groningen Seaports of 2019', available at <https://www.groningen-seaports.com/wp-content/uploads/General-conditions-and-rates-2019-publication.pdf>
[96] For a more comprehensive understanding see Section 2.3.3.
[97] Van Steenderen, A., van Steenderen, C*, 'Ports & Terminals in the Netherlands'*, Lexology, 2019.
[98] This is determined on a case-by-case basis, see further Groningen Seaports, *'Vestigingsbeleid Eemshaven/Delfzijl',* p. 20 – 21, available at <https://www.groningen-seaports.com/wp-content/uploads/Delfzijl_Eemshaven_Business_Location_Policy-1.pdf>; see also for Port of Amsterdam Paragraph 4 of the 'Port Bylaws of 9 May 2019', available at <https://www.portofamsterdam.com/sites/poa/files/media/pdf-en/port_bylaws_2019.pdf>
[99] For the bylaws of the Port of Den Helder see 'Havenbeheersverordening N.V. Port Den Helder of 2013', available at <https://portofdenhelder.nl>; see also specific conditions set forth to ensure that private parties operating in the Port of Den Helder do not cause inconvenience or nuisance to the public space or the adjacent plots of land in 'Aanwijzingsbesluit als bedoeld in artikel 1.8 Havenverordening Den Helder 1996', available in Dutch at <https://portofdenhelder.nl>
[100] The licences and permits required for the development of electrolysers (*i.e.* the production of green hydrogen), as well as for electricity cables and gas pipelines are further examined in Chapters 3 – 5.

2.3.2.3 Governing Bodies

The Dutch national legislator and the relevant provinces and municipalities have wide regulatory powers with respect to all aspects of port regulation. While national physical and environmental issues are the responsibility of the central government and provinces are responsible for provincial interests, the municipalities are primarily responsible for physical planning and environmental issues, which include the spatial planning of port regions.[101]

The Ministry of Infrastructure and Water Management is responsible for, *inter alia*, transport, public works, spatial planning and management, and water management, and as such is responsible for Dutch ports.[102] The 'Rijkswaterstaat', as the executive agency of the Dutch Ministry of Infrastructure and Water Management, is responsible for the design, construction, management and maintenance of the main infrastructure facilities in the Netherlands. This includes the main road network, the main waterway network and water systems.[103]

2.3.3 Ownership of Immovable Property and Third-Party Rights

Immovable property is property that cannot be moved from one place to another meaning it is connected to the ground on which it sits. The term immovable property also includes the land. In accordance with the Dutch Civil Code, ownership of land comprises the topsoil, the layers of earth beneath the topsoil, and buildings and constructions permanently attached to the soil.[104] The right of the landowner to use its land includes the right to make use of the space above and beneath its surface.[105] The landowner may grant temporary or limited rights of use to third parties regarding its immovable property. This is done by entering into an agreement that gives third parties a certain right to use its immovable property.

The long leasehold (*erfpacht*), which can only be established on immovable property, gives its proprietor – the leaseholder – almost the same rights and powers as the owner of the immovable property. Similar to the owner, the leaseholder has the full use of the immovable property,[106] and is entitled to "all of its natural and civil fruits".[107] A long leasehold is generally established for a fixed period of time, but it may also be granted in perpetuity.[108] Whereas the leaseholder may terminate the lease on grounds mentioned in the deed of establishment,[109] the owner may only terminate when the leaseholder is in default of payment.[110] Although a long leasehold in many ways resembles a right of ownership, there are significant differences. A long leasehold may include several restrictions with regard to the way in which the property may or may not be used.[111] Furthermore, the leaseholder usually has to pay an annual sum (ground rent) to the owner of the land, sometimes in addition to a lump sum for the acquisition of the long leasehold.[112] Moreover, the majority of long leaseholds are established for a certain period of time, which means that when the lease period ends the owner regains full control over the land, all rights and powers that were temporarily vested in the leaseholder revert to the owner.[113]

In addition to a long leasehold, there is also the right of *superficies* (*opstalrecht*), which enables its proprietor – the superficiary – to have or obtain buildings, constructions or plants located in, on or above

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[101] Association of Netherlands Municipalities, *'Local Government in the Netherlands'*, p. 11, available at <https://www.publieksdiensten.nl/wp-content/uploads/2018/04/DENMARK-4-Local-Government-in-the-Netherlands.pdf>
[102] Government of the Netherlands, *'Organisation of the Ministry of Infrastructure and Water Management'*, available at <https://www.government.nl/ministries/ministry-of-infrastructure-and-water-management/organisation>
[103] Rijkswaterstaat, *'Organisatie'*, available in Dutch at <https://www.rijkswaterstaat.nl/over-ons/onze-organisatie>
[104] Article 5:20 of the DCC.
[105] Article 5:21 of the DCC.
[106] Articles 5:85(1) and 5:89 of the DCC.
[107] Article 5:90 of the DCC.
[108] Article 5:86 of the DCC.
[109] Article 5:87(1) of the DCC.
[110] Article 5:87(2) of the DCC.
[111] Article 5:89(1) of the DCC.
[112] Article 5:85(1) of the DCC.
[113] Article 5:86 of the DCC.

an immovable property which is owned by someone else.[114] This immovable property may be someone else's land – but it is possible as well to establish a right of *superficies* over a part of a building on that land.[115] A right of *superficies* may therefore serve to obtain the ownership of for example pipelines and cables under someone else's land.[116] The notarial deed, by which a right of *superficies* has been established, may impose an obligation upon the superficiary to pay a sum (ground rent) at regular or irregular intervals to the owner of the encumbered immovable thing.[117] When the right of *superficies* ends, the ownership of the buildings, constructions and plants (vegetation) will, by operation of law, belong to the owner of the immovable thing encumbered with that right of *superficies*.[118] The right of superficies thus creates a separation between the land and that which is built or placed on it. The relationship between leasehold and superficies is that, in both cases, there are two owners – one for the subsoil, and one for what is standing on the ground.

At Dutch ports, the legal title to the land remains with the municipal government and port authorities have leased this land in perpetuity. In line with what was explained above, these lease agreements allocate the economic ownership of the port area to the port authorities.[119] Port authorities can thus use the land as if they own it, but they cannot sell it. As such, port authorities may grant third parties temporary or limited right of use of immoveable property within the port area.[120] Third parties who want to establish themselves in a port must therefore enter into an agreement with the port authority to use the land and/or building(s).[121] When port authorities grant third parties temporary or limited right of use of immovable property in their ports, it is generally done under a long leasehold.[122]

2.4 Investment in Port Developments

In the pre-commercialisation era, the development and management of projects and infrastructure in port areas was the prerogative of the government. This enabled interventions through direct access to state funds and resources. In the 'landlord port model', the management responsibility has instead been delegated to the port authority, but the title to the land and assets remains with the government.[123] The public sector is therefore still responsible for port planning and acts as a regulatory body. Furthermore, the public sector owns all port-related and basic infrastructure that has been leased to third parties.[124] Although port authorities formally operate as autonomous state-owned corporate entities, there is a clear transition towards a more commercially operating port authority. Nonetheless, the presumption is that port authorities are not involved in commercial activities, which is typically the prerogative of private companies.

Since the corporatisation of Dutch ports, public-private partnerships (PPPs) have become a means of managing port operation more effectively. In PPPs, public bodies work together (predominantly with private companies) to provide public services and develop investment intensive infrastructure. Given that municipalities are the main shareholders in most Dutch ports, port authorities engaging with private companies do so through PPP transactions. Such transactions may cover investment intensive construction works, such as, for example, energy (hydrogen) infrastructure. The partnership may be

[114] Article 5:101(1) of the DCC.
[115] For a more comprehensive understanding see Dutch Civil Law, *'Limited real rights'*, available at <http://www.dutchcivillaw.com/content/dutchcivillaw022.htm>
[116] See Article 5:20 (2) of the DCC; for a comprehensive understanding see Goossens, H., *'Dutch Civil Law: Limited real rights'*, available at <http://www.dutchcivillaw.com/content/dutchcivillaw022.htm>
[117] Article 5:105(1) of the DCC.
[118] Article 5:101(3) of the DCC.
[119] See further Section 2.3.2.1.
[120] For a more comprehensive understanding see Groningen Seaports, *'Jaarverslag 2018'*, available in Dutch at <https://www.groningen-seaports.com/wp-content/uploads/JAARVERSLAG-2018-def.pdf>
[121] Title 5.7 of the DCC.
[122] Pursuant to Article 5:86 of the DCC parties may regulate the duration of the long leasehold in the notarial deed by which the long leasehold has been established. Consequently, the term of the long leasehold varies from case to case and may be limited in time (without a minimum) or unlimited ('perpetual').
[123] See Section 2.3.1.
[124] See Section 2.3.2.

solely financial (donations and sponsorship), or may involve a more concrete collaboration.[125] PPPs are based on the following principles: (i) both parties invest in the project in a financial sense (*e.g.* materials budget) and in an expertise-related sense (*e.g.* knowledge); and (ii) both parties contribute to a societal and often commercial purpose.[126] The importance of PPP to successfully deliver investment intensive infrastructure in a port is demonstrated by the Porthos project.[127] The aim of the project is to develop an open access CO_2 transport and storage network in the Port of Rotterdam, allowing for the safe capture and storage of five million tonnes of CO_2 per annum.[128] Whereas the state-owned parties are responsible for the project and the investment in the infrastructure, private companies invest in capture and pay for storage. Several private companies have already expressed interest in being part of the project.[129]

The Dutch legislature has not enacted specific PPP law in the Netherlands.[130] However, development of port areas may be subject to EU procurement rules,[131] pursuant to the Directive 2014/23/EU (the Concession Directive),[132] Directive 2014/24/EU (the Public Procurement Directive),[133] and Directive 2014/25/EU (the Utilities Directive).[134] These directives have been implemented in the Dutch Public Procurement Act 2012 (*Aanbestedingswet 2012*),[135] which generally requires the contracting authority to put port development concessions out to tender.[136] The award of port concessions is decided by the contracting authority or the relevant port authority.[137] Furthermore, as a general rule, the entire energy sector is subject to public procurement as both the Utilities Directive and the Concession Directive apply to the production, transmission, distribution, and supply of energy.[138] Thus, companies engaged in the production of electricity, gas or heat, and companies transporting and/or distributing electricity, gas or heat, and companies supplying electricity, gas, or heat to such networks, are subject to the procurement regime.[139] Different contract forms are possible for PPPs.[140] The most common contract form in the Netherlands is the DBFM(O) – Design, Build, Finance, Maintain (and Operate) contracts. In DBFM(O) contracts, the public body transfers elements of a construction project and project financing to a commercial entity.[141] These contracts are concluded on a long-term basis and may run for a period up to 30 years.

[125] Government of the Netherlands, *'Public-private partnership (PPP)',* available at <https://business.gov.nl/regulation/public-private-partnership/>
[126] Government of the Netherlands, *'Public-private partnership (PPP)',* available at <https://business.gov.nl/regulation/public-private-partnership/>
[127] Porthos project is led by three state-owned parties: EBN, Gasunie and Port of Rotterdam. For partners see Rotterdam CCUS project Porthos, 'CO_2 reduction through storage beneath the North Sea', available at <https://www.rotterdamccus.nl/en/>
[128] Rotterdam CCUS project Porthos, 'Project', available at <https://www.rotterdamccus.nl/en/the-project/>
[129] Rotterdam CCUS project Porthos, 'Customers', available at <https://www.rotterdamccus.nl/en/customers/>
[130] See Government of the Netherlands, *'Public-private partnership (PPP)'*, available at <https://business.gov.nl/regulation/public-private-partnership/>
[131] Public procurement refers to the process by which public authorities, such as government departments or local authorities, and public undertakings purchase work, goods or services from companies.
[132] Directive 2014/23/EU of the European Parliament and of the Council of 26 February 2014 on the award of concession contracts [2014] OJ L 94/1.
[133] Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC [2014] OJ L 94/65.
[134] Directive 2014/25/EU of the European Parliament and of the Council of 26 February 2014 on procurement by entities operating in the water, energy, transport and postal services sectors and repealing Directive 2004/17/EC [2014] OJ L 94/243.
[135] Article 1.4 of the Public Procurement Act (*Aanbestedingswet 2012*) of 1 November 2012.
[136] A 'contracting authority' is defined in Article 1.1 of the Dutch Procurement Act as 'the state, a province, a municipality, a water board or an institution under public law or a partnership of these authorities or institutions under public law'.
[137] For a more comprehensive understanding see Van Steenderen, A., van Steenderen, C*, 'Ports & Terminals in the Netherlands'*, Lexology, 2019.
[138] Roggenkamp, M., Vedder, H., Rønne, A., Del Guayo, I., 'EU Energy Law' in Roggenkamp, M., Redgewell, C., Rønne, A., Del Guayo, I. (eds) *Energy Law in Europe: National, EU and International Regulation* (3rd edn, Oxford 2016), p. 254.
[139] Articles 8 and 9 of the Utilities Directive and Annex II of the Concession Directive.
[140] Different contract forms are possible for PPP: DBFM(O) contracts, Design & Construct (D&C) or Design & Build, Engineering & Construct (E&C) and Alliances. The most common contract form is DBFM(O) see further Government of the Netherlands, *'Public-private partnership (PPP)',* available at <https://business.gov.nl/regulation/public-private-partnership/>
[141] Rijkswaterstaat, *'DBFM',* available at <https://www.rijkswaterstaat.nl/zakelijk/zakendoen-met-rijkswaterstaat/werkwijzen/werkwijze-in-gww/contracten-gww/dbfm.aspx>

2.5 Conclusions

The Dutch government devolved the responsibility for port developments and operations to port authorities. The 'landlord port model' is the dominant model in Dutch ports, which means that port authorities are separate legal entities with the capacity to enter into agreements and the responsibility to maintain standards. However, the public law competence remains with the public administration. Furthermore, the legal title to the land in ports still rests with the municipal government, and the port authorities have leased this land in perpetuity. The lease agreement with the municipal government allocates the economic ownership of the land to the port authorities.

Although port authorities have no specific role in the regulatory framework relevant to the development of hydrogen infrastructure in port regions, they have been authorised by the relevant municipality to perform all management, and other activities in relation to the port area. Third parties – individuals or companies – looking to establish their business within a port must therefore approach the relevant port authority to conclude a lease agreement for the granting of access to a plot of land or certain facilities within the port area. As port authorities are only responsible for activities within their own port area, measures must be taken at national level to promote the development of a hydrogen hub involving several ports in different municipalities and provinces.[142]

Technically there are no (or very few) obstacles to the development of hydrogen infrastructure in ports. There is, however, a need to guarantee investment to fund new infrastructure and to fund the repurposing of existing infrastructure in order to produce hydrogen and transport the hydrogen to the end-users. Port authorities could work together with private parties through PPPs to develop hydrogen infrastructure in port areas. The Netherlands has not adopted specific PPP legislation, but development of infrastructure in ports may be subject to procurement rules. If so, contracting authorities are required to put development concessions out to tender. Guidelines on port authorities' involvement in the development of hydrogen infrastructure in ports should be provided to curtail potential legal uncertainties in the process.

[142] For a more comprehensive understanding see Section 5.3.2.

3. Development of Power-to-gas Installations at Ports

3.1 Introduction

Various legal frameworks and guidelines pertaining to port development and operation are based on international conventions and EU law, which have been implemented in national law.[143] These legal frameworks generally focus on port-related activities.[144] The term 'port-related activities' is broad, and covers several different types of activities. However, it is usually understood that port-related activities encompass activities that facilitate: (i) the arrival and departure of ships; (ii) navigational aid and vessel traffic separation facilities; (iii) pilotage, tugging and mooring activities; (iv) the use of berths, sheds, and loading facilities; (v) the discharge, storage and distribution of cargo; and (vi) supply chain logistics and management.[145] This means that the development and operation of a PtG installation within a port area is not to be considered as a port-related activity.

Legislation pertaining to the development and operation of port-related activities is therefore of little relevance to the analysis in this section. This also follows from the conclusion in the previous section, which clarifies that ports do not have a specific role in the regulatory framework relevant to the development of hydrogen infrastructure in port areas. This section therefore examines the legislation pertaining to the development and operation of non-port-related activities in port areas. Section 3.2 and 3.3, respectively, focuses on the requirements of EU and national legislation applicable to the development of PtG installations and the production of hydrogen through electrolysis.

3.2 Overview of Applicable EU Law to (Green) Hydrogen Production

The production of hydrogen through electrolysis is subject to a significant number of requirements at the EU level. Despite being transposed into national law, the source of most of these requirements can be directly traced to EU directives.[146] The requirements applicable to the storage, transport, supply and distribution of hydrogen are not included in this section, as this section focuses exclusively on the development of PtG installations and, thus, the requirements applicable to the production of hydrogen through electrolysis. At EU level, the most relevant legislative acts for hydrogen production installations are: Directive 2012/18/EU (the Seveso Directive),[147] Directive 2010/75/EU (the Industrial Emissions Directive (IE Directive)),[148] Directive 2014/32/EU (the ATEX Directive),[149] and Directive 2011/92/EU (the Environmental Impact Assessment Directive (EIA Directive)).[150] Table 3 summarises the application of these directives to the production of hydrogen through electrolysis and the obligations on developers and operators generated by these directives.

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[143] International regulations are issued by the International Maritime Organization, see further Van Steenderen, A., van Steenderen, C, *'Ports & Terminals in the Netherlands'*, Lexology, 2019.
[144] See for instance the Port Security Act (*Havenbeveiligingswet*) of 6 July 2004 enhancing ship and port facility security, and the Port State Control Act (*Wet havenstaatcontrole*) of 6 November 1997 ensuring that ships in Dutch ports comply with international regulations concerning safety, prevention of pollution and living and working conditions.
[145] See Article 1 of Regulation (EU) 2017/352 of the European Parliament and of the Council of 15 February 2017 establishing a framework for the provision of port services and common rules on the financial transparency of ports [2017] OJ L 57/1 (the Port Service Regulation); see also Government of the Netherlands, '*The Dutch Maritime Strategy 2015 – 2025'* , joint publication of the Ministries of Infrastructure and the Environment, Economic Affairs, Defence, Education, Culture and Science, Finance, Foreign Affairs, Security and Justice, Social Affairs and Employment, January 2015;
[146] Floristean, A., *'EU regulations and directives which impact the deployment of FCH technologies'*, HyLAW Project, Deliverable 4.4, 2019.
[147] Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accidents hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC [2012] OJ L 197/7.
[148] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) [2010] OJ L 334/17.
[149] Directive 2014/34/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres (recast) [2014] OJ L96/309.
[150] Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment [2011] OJ L 26/1.

Seveso Directive[151]	The Seveso Directive covers establishments in which dangerous substances may be present (*e.g.* during processing) in quantities exceeding certain thresholds. In Annex I, hydrogen is classified as a dangerous substance, which means that the rules in the Directive apply to PtG installations (hydrogen production). Depending on the amount of dangerous substances present, establishments are categorised in lower and upper tier, the latter are subject to more stringent requirements. According to Annex I, the quantity threshold for hydrogen is less than 5 tonnes for the applicability of the lower requirements and more than 50 tonnes for the application of the more stringent requirements. The Directive establishes: general obligations on the operator (Article 5); notification of establishment, such as information on the form and amount of substances, and the activity and the surrounding environment (article 7); the obligation to deploy a major accident prevention policy (Article 8); the authorities to exert control of the siting of new establishments, modifications to new establishments, and new developments (including transport routes, locations of public use and residential areas) in the vicinity of the establishment (Article 13); the obligation to conduct a public consultation on specific individual projects that may involve a risk of major accidents (Article 15).
IE Directive[152]	The IE Directive applies to the production of hydrogen following point 4.2 of Annex I. Section 4 of Annex I, “production within the meaning of the categories of activities contained in this section means the production on an industrial scale […] of substances or groups of substances listed in points 4.1 to 4.6”. In accordance with Annex I, it is the responsibility of the EC to determine what is to be understood by ‘industrial scale’ – however, no such definition has yet been provided by the EC.[153] Guidance is though provided in the predecessor to the IE Directive, Directive 2008/1/EC (the IPPC Directive), which states*:* “the scale of chemical manufacture can vary from a few grams of a highly specialised product to many tonnes of a bulk chemical product, yet both scales may correspond to “industrial scale” for that particular activity. If the activity is carried out for “commercial purposes”, it should be considered as production on an industrial scale”.[154] The IE Directive thus applies to the production of hydrogen for commercial purposes. No distinction is made between production methods or between the sources used for the production of hydrogen, which indicates that the IE Directive applies irrespective of whether it is produced from renewable sources or fossil fuels. PtG installations (whether the input of electricity is generated from renewable energy or fossil fuels) emit substances, such as brine (from water purification), oxygen, trace materials, and in some cases solid waste in form of spent stacks, which may be held to be within the scope of the IE Directive.[155] Until further clarified by the EU legislators, it seems likely that both green and grey hydrogen are covered by these rules. The IE Directive is based on several pillars: (i) an integrated approach; (ii) the use of best available techniques; (iii) flexibility; (iv) inspections; and (v) public participation. The IE Directive establishes: basic obligations for the operator (Article 11); the content of permitting applications (Article 12); permitting conditions (Article 14); emission limit values (Article 15); monitoring requirements (Article 16); and access to information and public participation (Article 24).
ATEX Directive[156]	The ATEX Directive provides for the essential health and safety requirements and conformity assessment procedures (Article 4) to be applied before products (including hydrogen) can be placed on the EU market. These rules are significant for the engineering of hydrogen production installations, such as PtG installations. The ATEX Directive covers the equipment and protective systems intended for use in potentially explosive atmospheres (Article 1). The ATEX Directive requires that areas where hazardous explosive atmosphere may occur are divided into zones, and that manufacturers design the equipment so that it is suitable within their customer’s explosive atmosphere (Article 6). As such, customers must give manufacturers information about the classification of the zone and the flammable substance(s) within that zone.
EIA Directive[157]	An environmental impact assessment is a procedural device utilised to ensure that the environmental implications of a decision are considered before the commencement of a project. Production of hydrogen

[151] Rules incorporated in: Major Accidents (Risks) Decree (*Besluit risico's zware ongevallen*) of 25 June 2015.
[152] Rules incorporated in: Environmental Licensing (General Provisions) Act (*Wet algemene bepalingen omgevingsrecht*) of 6 November 2008; Environmental Management Act (*Wet milieubeheer*) of 13 June 1979; Water Act (*Waterwet*) of 29 January 2009.
[153] Floristean, A., *‘EU regulations and directives which impact the deployment of FCH technologies’*, HyLAW Project, Deliverable 4.4, 2019, p. 6.
[154] European Commission, *‘Guidance on Interpretation and Implementation of the IPPC Directive’*, available at <https://ec.europa.eu/environment/archives/air/stationary/ippc/general_guidance.htm>
[155] See Article 3(1), (2) and (4) of the IE Directive.
[156] Rules incorporated in: Commodities Act (Explosion-Proof Material) (*Warenwetregeling explosieveilig materieel*) of 17 of February 2016.
[157] Rules incorporated in: Environmental Management Act (*Wet milieubeheer*) of 13 June 1979.

	falls within the projects listed in point 6a of Annex II (production of chemicals), for which Member States shall determine whether the project shall be made subject to an assessment. Procedure: the project developer may request the competent authority to define what should be covered by the EIA information that is provided by the project developer (scoping stage – Articles 5(1) and (2)); the project developer must provide information on the environmental impact of the project (EIA report – Annex IV); the environmental authorities and the public must be informed and consulted (public consultation – Article 6); the competent authority's decision will consider the results of the consultation. The decision can be challenged in court (Articles 8 and 11).

Table 3. Overview of EU legislation applicable to the production of hydrogen

3.3 Dutch Law Applicable to Hydrogen Production through Electrolysis

For every construction project, several decisions and permits (which need to be obtained from national, provincial and local governments) are required. This section therefore analyses the rules that apply to areas where hydrogen production is planned, such as spatial standardisation and safety aspects in zoning plans. Furthermore, it examines permit requirements, conditions and standards that apply to hydrogen production sites. Lastly, it is determined whether the production of hydrogen through electrolysis is an activity for which an EIA needs to be prepared.

3.3.1 Spatial Integration

A project developer wishing to establish its business within a port must approach the relevant port authority to gain access to the land and/or the basic facilities located within the port area.[158] Pursuant to the Spatial Planning Act (*Wet ruimtelijke ordening*),[159] municipal and provincial authorities are obliged to draw up a zoning plan (*bestemmingsplan*).[160] Zoning plans are legally binding, and include detailed rules on how a certain plot of land or area can be used, and what buildings may be constructed.[161] The location for the development of the business within the port must thus comply with the municipal zoning plan of that particular area.[162] From a land use perspective, the production of hydrogen is regarded as an industrial activity and would most likely only be permitted in an area within the port designated as an industrial zone.[163]

If the zoning plan does not explicitly allow for the construction and operation of an electrolyser at a certain location, the applicant can request an amendment of the applicable zoning plan. Alternatively, the applicant can obtain a permission to deviate from the applicable zoning plan. This is granted by the competent authority by means of an environmental permit pursuant to Article 2.1(1)(c) of the Environmental Licensing (General Provisions) Act (*Wet algemene bepalingen Omgevingsrecht* (hereinafter 'Wabo')).[164] The application for such a permit is reviewed by the competent authority in accordance with Article 2.12 of the Wabo and can only be granted if the activity does not conflict with good spatial planning and the activity is not contrary to provincial or national regulations.

The purpose of the zoning plan is to provide 'good spatial planning'. The concept of 'good spatial planning' is however not specified in the Spatial Planning Act, which means that the concept can differ per municipality (and area). Therefore, the municipal council will have to determine, by means of a spatial structure of their choice, which forms of land use can be allowed in certain areas as well as which forms of land use that in their view should be explicitly excluded in certain areas.[165] In this decision,

[158] See further Section 2.3.2.2.
[159] Spatial Planning Act (*Wet ruimtelijke ordening*) of 1 July 2008.
[160] Articles 1.1(2b) and 3.1(1) of the Spatial Planning Act.
[161] Article 3.1 of the Spatial Planning Act.
[162] The most important instrument, of the spatial plans drawn up by the national government, the provinces and the municipality, is the zoning plan. How spatial plans are drawn up and amended is governed by the Spatial Planning Act.
[163] Floristean, A., *'EU regulations and directives which impact the deployment of FCH technologies'*, HyLAW Project, Deliverable 4.4, 2019.
[164] Environmental Licensing (General Provisions) Act (*Wet algemene bepalingen omgevingsrecht*) of 6 November 2008.
[165] Boeve, M.N., 'Omgevingsrecht', Europa Law Publishing (Groningen/Amsterdam), 2016, p. 229.

certain spatially relevant interests must be weighed against each other. An area earmarked for heavy industry usually means that other (sensitive) activities cannot be permitted in this area due to safety reasons. The requirements for the design of a certain area are sometimes incorporated in regulations, such as requirements for air quality or requirements for external safety. Provided that safety distances – especially to establishments where dangerous substances (*e.g.* hydrogen) are produced and/or processed – affect decisions on spatial integration, legislation and regulations pertaining to external safety must be taken into consideration. Pursuant to Article 13 of Directive 2012/18/EU (the Seveso Directive), Member States are obliged to take into account in their spatial planning potential risks associated with certain types of establishments. Hydrogen is included in Part 2 of Annex I of this Directive. As such, spatial planning decisions should ensure that sufficient (safety) distance is maintained between an establishment producing or processing hydrogen and residential areas, recreational areas, valuable natural areas, buildings and areas visited by the public and, particularly, other vulnerable areas. Article 13 of the Seveso Directive has been implemented in the Major Accidents (Risks) Decree (*Besluit risico's zware ongevallen*).[166]

Furthermore, the Decree on External Safety of Establishments (*Besluit externe veiligheid inrichtingen*)[167] obliges the competent authorities to maintain safety distances between high-risk establishments and sensitive objects. In the Decree, sensitive objects are defined as vulnerable and limited vulnerable objects.[168] The high-risk establishments are listed in Article 2 of the Decree (and further elaborated in Articles 1a – c of the Regulation of External Safety of Establishments (*Regeling externe veiligheid inrichtingen*)).[169] In general, high-risk establishments are companies where large quantities of hazardous substances are produced and/or processed such as *inter alia* chemical companies. The standards in the Decree are not effect-oriented, but based on a probability approach. The Decree defines 'site-specific risk' as the chance that someone will die at a specific location outside the company site as a result of a calamity involving hazardous substances.[170] Pursuant to Article 6.1 of the Decree, the site-specific risk to a 'vulnerable object' (*e.g.* buildings intended for accommodation and buildings in which large numbers of people are usually present for a large part of the day)[171] from a company site may not exceed 10^{-6} per year. The standard of 10^{-6} per year means that the probability of a fatal situation (as a result of an accident involving hazardous substances at a location to be built on) may not exceed one in a million in any given year.[172] Furthermore, the Decree on External Safety of Establishments includes a provision on 'group risk', which is understood to mean the cumulative probability that several persons will die outside the company premises as a result of a calamity involving hazardous substances contributing to the deaths of at least 10, 100 or 1000 persons.[173] These deaths must be a direct result of their presence in the area impacted by a high-risk establishment, and a result of an unusual incident attributable to that establishment.[174] In, practice, the site-specific risk and group risk is calculated using the calculation models of the SAFETI-NL.[175] This calculation model incorporates the standards prescribed in the Decree on External Safety of Establishments and the Regulation of External Safety of Establishments, providing a model for calculating the safety risks of establishments where hazardous substances are present, such as PtG installations.[176]

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[166] Major Accidents (Risks) Decree (*Besluit risico's zware ongevallen*) of 25 June 2015.
[167] Decree on External Safety of Establishments (*Besluit externe veiligheid inrichtingen*) of 27 May 2004.
[168] Article 1.1(l) of Decree on External Safety of Establishments.
[169] Regulation of External Safety of Establishments (*Regeling externe veiligheid inrichtingen*) of 8 September 2004.
[170] Article 1.1(o) of the Decree on External Safety of Establishments.
[171] The Decree does not contain an exhaustive or conclusive definition of the concept of vulnerable objects or limited vulnerable objects. Instead, the concepts are defined in more detail in case law. Additionally, the competent authority may, where it deems necessary, interpret these concepts in more detail, insofar as this interpretation does not limit the scope of the legislation. For a more comprehensive understanding see Vereniging van Nederlandse Gemeenten, *'Naar een veilige bestemming' VNG handreiking verankering externe veiligheid in ruimtelijke plannen*', 2007, p.26.
[172] Ministry of Infrastructure and Environment, *'Handboek buisleidingen in bestemmingsplannen'*, 2016, p. 13.
[173] Article 1.1(j) of the Decree on External Safety of Establishments.
[174] See Article 1.1(b) of the Decree on External Pipeline Safety.
[175] Software Application Fire Explosion Toxic Impact – Netherlands, available at <https://www.rivm.nl/safeti-nl>
[176] For a more comprehensive understanding see <https://www.rivm.nl/safeti-nl>

3.3.2 Permit Requirements and Conditions

In addition to the Spatial Planning Act, the Wabo is of importance for the regulation of the use of space. All physical activities conducted by a business at a certain location will generally be covered by one permit, which is referred to as the 'all-in-one' permit (*omgevingsvergunning*). This permit is designed to provide project developers with the opportunity to apply and receive all the necessary permissions relating to physical activities in one go.[177] The 'all-in-one' permit combines several permits relevant to an activity's impact on its physical surroundings. The main sub-permits included in the 'all-in-one permit' that are relevant to this research are: (i) the planning and zoning permit (as referred to in the previous section); (ii) the building permit; and (iii) the environmental permit.[178] In addition to these partial permits, the 'all-in-one' permit encompasses a number of other specific sub-permits, such as for example a fire safety permit.[179] Whether a developer needs to obtain any of these sub-permits is dependent on the specific activity.[180] The precise assessment framework for each sub-permit are quite complex, and are set out in Articles 2.10 – 2.22 of the Wabo and refer to several different laws and decrees such as, *inter alia*, the Spatial Planning Act, the Environmental Management Act (*Wet milieubeheer*),[181] the Decree on Environmental Law (*Besluit omgevingsrecht*)[182] and the Building Decree 2012 (*Bouwbesluit 2012*).[183] As previously mentioned, the planning and zoning permission is not required if the applicable zoning plan already allows for the planned developments.[184] Furthermore, it is useful to note with respect to the environmental (sub-)permit that this permit is only required by a specific subset of companies in the Netherlands that are deemed to have a significant environmental impact.[185] Companies that do not need an environmental permit, but which still affect the environment in some way, may be subject to the Activities Decree (*Activiteitenbesluit*).[186] The Decree contains general rules for, among other things, noise emissions, waste management and other environmental issues.[187]

Article 2.1(1) of the Wabo lists the activities that are subject to the 'all-in-one' permit. On the basis of this provision, it is forbidden to, for example set up, modify or operate an 'establishment' without obtaining a permit.[188] To determine whether an electrolyser is to be regarded as such an establishment, the Environmental Management Act (*Wet milieubeheer*) must be considered.[189] Pursuant to Article 1.1(1) of the Environmental Management Act, an establishment is 'every activity undertaken in economic context, or in a size as if it were in economic context, that is geographically limited to a certain extent'.[190] Additionally, to be classified as an establishment under the Environmental Management Act, the structure must fall under one of the category descriptions in Part B or Part C of Annex I of the Decree on Environmental Law (*Besluit omgevingsrecht*).[191] Establishments with an 'Integrated Pollution Prevention and Control' (IPPC) installation or the categories of establishments listed in Part B or Part C of Annex I of the Decree are subject to the permit requirements mentioned in Article 2.1(1)(e) of the

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177 There is also the option to split up the application unless Article 2.7 of the Wabo prohibits it, see further Ministry of Infrastructure and Water Management, *'An All-in-one Permit for Physical Aspects',* available at <https://rwsenvironment.eu/subjects/general-provisions-0/all-one-permit/>
178 Article 2.1 of the Wabo.
179 Government of the Netherlands, *'All-in-one permit for physical aspects: specific permits'*, available at <https://business.gov.nl/regulation/scope-permit-physical-aspects/>
180 For a complete overview of the sub-permits included in the 'all-in-one' permit see the Ministry of Housing, Spatial Planning and the Environment, *'Overzicht reikwijdte omgevingsvergunning: Wet algemene bepalingen omgevingsrecht, juli 2009'.*
181 Environmental Management Act (*Wet milieubeheer*) of 13 June 1979.
182 The categories of establishments referred to in Section 1.1(3) of the Environmental Management Act are those listed in Annex I, Part B and Part C in the Decree on Environmental Law (*Besluit omgevingsrecht*) of 25 March 2010.
183 Building Decree 2012 (*Bouwbesluit 2012*) of 29 August 2011.
184 See Section 3.3.1.
185 For a more comprehensive understanding see <https://rwsenvironment.eu/subjects/environmental-0/system-environmental/>
186 Activities Decree (*Activiteitenbesluit milieubeheer*) of 19 October 2007.
187 The Activities Decree contains rules per type of environmentally harmful activity (*e.g.* chemical production) and by type of environmental impact (*e.g*. noise).
188 As referred to in Article 2.1(1) subparagraph (e) in conjunction with Article 1.1(1) of the Environmental Management Act (*Wet milieubeheer*) of 13 June 1979.
189 Environmental Management Act (*Wet milieubeheer*) of 13 June 1979.
190 For a more comprehensive understanding see Rijkswaterstaat, *'Het begrip 'inrichting' uit de Wet milieubeheer',* available in Dutch at <https://www.infomil.nl/onderwerpen/integrale/activiteitenbesluit/begrip-inrichting/>
191 The categories of establishments referred to in Section 1.1(3) of the Environmental Management Act are those listed in Annex I, Part B and Part C in the Decree on Environmental Law (*Besluit omgevingsrecht*) of 25 March 2010.

Wabo. An IPPC installation is an installation for industrial activities as referred to in Annex I of the IE Directive.[192] Pursuant to point 4.2 of Annex I, the IE Directive applies to the production of hydrogen on an industrial scale (or more specifically the production of hydrogen for commercial purposes).[193] The Directive makes no distinction between production methods or the sources used for the production of hydrogen.[194] Therefore, it is likely that the production of hydrogen through electrolysis is covered by the rules of the Directive. Even if an electrolyser is not considered to be an IPPC installation, a permit is still required for an electrolyser if it falls under one of the categories listed in Part B or Part C of Annex I of the Decree on Environmental Law. In accordance with Part B of Annex I, establishments requiring a permit (pursuant to Article 2.1(2) of the Decree) are establishments subject to the rules of at least one of the decrees or regulations listed in Part B, Section 1(a). This list contains decrees, such as the Decree on External Safety of Establishments and the Major Accident (Risks) Decree, both of which are relevant for establishments producing or processing hydrogen. Hydrogen is included in Part 2 of Annex I of the Seveso Directive, which means that hydrogen is classified as a dangerous substance in accordance with Article 1(1)(c) of the Major Accident (Risks) Decree. Whether or not an electrolyser is classified as an IPPC installation, it is an establishment within the meaning of Part B of Annex I of the Decree. A developer of an electrolyser is thus required to apply for an 'all-in-one' permit for physical aspects in accordance with Article 2.1(1)(e) of the Wabo.[195] In addition, this establishment may also be subject to parts of the Activities Decree. The general rules of the Activities Decree may, therefore, apply in addition to the specific permit requirements included in the 'all-in-one permit'.

Article 2.14 of the Wabo contains the assessment criteria for the application under Article 2.1(1)(e) of the Wabo. When deciding on the application, the competent authority must at least pay attention to: (i) the existing state of the environment, in so far as the establishment may cause harm to it, (ii) the consequences for the environment, given the technical characteristics and the geographical location of the establishment, and (iii) the developments that can reasonably be expected from the establishment and the area where the establishment will be located, which are important with a view to protecting the environment. In addition, there are a number of matters that the competent authority 'must take into account' or 'observe' when making a decision on the application following Article 2.14(2) and (3) of the Wabo. Of particular relevance to hydrogen production sites is Article 2.14(3) of the Wabo, which stipulates that a permit can be rejected if it is in the interest of protecting the environment. Hence, when granting the permit, the competent authority must take into account the Best Available Technique (BAT) applicable to the establishment (the BAT shall be observed). The BAT for an electrolyser would be determined in accordance with Article 9.2 of the Ministerial Regulation on Environmental Law (*Regeling omgevingsrecht*)[196] in conjunction with Article 5.4 of the Decree on Environmental Law.

3.3.3 Environmental Impact Assessment

An environmental impact assessment (EIA) is a procedural instrument utilised to ensure that environmental implications of a decision are considered before the commencement of an activity. Pursuant to the EIA Directive, hydrogen production is an Annex II activity for which EU Member States decide whether the activity should be subject to an EIA.[197] In the Netherlands, the EIA Directive has been implemented in the Decree on Environmental Impact Assessment (*Besluit milieueffect-rapportage*).[198] The Decree stipulates which activities, plans and decisions (hereinafter 'activities') an EIA should be prepared for. In some cases, an EIA is compulsory (EIA obligation).[199] In other cases, the

[192] See Article 1.1 of the Wabo.
[193] For a more comprehensive understanding see Section 3.1, table 3.
[194] For a more comprehensive understanding see Section 3.1, table 3.
[195] The 'all-in-one' permit for an establishment (Article 2.1(1)(e) and 2.14 of the Wabo) will be prepared in conformity with the extended procedure pursuant to Article 3.10 of the Wabo.
[196] Ministerial Regulation on Environmental Law (*Regeling omgevingsrecht*) of 30 March 2010.
[197] See Section 3.1, table 3.
[198] Decree on Environmental Impact Assessment (*Besluit milieueffectrapportage*) of 4 July 1994.
[199] Article 2(1) of the Decree on Environmental Impact Assessment in conjunction with Article 7.2(1)(a) of the Environmental Management Act.

municipality or province decides whether an EIA is required (evaluation obligation).[200] Whereas Part C of the Annex lists the activities for which an EIA is compulsory, Part D of the Annex lists activities for which the competent authority evaluates whether an EIA is necessary.[201]

The Decree on Environmental Impact Assessment must therefore be consulted to determine whether the production of hydrogen through electrolysis is an activity for which an EIA needs to be prepared. The fact that 'hydrogen' does not appear in the decree does not mean that the production of hydrogen is not subject to an EIA. The production of hydrogen through electrolysis is a process in which water is split into hydrogen and oxygen by means of electricity. This is thus a chemical conversion process intended to produce hydrogen. It can therefore be argued that the production of hydrogen through electrolysis is an activity within the meaning of either Part C, Section 21.6 of the Annex (the establishment of an integrated chemical installation, *i.e.* an installation for the production on an industrial scale of substances by chemical conversion, in which several units coexist and are functionally linked together, intended for the manufacture of basic inorganic chemicals) or Part D, Section 34.4 of the Annex (the establishment, modification or extension of an installation belonging to the chemical industry for the treatment of intermediates and the manufacture of chemicals).[202]

In order to determine whether an EIA is compulsory, it must be established whether an electrolyser is considered to be an 'integrated chemical installation' as specified in Part C, Section 21.6 of the Annex of the Decree on Environmental Impact Assessment. In general, an installation is not considered to be an 'integrated chemical installation' if there are only 'individual chemical production processes' and where, in addition to individual chemical production processes, only pre-treatment and/or post-treatment of the chemicals takes place.[203] This is supported by case law. In a judgement from 2008 by the Administrative Jurisdiction Division of the Council of State (*Afdeling Bestuursrechtspraak van de Raad van State* (hereinafter 'ABRvS')), the ABRvS had to answer whether the production of biodiesel from vegetable substances could be considered an 'integrated chemical installation' and thus whether the production takes place within several process units.[204] The ABRvS emphasised that it is important when assessing whether there is one or more process units to consider whether 'marketable intermediate products' arise. Although the production of biodiesel consists of several production processes, these production processes do not lead to intermediate products that can be traded separately. The ABRvS therefore concluded that it was not to be considered as an 'integrated chemical installation'. Another judgment from the ABRvS from 2013 also shows that if there is a single process unit with several ancillary (complementary) processes, this installation should not be considered an 'integrated chemical installation'.[205] On the basis of these judgements it can be argued that an electrolyser, in which the production process only consists of an electrolysis process with pre-treatment and post-treatment processes of the water and the hydrogen gas, should not be regarded as an 'integrated chemical installation' as referred to in Part C, Section 21.6 of the Annex.[206] As a result, there is no EIA obligation within the meaning of Article 7.2(1) of the Environmental Management Act in conjunction with Article 2(1) of the Decree on Environmental Impact Assessment.

The remaining question is therefore whether an electrolyser falls under Part D, Section 34.4 of the Annex of the Decree on Environmental Impact Assessment. According to the Explanatory Memorandum of the

[200] Article 2(2) of the Decree on Environmental Impact Assessment in conjunction with Article 7.2(1)(b) of the Environmental Management Act.
[201] It may be necessary to draw up an EIA when applying for an environmental permit or for a permit regarding dispensation from or amendments to a zoning plan. Both permits are part of the 'all-in-one' permit explained in Section 3.2.2.
[202] Zwalve Erades, J., Kreeft, G., 'Waterstofproductie door waterelektrolyse en het Besluit milieueffectrapportage', omgevingsweb.nl of 24 January 2020.
[203] Zwalve Erades, J., Kreeft, G., 'Waterstofproductie door waterelektrolyse en het Besluit milieueffectrapportage', omgevingsweb.nl of 24 January 2020.
[204] ABRvS 3 of September 2008, ECLI:N:RVS:2008:BE9688.
[205] ABRvS 20 of March 2013, ECLI:N:RVS:2013:BZ4974.
[206] For a more comprehensive understanding see Zwalve Erades, J., Kreeft, G., 'Waterstofproductie door waterelektrolyse en het Besluit milieueffectrapportage', omgevingsweb.nl of 24 January 2020.

Decree, simple chemical production processes under Part D may fall under the EIA evaluation obligation. Part D, Section 34.4 includes the establishment, modification or extension of an installation belonging to the chemical industry for the treatment of intermediates and the manufacture of chemicals. The category description includes an indicative threshold value of a production capacity of 100 000 tons per year or more. If this is the case, the competent authority must assess whether an EIA should be drawn up (evaluation obligation).[207] The threshold values included in Part D are only indicative,[208] which means that the competent authority must assess whether an activity can have significant adverse effects on the environment even in cases where the activity does not exceed the threshold value.[209] This is referred to as a 'form-free EIA' and means that an assessment must be made in consultation with the applicant of the associated plan or decision as to whether there is a reason to evaluate whether an EIA is required or to carry out an EIA directly.[210] If the threshold values of 100 000 tons of hydrogen production through electrolysis per year is not met, a so-called 'form-free EIA', as described in Article 2.5(b) of the Decree, will therefore suffice.

3.3.4 Revision of Environmental and Planning Laws

Environmental legislation consists of dozens of laws and hundreds of regulations for land use, residential areas, infrastructure, the environment, nature and water. The previous sections of this report demonstrate how some of these laws and regulations have their own starting points, procedures and requirements. This makes the legislation very complex for both authorities and project developers. As a result, it takes longer to get projects off the ground.[211] The government therefore wants to simplify environmental and planning laws and combine them into a single Environment and Planning Act (*Omgevingswet*).[212] For the time being, the forthcoming Environment and Planning Act will replace 15 existing laws and the provisions of eight other laws will be transferred to the Act.

The legislative bill provides for an integrated framework for site-specific activities carried out by individuals, businesses and authorities within the physical environment. It provides regulations relating to the assignment of duties of authorities, standard setting, formation of visions and plans, general rules, decision-making, special circumstances, supervision and enforcement.[213] These elements are necessary for the effective implementation of regulations in practice. Successful elements from existing permission-granting systems relating to activities in the physical environment have been incorporated into the legislative bill. The new bill has been approved by both chambers of parliament and the cabinet is now responsible for drafting the introductory legislation. The new legislation is expected to enter into force in 2022.[214]

Improved facilitation of construction projects is an important purpose of the Environment and Planning Act.[215] The intention of the government to simplify and merge rules for physical development is of particular importance for future PtG activities, as this may change the current rules applicable to PtG installations regarding spatial integration, permit requirements and environmental and safety standards.

[207] Article 2(2) of the Decree on Environmental Impact Assessment in conjunction with Article 7.2(1)(b) of the Environmental Management Act.
[208] Since a judgment of the European Court of Justice in 2009, the threshold values of part D of the Annex are only indicative. This was necessary to meet the requirements of the EIA Directive. See Commission of the European Communities v Kingdom of the Netherlands (Case C-255/08) [2009] ECLI:EU:C:2009:630.
[209] See Rijkswaterstaat, *'De vormvrije m.e.r.-beoordeling: vereisten'*, available in Dutch at <https://www.infomil.nl/onderwerpen/integrale/mer/praktijkhandreiking/beoordeling-vorm/drempelwaarde/vormvrije/>
[210] See Rijkswaterstaat, *'Wanneer is m.e.r. of m.e.r.-beoordeling verplicht?',* available in Dutch at <https://www.infomil.nl/onderwerpen/integrale/mer/procedurehandleiding/wanneer-beoordeling/>
[211] Government of the Netherlands, *'Revision of Environment and Planning Laws'*, available in Dutch at <https://www.government.nl/topics/spatial-planning-and-infrastructure/revision-of-environment-planning-laws>
[212] Environment Act (*Omgevingswet*) of 26 April 2016, see also Rijksoverheid, 'Voorbeeldprojecten toekomstige Omgevingswet', available in Dutch at <https://www.rijksoverheid.nl/onderwerpen/omgevingswet>
[213] Explanatory Memorandum of the Environment and Planning Act (*Omgevingswet*) of 18 June 2014, Kamerstuk 33962, nr. 3.
[214] Government of the Netherlands, *'Revision of Environment and Planning Laws'*, available in Dutch at <https://www.government.nl/topics/spatial-planning-and-infrastructure/revision-of-environment-planning-laws>
[215] Government of the Netherlands, *'Nieuwe omgevingswet maakt omgevingswet eenvoudiger'*, available in Dutch at <https://www.rijksoverheid.nl/onderwerpen/omgevingswet/vernieuwing-omgevingsrecht>

One amendment of particular importance is the abandoning of the term 'establishment' (*inrichting*) as the central reference point for environmentally harmful activities.[216] In this context, the term 'activity' has been chosen as the umbrella term. The legislative bill distinguishes a variety of activities, including the environmentally harmful activity.[217] The basis for the environmentally harmful activity is broader than the definition given in the Environmental Management Act: 'adverse consequences which establishments may cause'. The new term comprises activities both within and outside the establishment, either location specific or not, and irrespective of their duration.[218] At present, however, it is unclear exactly how the proposed changes will affect the development of PtG activities.

3.4 Conclusions

The production of hydrogen through electrolysis is subject to a significant number of requirements at the EU level. Despite being transposed into national law, the source of most of these requirements can be directly traced to EU directives. Developers and operators of hydrogen production installations are subject to risk assessments (Seveso Directive), health and safety requirements (ATEX Directive), and potentially integrated environmental obligations (IE Directive) and environmental impact assessment procedures (EIA Directive).

As far as spatial integration is concerned, zoning plans must guarantee 'good spatial planning'. Zoning plans must therefore recognise that the location of certain activities in close proximity to each other is not – or only under strict conditions – compatible. The Decree of External Safety of Establishments concretises these standards by means of a risk analysis and calculation of the risk contour, which establishes an area around a hydrogen production site where no (limited) vulnerable objects may be located. If the applicable zoning plan does not explicitly allow for the construction of an electrolyser at a certain location, the applicant can request an amendment of the applicable zoning plan or apply for a permit to deviate from the applicable zoning plan.

Electrolysers that produce hydrogen on an industrial scale are considered to be IPPC installations within the meaning of the IE Directive, which means that the permit requirements of the Wabo apply to such installations. Even if an electrolyser is not considered as such an installation, the permit requirements in Wabo still apply. This is because hydrogen production sites are subject to the rules of the Decree of External Safety of Establishments and the Major Accident (Risks) Decree. The production of hydrogen through electrolysis is however not an activity for which it is compulsory to prepare an EIA.

Although hydrogen is a chemical of which the production (including the construction of a PtG installation) is regulated under EU and national legislation pertaining to the protection of the environment and human health, the relevant legislative instruments contain no direct reference to PtG. Their applicability therefore remains partially open to interpretation, which creates legal uncertainty for both authorities and PtG developers in the authorisation procedure.

[216] See Section 3.3.2.
[217] Explanatory Memorandum of the Environment and Planning Act (*Omgevingswet*) of 18 June 2014, Kamerstuk 33962, nr. 3.
[218] Explanatory Memorandum of the Environment and Planning Act (*Omgevingswet*) of 18 June 2014, Kamerstuk 33962, nr. 3.

4. Electricity Input for Hydrogen Conversion

4.1 Introduction

In addition to the development of PtG installations (electrolysers) in port areas, the input of electricity for the conversion process must be guaranteed. This can be achieved by: (i) connecting the onshore electrolyser to the onshore electricity transmission grid; or (ii) connecting the onshore electrolyser directly to an offshore wind farm. Thus, to facilitate the supply of electricity generated from offshore wind, there is the need to construct an electricity cable between the electrolyser and either the onshore transmission grid (which is fed electricity from offshore wind farms) or an offshore wind farm. From a legal perspective, it is therefore necessary to determine whether national law facilitates the supply of electricity to the electrolyser from either the onshore transmission grid or an offshore wind farm. This is analysed from an energy law perspective.[219]

The procedure for establishing a connection between the onshore transmission grid and an onshore electrolyser (end-user) is rather straightforward. This procedure is explained in more detail in Section 4.2. The procedure for establishing a direct connection between an offshore wind farm (generation asset) and an onshore electrolyser (end-user) is, however, more complex. The legal issues here are how to define the cable transporting electricity directly from an offshore wind farm to an onshore electrolyser, and who ought to be responsible for the construction and operation of the cable. Section 4.3 seeks to address these issues.

4.2 Connection to the Onshore Electricity Grid

All system users are awarded an equal right of access to the electricity system, in accordance with Article 6 of Directive (EU) 2019/944 (the 2019 Electricity Directive).[220] Article 2(36) of the 2019 Electricity Directive defines 'system users' as: "a natural or legal person who supplies to, or is supplied by, a transmission system or a distribution system". System operators are thus required to provide system users (producers as well as consumers) with the information that they need for efficient access to the system, and must refrain from discriminating between system users or classes of system users.[221] However, the obligation to provide all system users access to the electricity grid does not imply that all system users have a right to be connected to the grid.

The EU court emphasised in the case *Julius Sabatauskas and others* that the term 'access' refers to the right to use the electricity system and should be distinguished from the term 'connection' that corresponds to a physical connection to the system.[222] The term 'access' therefore applies to the ability to have energy 'transported' through networks, which requires that network capacities are available and can technically facilitate transportation. Member States are responsible to manage the way in which system users are connected to the grid as long as the process is based on objective and non-discriminatory criteria.[223] In other words, "the principle of non-discriminatory access to the grid does not allow customers to choose, at their own discretion, the type of system – transmission or distribution – to which they wish to be connected."[224] Although Member States are responsible to manage the way in which system users are connected to the grid, grid connection rules are harmonised in the framework

[219] Spatial planning regulations and permitting requirements are therefore not analysed in this section.
[220] Directive (EU) 2019/944 of the European Parliament and the Council of 5 June 2019 concerning common rules for the internal market in in electricity and repealing Directive 2012/27/EU, [2019] OJ L 158/125; Article 6(1) of the 2019 Electricity Directive does not enter into force until the 1 of January 2021.
[221] Articles 31 and 40 of the Electricity Directive.
[222] Julius Sabatauskas and Others (Case C-239/07) [2007] ECR, II-7523, para 42.
[223] For a more comprehensive understanding see Roggenkamp, M., Vedder, H., Rønne, A., Del Guayo, I., 'EU Energy Law' in Roggenkamp, M., Redgewell, C., Rønne, A., Del Guayo, I. (eds) *Energy Law in Europe: National, EU and International Regulation* (3rd edn, Oxford 2016), p. 278 – 279.
[224] Roggenkamp, M., Vedder, H., Rønne, A., Del Guayo, I., 'EU Energy Law' in Roggenkamp, M., Redgewell, C., Rønne, A., Del Guayo, I. (eds) *Energy Law in Europe: National, EU and International Regulation* (3rd edn, Oxford 2016), p. 279.

guidelines adopted by the Agency for Cooperation of Energy Regulators (ACER). These framework guidelines aim to provide minimum standards and requirements for connections, and to promote the exchange of information between parties.

The Dutch Electricity Act (*Elektriciteitswet*)[225] defines 'connection' in Article 1(1)(b) as one or more constructions between a grid and an immovable property, or a construction between the grid of one network operator and the grid of another network operator.[226] A connection consists of three components – the actual/physical link to the grid, the main breaker at the premises of the customer, and the cable in between – and is in principle considered as being part of the grid.[227] If so requested, electricity network operators are obliged to provide every person, on a non-discriminatory basis, with a connection to the grid at the required voltage level, as well as an estimate of the costs involved.[228] An exception is made for custom-made connections of more than 10 MVA as these connections can be established by others than the network operator on the basis of a tendering procedure.[229] Whereas standard connections need to be established at the nearest point in the grid, custom-made connections can be offered at a point in the grid where sufficient capacity is available.[230] Although all connections need to be established within a reasonable period of time, there is a strict limit of a maximum eighteen weeks for connections below 10 MVA and for connections involving renewable energy production.[231] To ensure that reliable grid operation is not comprised, all transmission grid subscribers in the Netherlands must meet the minimum requirements, which are detailed by TenneT (the Dutch TSO).[232] The minimum requirements for the onshore TenneT grid are presented in the document 'Grid Connection rules – extra high voltage'.[233]

4.3 Connection Directly to an Offshore Wind Farm

Establishing a connection via cable directly between an offshore wind farm and an onshore electrolyser is more complex from a legal perspective than establishing a connection between the onshore transmission grid and an electrolyser. In accordance with the UN Convention on the Law of the Sea of 1982 (UNCLOS), the Netherlands may only exercise a functional jurisdiction with regard to the production and use of energy (oil/gas and electricity from wind and waves) on its continental shelf (CS) and its exclusive economic zone (EEZ).[234] This includes the right to issue and maintain legislation governing production installations and all cables and pipelines connected to it.[235] On the Dutch CS and EEZ, few national laws apply, and of relevance for the analysis in this section are the Wind Energy at Sea Act (*Wet windenergie op zee*)[236] and the Electricity Act (*Elektriciteitswet*).[237] It must be noted, however, that only very few of the provisions of the Electricity Act apply offshore.[238]

[225] Electricity Act (*Elektriciteitswet*) of 2 July 1998.
[226] A definition of immovable property is included in Article 16(a) – (d) in the Valuation of Immovable Property Act (*Wet waardering onroerende zaken*) of 15 December 1994.
[227] See Roggenkamp, M., 'Energy Law in the Netherlands' in Roggenkamp, M., Redgewell, C., Rønne, A., Del Guayo, I. (eds) *Energy Law in Europe: National, EU and International Regulation* (3rd edn, Oxford 2016), p. 775.
[228] Article 23 of the Electricity Act. See further Article 28 of the Electricity Act, which provides for a regulated connection tariff.
[229] See Article 16c of the Electricity Act.
[230] Article 27(4) of the Electricity Act.
[231] Article 23(4) of the Electricity Act.
[232] The core tasks of TenneT follow from its appointment as grid operator under the Dutch Electricity Act (*Elektriciteitswet*). TenneT is primarily tasked with providing power transmission services, system services and facilitating the energy market.
[233] TenneT TSO, 'Grid Connection Regulations: High and Extra-High Voltage' of 27 April 2019, available at <https://www.tennet.eu/fileadmin/user_upload/The_Electricity_Market/German_Market/Grid_customers/tennet-nar-2019_04_EN.pdf>
[234] Articles 56 and Article 77 of the UNCLOS; Coastal states therefore have only limited rights to regulate such activities/functions, see further Drankier, D., Roggenkamp, M., *North Sea Energy II Regulatory Framework: Barriers or Drivers for Offshore System Integration*, North Sea Energy, Deliverable B.1, 2018, p. 8-10.
[235] H.K, Müller, 'A Legal Framework for a Transnational Offshore Grid in the North Sea', PhD, Intersentia, 2015, 408 pp.
[236] Wind Energy at Sea Act (*Wet windenergie op zee*) of 24 June 2015.
[237] Electricity Act (*Elektriciteitswet*) of 2 July 1998.
[238] See Article 1(5) of the Electricity Act.

The Wind Energy at Sea Act (*Wet windenergie op zee*)[239] applies to the development of wind farms offshore. Per the legislation, 'wind farm' is a term inclusive of the facilities necessary to produce electricity from wind energy (wind turbines) and the subsea cables that internally connects the wind turbines, which are connected to an offshore converter station and thus to the offshore electricity network bringing the electricity to shore.[240] Initially, developers of wind farms offshore were responsible for the construction of the cable from the wind farm to shore (at the grid connection point).[241] Wind farm developers therefore needed to construct and operate this cable.[242] This changed following legislative changes in 2016, through which a more coordinated grid planning approach was adopted. The grid connection now takes place at sea at the converter station, and the responsibility for the construction of the converter station and the cable from the converter station to shore has been shifted from the wind farm developer to the TSO.[243] In September 2016, TenneT was officially appointed as the TSO at sea and is therefore responsible for developing and operating the cables connecting offshore wind farms to the onshore transmission grid.[244,245]

To establish the rules applicable to the proposed cable connecting an offshore wind farm to an onshore electrolyser, the legal definition and classification of the cable must be determined. Pursuant to Article 15a of the Electricity Act (*Elektriciteitswet*),[246] the offshore electricity network comprises the networks intended for the transport of electricity connecting one or more offshore wind farms to the national transmission network. Article 15a of the Electricity Act therefore does not include the option to develop alternative cables connecting offshore wind farms directly to end-users (offshore or onshore). As such, the cable connecting the wind farm directly to the electrolyser (end-user) could not be considered as an offshore 'transmission line'.

Alternatively, the proposed cable may be considered as a "direct line". This distinction may be made, as the cable does not bring electricity from a wind farm to the transmission grid, instead only transmitting electricity from a wind farm to an electrolyser (end-user). The notion of 'direct line' has existed in EU energy law since Directive 96/92/EC (the 1996 Electricity Directive),[247] and is defined in Article 2(41) of the 2019 Electricity Directive as:

> "either an electricity line linking an isolated generation site with an isolated customer or an electricity line linking a producer and an electricity supply undertaking to supply directly their own premises, subsidiaries and customers"[248]

The regime is further detailed in Article 7 of the same directive, and has been little changed since Directive 2009/72/EC (the 2009 Electricity Directive).[249] Thus, direct lines are electricity lines reserved for the sole purpose of providing electricity to an isolated site or a large consumer, and may not be used by other market actors. The rules on direct lines have been incorporated in Articles 1(1) and 9 of the Dutch Electricity Act. Per the first sub-paragraph of Article 1, a 'direct line' is one or more connection(s)

[239] Wind Energy at Sea Act (*Wet windenergie op zee*) of 24 June 2015.
[240] Article 1 of the Wind Energy at Sea Act.
[241] Müller, H.K., *A Legal Framework for a Transnational Offshore Grid in the North Seas*, Intersentia, 2016, p. 148.
[242] The reason for this was that the Electricity Act of 1998 was not applicable to the EEZ, except for the provision regarding electricity production.
[243] Article 16(2) subparagraph (n) of the Electricity Act. For a more comprehensive understanding see Nieuwenhout, C.T., *Legal Framework and Legal Barriers to an Offshore HVDC Electricity Grid in the North Sea*, PROMOTioN, Deliverable 7.1, 2017, p. 95.
[244] The party who wishes to be a TSO has to request this pursuant to Article 10(3) of the Electricity Act.
[245] TenneT is appointed as the TSO at the sea for the coming 10 years. The decision is available in Dutch at <https://www.acm.nl/nl/publicaties/publicatie/16048/Besluit-certificering-TenneT-als-netbeheerder-van-het-net-op-zee>
[246] Electricity Act (*Elektriciteitswet*) of 2 July 1998.
[247] Article 21 of the Directive 96/92/EC of the European parliament and of the Council of 19 December 1996 concerning common rules for the internal market in electricity.
[248] It should be noted that the definition of a 'direct line' was different in the 1996 Electricity Directive. Article 1(12) of the 1996 Electricity Directive defined a 'direct line' as an "electricity line complementary to the interconnected system".
[249] Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC [2009] OJ L 211/55.

for the transport of electricity, linking an isolated generation site with an isolated customer. For this definition to apply to a cable, the provision indicates that neither generator nor final customer may be connected to the transmission grid (or another connection for the transport of electricity). As a connection may only be considered a 'direct line' if both nodes are remote, any installation that is deemed to be connected in some way to the transmission network is likely incapable of being defined as a 'direct line'.[250] Nonetheless, the provisions of the Dutch Electricity Act regulating direct lines are not applicable in the EEZ.[251] There is thus no classification of such an electricity cable offshore in Dutch law.

Furthermore, a determination of who is responsible (or even legally permitted) to construct the proposed cable between an offshore wind farm and an onshore electrolyser must also be made. Is it (for instance) TenneT, an independent party, the wind farm developer, or the developer of the electrolyser? First, it must be repeated that the construction and operation of this particular electricity cable is not the responsibility of TenneT.[252] Secondly, at the moment it is not clear whether the proposed electricity cable will be developed by an independent party, the wind farm developer, or the developer of an electrolyser, as no such cables have yet been established. The general rule in the Netherlands is that the construction of electricity lines that are considered as a grid is not free, but limited to those companies which are appointed as network operators.[253] Nevertheless, pursuant to Article 15 of the Electricity Act, the Consumer and Market Authority (ACM) may, upon application, exempt an owner of a system other than the national high-voltage network from designating one or more public or private limited companies as network operator for the purpose of operating that network.[254] A direct line is, however, not a network and the owner does not have to appoint a network operator.[255] For a direct line, a notification obligation applies to ACM.[256] With a direct line the customer and the producer can be different persons, but the customer must be connected directly via an electricity cable to the production installation.[257] Pursuant to Article 1(5) of the Electricity Act, however, the provisions of the act only apply in the EEZ with regard to certain specific electricity networks and not direct lines. The provisions on direct lines in the Electricity Act are therefore not applicable in the EEZ.

In 2018, the Ministry of Economic Affairs and Climate opened a consultation for the amendment of the Wind Energy at Sea Act.[258] To facilitate the production of energy carriers (such as hydrogen), the amending legislation will replace the concept of a network connection with the concept of a 'connection point'.[259] The memorandum provides three examples of such connection points: (i) the connection of an electricity cable to a hydrogen facility (onshore or offshore); (ii) the connection of a hydrogen pipeline to an installation where the hydrogen is distributed over various means of transport; and (iii) the connection of a hydrogen pipeline to an installation where electricity is produced from hydrogen.[260] Through the introduction of the concept of a 'connection point', the proposed amendment promotes the possibility of connecting an offshore wind farm to an onshore electrolyser (hydrogen installation). The memorandum however fails to provide clarification regarding how the electricity cable (establishing the connection) would be defined or classified by law, as well as who ought to be responsible for developing and

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[250] For a more comprehensive understanding see Andreasson, L.M., Roggenkamp, M.M., *'Regulatory Framework: Legal Challenges and Incentives for Developing Hydrogen Offshore*', North Sea Energy, Deliverable 2.2, 2.2, p. 62.
[251] See Article 1(5) of the Electricity Act.
[252] See Article 15a of the Electricity Act.
[253] This mainly applies to transmission and distribution grids and not to 'other grids', see Roggenkamp, M., 'Energy Law in the Netherlands' in Roggenkamp, M., Redgewell, C., Rønne, A., Del Guayo, I. (eds) *Energy Law in Europe: National, EU and International Regulation* (3rd edn, Oxford 2016), p. 780.
[254] Article 10(9) of the Electricity Act provides that anyone to whom a network other than the national high-voltage network or a cross-border network belongs, designates one or more public or private companies as network operator for the management of that network.
[255] Article 9(h) subparagraph 1 of the Electricity Act.
[256] Article 9(h) subparagraph 2 of the Electricity Act.
[257] See Article 1(1) subparagraphs (i) and (ar) of the Electricity Act.
[258] Act amending the Wind Energy at Sea Act (*Wijziging van de Wet windenergie op zee*) of 28 November 2018, Kamerstuk 35092 no. 3, available at <https://zoek.officielebekendmakingen.nl/kst-35092-3.html>
[259] Para. 2.1.2 of the Act amending the Wind Energy at Sea Act.
[260] Para. 2.1.2 of the Act amending the Wind Energy at Sea Act.

operating such a cable. As previously discussed, the cable could be defined as a direct line, but this would require the legislator to extend the application of the rules on direct lines in the Electricity Act to the EEZ. Another option would be to consider the cable as a part of the offshore wind farm installation as the case was prior to the legislative changes of 2016. Hence, the successful implementation of the proposed amendments to the Wind Energy at Sea Act requires that such amendments are also reflected in the Electricity Act.

4.4 Conclusions

The procedure for establishing a direct connection between the onshore transmission grid and an onshore electrolyser (end-user) is rather straightforward. EU Member States are responsible for managing the way in which system users (producers as well as consumers) are connected to the grid, with the process needing to be based on objective and non-discriminatory criteria. If so requested, Dutch electricity network operators are obliged to provide every person, on a non-discriminatory basis, with a connection to the grid at the required voltage level, as well as an estimate of the costs involved. The Electricity Act distinguishes between small and large customers and different connection rules apply with regard to the point and time of connection, Whereas a connection of less than 10 MVA is established by the network operator at the nearest point in the grid, a connection of more than 10 MVA can be established by other than the network operator on the basis of a tendering procedure at a point in the grid where sufficient capacity is available. All connections need to be established within a reasonable period of time, but a strict limit of eighteen weeks applies to connections below 10 MVA. It must be emphasised, however, that in cases where the electrolyser is connected to the onshore transmission network, there is no guarantee that the electricity used is actually renewable and that the hydrogen produced is green. This can only be guaranteed if a direct connection via cable is established between an installation that produces renewable electricity and the electrolyser.

The procedure for establishing a direct connection via cable between an offshore wind farm (generation asset) and an onshore electrolyser (end-user) is more complex. The electricity cable establishing such a connection would most likely be classified as a 'direct line', *i.e.* it would not be part of either the onshore or the offshore transmission network. However, the classification of such a cable as a 'direct line' under Dutch law is problematic, as the provisions governing 'direct lines' in the Netherlands are not applicable offshore. A definition, and possibly a separate legal regime governing such cables, should therefore be considered. Proposed amendments to the Wind Energy at Sea Act seem to promote the possibility of connecting offshore wind farms to onshore consumers (*e.g.* energy conversion installations) through the introduction of a new type of connection. There is, however, no clarification in this amendment as to how the cable establishing such a connection should be classified and who ought to be responsible for the development and operation of the cable.

5. Hydrogen Transport

5.1 Introduction

In the final step of the PtG process, the produced hydrogen must be transported from the PtG installation to an end-user. This report focuses on the legal framework governing piped transportation of hydrogen to end-users. The following two alternatives are subject to analysis: (i) connecting an electrolyser to the existing natural gas transmission network, *i.e.* blending hydrogen with natural gas; or (ii) connecting an electrolyser to an end-user via a pipeline (or via a pipeline network) dedicated for hydrogen transport, *i.e.* developing hydrogen pipelines or repurposing existing natural gas pipelines for hydrogen transport. From a legal perspective, it is necessary to scrutinise laws and regulations governing the connection of an electrolyser to the natural gas network and to ascertain the gas quality specifications applicable to the injection of hydrogen into the existing natural gas network. Furthermore, it is necessary to examine laws pertaining to the development and operation of hydrogen pipelines, as well as the repurposing of existing natural gas pipelines for hydrogen transport.

The Netherlands has one of the most extensive natural gas networks in the world. A great deal of knowledge and experience has thus been gained in relation to the transport of gaseous molecules. Although there are substantial differences between natural gas and hydrogen, it has been shown that existing natural gas pipelines can be made suitable for transporting hydrogen.[261] The procedure for establishing a connection between an electrolyser and the existing natural gas transmission network is governed by EU and national gas laws.[262] This is examined in more detail in Section 5.2, which specifically analyses the rules governing the admixture of hydrogen into the natural gas transmission network. Dedicated hydrogen pipelines have not yet been developed on a large-scale in the Netherlands.[263] Section 5.3 therefore analyses the rules in national law applicable to the construction and operation of gas pipelines, as well as to the repurposing of existing natural gas pipelines for hydrogen transport (with particular focus paid to spatial integration, safety aspects and environmental regulations).

5.2 Blending of Hydrogen into the Existing Natural Gas Network

Article 1(1) of Directive 2009/73/EC (the Gas Directive)[264] establishes the rules relating to the organisation and functioning of the natural gas sector.[265] PtG, however, is not defined; nor are there any provisions specifically for hydrogen. Although the title and the scope of the Gas Directive indicate that it applies to natural gas, Article 1(2) establishes that its rules “shall also apply in a non-discriminatory way to biogas and gas from biomass or other types of gas”. The reference to ‘other types of gas’ suggests that hydrogen is within the scope of the Gas Directive. At the time of writing, there is no European Court of Justice jurisprudence determining what is to be understood with ‘other types of gas’, and what regime is applicable to such gases. Given the lack of clarification of ‘other types of gas’, it is not yet clear under what circumstances hydrogen is subject to the rules of the Gas Directive.

[261] A hydrogen transport pipeline in Zeeland was put into use in October 2018. The hydrogen transport pipeline is an old natural gas transport pipeline that has been converted into a hydrogen transport pipeline, see <https://www.hynetwork.nl>
[262] Of relevance are also planning, safety and environmental laws.
[263] See Gasunie hydrogen pipeline from Dow to Yara brought into operation, available at <https://www.gasunie.nl/en/news/gasunie-hydrogen-pipeline-from-dow-to-yara-brought-into-operation>
[264] Directive 2009/73/EC of the European Parliament and the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC [2009] OJ L211/94.
[265] In 2019 amendments were made to the Gas Directive through the Directive (EU) 2019/692 of the European Parliament and of the Council of 17 April 2019 amending Directive 2009/73/EC concerning common rules for the internal market in natural gas [2019] OJ L 117/1. These amendments had the goal of ensuring that the rules governing the EU’s internal gas market apply to gas transmission lines between a member states and a third country. This new legislation, however, only amended and did not completely replace the Gas Directive. The EC is expected to propose a new legislative package containing more widespread reforms for the gas sector in 2020.

A continued reading of Article 1(2) of the Gas Directive clarifies that 'other types of gas' fall within the scope provided they can be "technically and safely injected into, and transported through, the natural gas system".[266] In other words, "the technical and safety standards applicable to the injection and transportation of gas through the natural gas system, including gas quality standards, form the benchmark with which other gases need to comply."[267] Thus, if other gases are equivalent to that of natural gas, it can be argued that the rules of the Gas Directive apply to their injection into, and the transport through, the natural gas system. The rules therefore apply to the injection of hydrogen, insofar as the legal standard for its maximum permitted volume is not exceeded.

5.2.1 Gas Quality Requirements and Prerequisites for the Blending of Hydrogen

Gas quality requirements are set through gas quality standards, which establish the maximum and minimum acceptable levels for individual parameters and components of gases.[268] The gas parameters include descriptive properties, such as Wobbe Index; physical properties, such as density; compositional properties, such as methane content; and conceptual properties, such as odour.[269] Given that hydrogen and natural gas have different physical and chemical properties (such as, *inter alia*, density, calorific value, and burning velocity),[270] the admixture of hydrogen impacts the integrity of natural gas networks, and the functioning of end-use appliances connected to the network.[271] Gas quality harmonisation efforts by the European Committee for Standardisation have not led to a consensus on a common Wobbe Index or hydrogen limit.[272] In the absence of harmonised standards, it is for the Member States to specify the Wobbe Index range and the hydrogen limit applicable to their national gas networks.[273]

The Dutch Gas Act (*Gaswet*)[274] regulates the transport of natural gas. The applicability of the legislation to hydrogen is contingent on the definition of 'gas'.[275] In 2012, the Gas Act was amended to explicitly state that the term 'gas' covers natural gas and other substances – to the extent that these substances meet a set of specifications concerning the production method and the chemical state of the substance at a particular temperature and pressure.[276] Per Chapter 2 of the Gas Act, the main requirement is that the gas can be transported safely through the natural gas network. However, no further guidance on the meaning of 'safe transport' is provided. Article 11 of the Gas Act specifies that the requirements that the gas must meet before it can be fed into the natural gas network are listed in the Ministerial Decree on Gas Quality (*Regeling Gaskwaliteit*).[277] In 2016, the Minister updated the gas quality requirements and detailed the prerequisites to the admixture of hydrogen into the natural gas stream: the maximum hydrogen content level in H-gas was set at 0.02mol%,[278] with no distinction made between different types of H-gas networks.[279] For the L-gas pipeline network, the maximum hydrogen content level in

[266] Article 1(2) of the Gas Directive.
[267] Kreeft, G., *European Legislative and Regulatory Framework on Power-to-Gas*, Store&Go, Deliverable 7.2, 2017, p. 24.
[268] Tempelman, D., 'Harmonising Gas Quality: Obstacles and Challenges in an Internal Energy Market' in Roggenkamp, M., Bjorneby, H. (eds.) *European Energy Law Report X* (Intersentia 2014), p. 88-89.
[269] Van Stiphout, M., *'Gas Quality Standards in the European Union: the need to develop European gas quality standards to achieve market integration and a competitive gas appliance market'*, DG Energy and Transport, European Commission, available at <http://members.igu.org/html/wgc2009/papers/docs/wgcFinal00785.pdf>
[270] Altfeld, K., Pinchbeck, D., 'Admissible Hydrogen Concentrations in Natural Gas Systems', Gas for energy No. 3 (2013), *GERG study,* p. 36-47.
[271] NaturalHY, *'Using the Existing Naturals Gas System for Hydrogen: preparing for the Hydrogen Economy by Using the Existing Natural Gas System as a Catalyst'*, No. SES6/CT/2004/502661, 2009, p. 10.
[272] For a comprehensive understanding see Andreasson, L.M., Roggenkamp, M.M., *'Regulatory Framework: Legal Challenges and Incentives for Developing Hydrogen Offshore*', North Sea Energy, Deliverable 2.2, 2.2, p. 38 – 41.
[273] Recital 41 of the Gas Directive, see further Tempelman, D.G., 'Harmonising Gas Quality Standards: Obstacles and challenges in an internal market' in Roggenkamp, M., Bjrørneby, H., (eds) *European Energy Law Report X* (Cambridge 2014), p. 89.
[274] Gas Act (*Gaswet*) of 22 June 2000.
[275] See Article 1(1)(b) of the Gas Act.
[276] Natural gas or any other substance (equivalent to methane as far as possible), which is in gaseous form at a temperature of 15 degrees Celsius and at a pressure of 1,01325 bar, see further Article 1(1)(b) subparagraphs 1 and 2 of the Gas Act.
[277] Ministerial Decree on Gas Quality (*Regeling Gaskwaliteit*) of 11 July 2011.
[278] High-calorific natural gas or natural gas with a high calorific value. This gas contains relatively large proportions of higher hydrocarbons and consequently has more energy than low-calorific value, see further Gasunie, *'H-Gas'* <https://www.gasunie.nl/en/glossary/h-gas>
[279] Article 2.1 and 2.3 of the Ministerial Decree on Gas Quality, Annexes 1 and 3 of the Ministerial Decree on Gas Quality.

some parts of the L-gas network was set at 0.5mol%.[280] The exact composition of the mixture may change over time, however, the volume of natural gas in existing natural gas pipelines is likely to decrease following the cessation of natural gas production from the Groningen and North Sea gas fields. Thus, some room exists for the injection of hydrogen into the natural gas network.

Alternatively, demand for green hydrogen may be increased by imposing an obligation to blend the gas into natural gas networks. This is an ongoing discussion at the EU level in the context of increasing the sustainability of the European gas system. Directive (EU) 2018/2001 (the 2018 Renewable Energy Directive)[281] also offers room for this option,[282] which is seen by the International Renewable Energy Agency (IRENA) (among others),[283] as a cost-effective and flexible way to support the scaling up of green hydrogen. An obligation to blend green hydrogen into the natural gas networks is being considered in the Netherlands to ensure offtake, starting with 2% physical blending, which could be increased incrementally, up to 10-20%.[284] Until 2030, the expectation is that most developments will take place on a regional (and local) scale, in part through regional energy strategies.[285]

5.2.2 Rules on Connection and Access

The connection of a gas production installation to the natural gas network is regulated by EU and national gas laws. As previously mentioned, the term 'connection' corresponds to the physical connection to the network and third-party access (TPA) brings with it the obligation to connect network users to the grid. Member States have the responsibility to manage the way in which system users are connected to the network, as long as the process used is based on objective and non-discriminatory criteria.[286] In terms of access to the natural gas transmission network, the Gas Directive charges the network operator with the task of maintaining a safe and reliable network.[287] Transport of gas is based on the principle of TPA, which entails that all system users should be awarded an equal access to the network.[288] Member States must ensure the implementation of a regulated TPA to the transmission and distribution networks, based on published tariffs applicable to all eligible customers, including gas supply undertakings, and applied objectively and without discrimination between network users. These access tariffs, or the methodology underlying their calculation, must be approved by the National Regulatory Authority (NRA).[289] Nonetheless, the Gas Directive makes it possible to treat different groups of network users unequally, provided network users within a group are treated equally.[290] System operators can therefore discriminate between classes of network users, as long as such discriminatory treatment is based on objective criteria. Such objective criteria can be found in the technical safety criteria referred to above, which are aimed at ensuring the integrity of the gas system, including gas quality standards.[291] Access to the natural gas network may be granted on the condition that technical and safety rules are complied with – this is explicitly stipulated in Recital 41 of the Gas Directive:

[280] This is only the case for gas transportation networks that are not managed by the network operator of the national gas transport network. For the high-pressure networks, the admixing limitation of hydrogen for L-gas networks is 0,02mol%; see Article 2.2 and 2.4 of the Ministerial Decree on Gas Quality, Annexes 2 and 4 of the Ministerial Decree on Gas Quality.
[281] Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources [2018] OJ L328/82.
[282] The following provisions of the Renewable Energy Directive supports the integration of green hydrogen as a renewable gas in the EU energy sector: Recital 59 acknowledges that hydrogen is a renewable gas; Article 7(1) stipulates that hydrogen is considered for the purpose of calculating the share of gross final consumption of energy from renewable sources; Article 19 stipulates that guarantees of origin shall be issued for renewable gases; and, Article 20 requires Member States to assess the need to extend existing gas network infrastructure to facilitate the integration of gas from renewable sources.
[283] IRENA, *'Hydrogen: A Renewable Energy Perspective'*, 2019, p. 20.
[284] Government Strategy on Hydrogen of 6 April 2020, Section 2, p. 8 – 9.
[285] Government Strategy on Hydrogen of 6 April 2020, Section 2, p. 13.
[286] Connection to the gas network is defined in Article 1.1(m) of the Gas Act as one or more constructions between a grid and an immoveable property or a construction between the grid of one network operator and the grid of another network operator.
[287] Article 13 of the Gas Directive.
[288] Article 32 of the Gas Directive; for grounds to refuse access to the system see Chapter VII of the Gas Directive.
[289] Article 32 of the Gas Directive in conjunction with Article 41(1) and 41(6) of the Gas Directive.
[290] Kruimer, H., 'The Non-Discrimination Obligation of Energy Network Operators: European Rules and Regulatory Practice' (2014) Energy Law Series 15, p. 4.
[291] See Section 4.4.2.5.

> "Member States should ensure that, taking into account the necessary quality requirements, […] other types of gas are granted non-discriminatory access to the gas system, provided such access is permanently compatible with the relevant technical rules and safety standards".

In conclusion, compliance with gas quality standards is an important prerequisite to being permitted to inject hydrogen into the natural gas network. The 2009 EU Gas Directive and the Dutch Gas Act make no distinction between different types of gases (based on the production method or the sources used to produce the gas) in their application – the scope of their application is instead based on whether the gas can be technically and safely injected into, and transported through, the natural gas system. This implies that, where the rules of the Gas Directive and the Dutch Gas Act apply to hydrogen, both green and grey hydrogen fall within their scope.

5.2.3 Connecting an Electrolyser to the Transmission Network

Due to the absence of rules specifically regulating the connection of hydrogen injection facilities (*e.g.* electrolysers) to the transmission network, nothing binds or prevents the TSO to proceed to connect such facilities as long as it is established by the TSO (or to the TSO by the owner of the injection facility) that hydrogen can be safely injected into, and transported through, the network and that such injection is compatible with the gas quality requirements. Owners of electrolysers can, thus, apply to Gasunie Transport Service for a connection to the transmission network.[292] A connection consists of three components – the physical link to the network, the main fuse at the premises of the customer, and the pipeline in between.[293] In the Netherlands, Gasunie only provides and owns the connection point.[294] A connection point is the nearest point of the gas transport network where sufficient capacity and pressure is available. In practice, this is a split-Tee with a valve, to which the gas producer connects the feeder pipe.[295] While Gasunie is responsible for establishing the connection point on their pipeline, the gas producer is responsible for developing the pipeline from the production site to the connection point. The rules applicable to the development of such a pipeline are examined in more detail in the following sections.

5.3 Development of Dedicated Hydrogen Pipelines

If the existing natural gas pipeline network cannot accommodate the transport of hydrogen, *i.e.* blending hydrogen in the existing natural gas network, dedicated hydrogen pipelines can be used for this purpose by either (i) developing new hydrogen pipelines, or (ii) repurposing existing natural gas pipelines. This section analyses the regulatory framework pertaining to the development, ownership and operation of new hydrogen pipelines and repurposed natural gas pipelines for hydrogen transport, specifically focusing on spatial integration, safety aspects and environmental regulations.

5.3.1 Who is Entitled to Develop and Manage Hydrogen Pipelines

There is no general law regulating the construction and use of subsoil gas pipelines in the Netherlands. Hence, anyone who wishes to construct and operate such pipelines needs to comply with all other relevant laws such as planning, environmental and safety laws but also the Gas Act.[296] The latter act contains an important exemption to this general rule as it explicitly states that distribution and transmission pipelines for natural gas can only be constructed and operated by existing network operators. In other words, the freedom to construct pipelines does no longer apply to natural gas

[292] A new connection involves using a connection pipeline to make a link between the gas transmission network and the injector's installation. A Grid Connection Agreement is drawn up, see further Gasunie, 'Connection Agreement' at <https://www.gasunietransportservices.nl/en/connected-party/connected-parties/connection-agreement>
[293] See Article 1(1)(m) of the Gas Act.
[294] Pursuant to Article 10(6)(b) of the Gas Act network operators are obliged to provide applicants with a capacity greater than 40m^3 with a connection at the nearest point on the gas transport network at a pressure and capacity suitable for that connection.
[295] For a more comprehensive understanding see <https://www.hylaw.eu>
[296] For a more comprehensive understanding see Roggenkamp, M., 'Energy Law in the Netherlands' in Roggenkamp, M., Redgewell, C., Rønne, A., Del Guayo, I. (eds) *Energy Law in Europe: National, EU and International Regulation* (3rd edn, Oxford 2016), p. 780.

pipelines.[297] The question of whether hydrogen producers can construct and operate their own hydrogen pipelines to supply their customers is therefore complex as it is not clear whether hydrogen pipelines should be treated like natural gas pipelines. Given that the rules of the Gas Act only apply to "other types of gas" insofar as such gases can technically and safely be injected into and transported through the natural gas system, it is assumed that the provisions in the Gas Act on unbundling only apply to natural gas companies and not hydrogen companies.[298] Owners and operators of hydrogen production facilities (including electrolysers) should thus have the right to construct and operate their own hydrogen pipelines as long as these pipelines are in no way connected to the natural gas system.

Given that the existing natural gas network can be repurposed for the transport of hydrogen (but also because hydrogen can be blended into the existing natural gas network),[299] it is vital to explore whether TSOs and DSOs are entitled by law to be involved in the transport of hydrogen, but also in the construction and management of new hydrogen pipelines. With regard to the activities that TSOs and DSOs may employ, a distinction must be made between the activities of TSOs and DSOs active in the gas sector, and companies within the same corporate group as TSOs or DSOs.[300] TSOs and DSOs must limit their activities to the operation of gas networks within the parameters specified by law and may generally not act in the hydrogen market, except in cases where hydrogen is offered to them and it can be injected into their gas networks.[301] Companies within the same corporate group as a TSO or DSO, however, have more flexibility to act in the hydrogen market, as will be discussed below.[302] The ACM has published a consultation on a draft guidance note, titled ‘Network companies and alternative energy carriers guide’.[303] This guidance note indicates that the ACM sees no reason why companies in a corporate group (to which a TSO or DSO belong) may not be involved in both the transport of hydrogen and the construction and management of hydrogen production and transport facilities. In the guidance note, the ACM summarises the rules as follows: (i) companies within the same corporate group as a TSO or DSO may establish and manage infrastructure for alternative energy carriers; (ii) companies within the same corporate group as a TSO or DSO may transport alternative energy carriers using that infrastructure, but may not supply or trade alternative energy carriers; and (iii) companies within the same corporate group as a TSO or DSO may establish and manage, but not exploit, production and storage facilities for alternative energy carriers.[304] Albeit to a limited extent, companies in the same corporate group as a TSO or DSO are therefore allowed to establish and manage hydrogen infrastructure, such as pipelines for the transport of hydrogen.

5.3.2 Spatial Integration, Safety Aspects and Environmental Regulation

Spatial policy plans (*structuurvisies*) are the first step in the spatial planning process, as they present an indicative outlook of projected spatial developments.[305] The construction of high-pressure pipelines is facilitated by such a policy plan.[306] The Structural Vision for Pipelines (*Structuurvisie Buisleidingen*) – a plan set out by the national government – aims to assess how much space is needed to free up sufficient space in the Netherlands the next 20 to 30 years for future pipelines for the transport of

[297] See Article 2 – 9 of the Gas Act.
[298] See Article 1(1)(b) of the Gas Act.
[299] See Section 5.2.
[300] Illustrative of this distinction is Gasunie Waterstof Services B.V. (GWS), a company in the same corporate group as the national gas TSO, Gasunie Transport Services B.V. (GTS). GWS manages a hydrogen pipeline and transports hydrogen through this pipeline.
[301] Article 10A of the Gas Act.
[302] For a more comprehensive understanding see Stibbe, *‘Hydrogen: Consultation by the Dutch regulator (ACM) on the role of group companies of TSOs and DSOs in the Dutch hydrogen market’,* 2020, available at <https://www.stibbe.com/en/news/2020/april/hydrogen-consultation-by-the-dutch-regulator-acm-on-the-role-of-group-companies-of-tsos-and-dsos-in>
[303] Guidance note by the ACM on Network companies and alternative energy carriers guide (*Leidraad netwerkbedrijven en alternatieve energiedragers*) Zaaknr. ACM/19/036168 / Documentnr. ACM/UIT/526517, available in Dutch at. <https://www.acm.nl/nl/publicaties/acm-consulteert-leidraad-netwerkbedrijven-en-alternatieve-energiedragers>
[304] See the ‘Summary’ provided by the ACM in the Consultation on a Draft Guidance Note.
[305] Articles 2.1, 2.2 and 2.3 of the Spatial Planning Act.
[306] Structuurvisie Buisleidingen 2012-35 presents policy plans for high-pressure pipelines transporting dangerous goods, including gas.

hazardous substances. Although this Structural Vision is not formally binding for provinces and municipalities, the government aims to provide guidance for the provinces and municipalities, so that they can more easily meet their obligations and adapt their spatial plans accordingly. The plan is also of use to the business community, as it clarifies the government's priorities and indicates that the necessary (reliable) connections for pipeline transport will become available.[307] Within the plan, the potential sites for transmission pipelines are indicated. The legal effects of the Structural Vision have been considered in the Decree on General Spatial Planning Regulations (*Besluit algemene regels ruimtelijke ordening*).[308] The Decree obliges the competent authorities, when drawing up or adjusting (municipal) zoning or (provincial) integration plans, to reserve space for pipelines on the basis of the Structural Vision, so that these can be realised in the future.[309] In addition, the National Environmental Vision (*Nationale Omgevingsvisie*)[310] stipulates that the national government is responsible for reserving sufficient space for the development and maintenance of a robust, efficient, reliable and safe main network of pipelines for the transport of hazardous substances.[311] This is because the substances transported through pipelines are expected to change in the future. The government must therefore ensure that the main network of pipelines for the transport of hazardous substances is set up in such a way that it only leads to negligible risks to people and the environment.[312]

The Decree on External Pipeline Safety (*Besluit externe veiligheid buisleidingen*)[313] is based on the Spatial Planning Act and the Environmental Management Act. The purpose of the Decree is to limit the potential external safety risks that may emerge from the existence of an extensive pipeline infrastructure intended to transport hazardous substances.[314] The Decree defines 'site-specific risk' as the risk at a place near a pipeline, expressed as the probability that each year a person who would stay continuously and unprotected at that particular place would die as a direct consequence of an unusual incident caused by that pipeline.[315] Pursuant to Article 6.1 of the Decree, the site-specific risk to a 'vulnerable object' (*e.g.* buildings intended for accommodation and buildings in which large numbers of people are usually present for a large part of the day)[316] from a pipeline may not exceed 10^{-6} per year. The standard of 10^{-6} per year means that the probability of a fatal situation (as a result of an accident involving hazardous substances at a location to be built on) may not exceed one in a million in any given year.[317] Furthermore, the Decree on External Pipeline Safety includes a provision on 'group risk', which is understood to mean the cumulative probability (per kilometre) of a pipeline contributing to the deaths of at least 10, 100 or 1000 persons. These deaths must be a direct result of their presence in the area impacted by a pipeline, and a result of an unusual incident attributable to that pipeline.[318] The operator of a pipeline is responsible for calculating the site-specific risk and the group risk for the relevant pipeline on the basis of current and authentic data provided by the competent authority, as will be discussed below.[319]

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[307] Structuurvisie buisleidingen 2012-2035, p.15
[308] Decree on General Spatial Planning Regulations (*Besluit algemene regels ruimtelijke ordening*) of 1 January 2018. The Decree is binding for provinces and municipalities, but not for businesses and citizens.
[309] Structuurvisie buisleidingen 2012-2035 p. 97.
[310] National Structural Vision (*Nationale Omgevingsvisie*), available in Dutch at <https://denationaleomgevingsvisie.nl/default.aspx>
[311] The National Environmental Vision is part of the new Environment and Planning Act (*Omgevingswet*), which is described in more detail in Section 3.3.4.
[312] National Structural Vision, p. 56.
[313] Decree on External Pipeline Safety (*Besluit externe veiligheid buisleidingen*) of 24 July 2010.
[314] See 'buisleiding' in Article 1.1(b) of the Decree on External Pipeline Safety.
[315] See 'plaatsgebonden risico' in Article 1.1(b) of the Decree on External Pipeline Safety.
[316] In Article 1.1(b) of the Decree on External Pipeline Safety, reference is made to the Decree on External Safety of Establishments (*Besluit externe veiligheid inrichtingen*) of 27 May 2004. Neither the former nor the latter Decree contain an exhaustive or conclusive definition of the concept of vulnerable objects or limited vulnerable objects. Instead, the concepts are defined in more detail in case law. Additionally, the competent authority may, where it deems necessary, interpret these concepts in more detail, insofar as this interpretation does not limit the scope of the legislation. For a more comprehensive understanding see Vereniging van Nederlandse Gemeenten, *'Naar een veilige bestemming' VNG handreiking verankering externe veiligheid in ruimtelijke plannen*', 2007, p.26, available at <https://www.groepsrisico.nl/doc/VNG%20Naar_een_veilige_bestemming[1].pdf>
[317] Ministry of Infrastructure and Environment, *'Handboek buisleidingen in bestemmingsplannen'*, 2016, p. 13.
[318] See Article 1.1 (b) of the Decree on External Pipeline Safety.
[319] See Article 7.1 of the Decree on External Pipeline Safety.

Pursuant to Article 1.1(b) of the Decree on External Pipeline Safety, a 'pipeline' is understood as referring to a pipeline intended or used for the transport of dangerous substances in addition to its associated facilities. 'Dangerous substances' are substances which belong to the categories of substances designated by Ministerial order. The regulation referred to here is the Regulation on the External Safety of Pipelines (*Regeling externe veiligheid buisleidingen*).[320] Article 2 of this Regulation specifies the categories of pipelines to which the Decree on External Pipeline Safety applies. Of relevance to hydrogen pipelines is Article 2(c), which refers to pipelines for flammable substances with an external diameter of 70 mm or more, or an internal diameter of 50 mm or more, and a pressure of 1 600 kilopascal (kPa) or more. In accordance with Article 1.1(d) of the Regulation, 'flammable substances' are substances other than natural gas or petroleum products that are classified as flammable, highly flammable or extremely flammable. Besides the fact that hydrogen is generally considered a (highly, or even extremely) flammable gas, the Ministry of Infrastructure and Water Management has, in an amendment to the Regulation on External Safety of Pipelines, explicitly included the transport of hydrogen via pipelines as being within the scope of the Regulation.[321] The rules in the Regulation on the External Safety of Pipelines and the Decree on External Pipeline Safety therefore apply to the transport of hydrogen by pipeline.

Following Article 4.3 of the Decree on External Pipeline Safety, developers and operators of pipelines are required to prepare a document in which the means to fulfil the duty of care are specified. This must include a list of measures to be taken to prevent unusual incidents, and to limit and undue consequences for human health and the environment (as much as possible) should such incidents occur. Furthermore, pipeline operators are obliged to report to the competent authority when their pipelines are taken out of order or are subjected to modifications (*e.g.* adjustments to the substance and/or the pressure).[322] Therefore, when repurposing a natural gas pipeline for hydrogen transport, the operator is required to report this to the competent authority. Additionally, the operator is required to determine the effect of such a modification on the site-specific risk and the group risk.[323] In the case of pipelines transporting natural gas, the 10^{-6} standard applies at a distance of four metres from either side of the pipeline.[324] In other words, at a distance of four metres from such a pipeline, the probability of a person dying as a result of an unusual incident due to that pipeline must not exceed 1 on 1.000.000. For hydrogen pipelines, the 10^{-6} standard applies at a distance of five metres from either side of the pipeline.[325] In practice, the site-specific risk and group risk for natural gas pipelines is calculated using the calculation model in the Computer Application for Risk Calculations on Underground Pipelines with Natural Gas (*Computerapplicatie voor Risicoberekeningen aan Ondergrondse Leidingen met Aardgas*).[326] The same is calculated for hydrogen pipelines using the calculation model in the SAFETI-NL.[327] Both calculation models incorporate the standards prescribed in the Decree on External Pipeline Safety and the Regulation on the External Safety of Pipelines. Given that the risk contours are lower for natural gas pipelines than for hydrogen pipelines, there is a risk that vulnerable objects that were once at a safe distance from these pipelines are too close if the operator changes the substance transported through these pipelines. This may prevent the possibility of reusing natural gas pipelines for hydrogen transport.

[320] Regulation on the External Safety of Pipelines (*Regeling externe veiligheid buisleidingen*) of 30 December 2010.
[321] Regeling van de Staatssecretaris van Infrastructuur en Milieu, van 17 juni 2014, nr. IENM/BSK-2014/40689, houdende een wijziging van de Regeling externe veiligheid buisleidingen waarmee het Besluit externe veiligheid buisleidingen van toepassing wordt op buisleidingen voor het transport van andere chemische stoffen dan aardgas en aardolieproducten.
[322] Article 4.7 of the Decree on External Pipeline Safety.
[323] See Article 1.1 of the Decree on External Pipeline Safety.
[324] This is the case for pipelines transporting natural gas with a pressure between 16 and 40 bar, see Article 5 of the Regulation on the External Safety of Pipelines.
[325] Article 6.2 of the Decree on External Pipeline Safety.
[326] Computer Application for Risk Calculations on Underground Pipelines with Natural Gas, available at <https://www.rivm.nl/carola>
[327] Software Application Fire Explosion Toxic Impact – Netherlands, available at <https://www.rivm.nl/safeti-nl>

Furthermore, the Decree on External Pipeline Safety stipulates that the construction or replacement of a pipeline is only permitted if the pipeline is laid or replaced in accordance with the local zoning plan, or if the pipeline is granted an environmental permit (as referred to in Article 2.12 of the Wabo), allowing it to deviate from the zoning plan in place.[328] Pursuant to the Decree, zones intended for pipelines must be included in spatial plans. If the intention is to use an existing natural gas transport pipeline for the transport of hydrogen, various options are available for the enabling municipality. First, a so called 'stamp zoning plan' (*postzegel-bestemmingsplan*) can be drawn up for the route of the pipeline.[329] Secondly, an environmental permit can be granted, giving the operator permission to deviate from the applicable zoning plan(s) in accordance with Article 2.12(1a) of the Wabo. Finally, the municipality(-ies) can proceed to partially revise the applicable zoning plan(s) and amend the applicable regulation(s).[330]

As previously mentioned, an EIA is required for the construction of most major gas pipelines in the Netherlands. As already described in Section 3.2.3, the Decree on Environmental Impact Assessment stipulates which activities an EIA should be prepared for.[331] Whereas Part C of the Annex lists the activities for which an EIA is compulsory, Part D of the Annex lists activities for which the competent authority assesses whether an EIA is necessary. Part C, Section 8.1 of the Annex lists the construction, modification, or extension of a pipeline for the transport of chemicals for geological storage, including pumping stations, as activities which requires an EIA. An EIA is thus required for the construction of a hydrogen pipeline. This is, however, only the case for hydrogen pipelines with a diameter of more than 80 centimetres and a length of more than 40 kilometres. The modification or extension of a pipeline for the transport of chemicals is furthermore included under Part D, Section 8.1 of the Annex. This means that in cases where the activity concerns a pipeline located or projected in a sensitive area (as referred to in Part A Sections 1(a), (b) or (d) of the Annex) over a length of one kilometre, an EIA may be required.

5.3.3 Affected Landowners

Furthermore, the operator of a pipeline needs prior permission from the landowners to lay the pipeline. If landowners do not wish to conclude such an agreement, the network operator can invoke the Law on Hindrances in Private Law (*Belemmeringenwet Privaatrecht*),[332] which establishes that landowners may have to tolerate the construction on their property of public works, if these are in the general interest.[333] This, however, requires that the development of a hydrogen network is considered a public work in the general interest. Although the Gas Act confirms that natural gas networks are to be regarded as public works in the general interest, this provision most likely does not apply to hydrogen networks.[334] If there is no explicitly recognised public interest in law, a duty of tolerance can only be requested if a public interest has been recognised and/or a concession has been granted.[335] In cases where the owner of an existing natural gas pipeline wants to use this pipeline for hydrogen transport and physical changes need to be made to the pipeline in question, the landowner is obliged to tolerate such changes.[336] Until an amendment of the Dutch Civil Code (DCC) in 2007 it was often not clear whether the landowner or the pipeline operator were to be considered as the legal owner of the subsoil pipeline. As a general rule

[328] Article 6.4 of the Decree on External Pipeline Safety.
[329] For spatial initiatives of limited size that do not fit within the possibilities of the applicable zoning plan a 'stamp zoning plan' can be drawn up for the specific area. Such a plan describes the spatial layout of a small area and/or terrain and can be used to change the applicable zoning plan. This approach was considered for the pipeline transporting hydrogen from DOW Benelux (hydrogen supplier) to Yara Sluiskil (hydrogen customer) operated by Gasunie Waterstof Services, a subsidiary of N.V. Nederlandse Gasunie, see further <https://www.gasuniewaterstofservices.nl>
[330] See Toelichting 'Facetherziening bestemmingsplannen terneuzen, waterstofgasleiding', available in Dutch at <https://www.ruimtelijkeplannen.nl/documents/NL.IMRO.0715.BPBG36-VG01/t_NL.IMRO.0715.BPBG36-VG01.html>
[331] Article 2 of the Decree on Environmental Impact Assessment.
[332] Law on Hindrances in Private Law (*Belemmeringenwet Privaatrecht*) of 13 May 1927.
[333] This requires a ruling of the subdistrict court (*kantongerecht*), see Articles 1 and 14 of the Law on Hindrances in Private Law.
[334] Article 39a of the Gas Act affirms that for the purpose of applying the Law on Hindrances in Private Law these networks are to be considered as public works in the general interest.
[335] See Article 1 of the Law on Hindrances in Private Law. This is explained in more detail at <http://publicaties.minienm.nl/documenten/leidraden-belemmeringenwet-privaatrecht-maart-2008>
[336] Article 3(1) of the Law on Hindrances in Private Law. Article 3 (2) of the Law on Hindrances in Private Law gives eligible landowners the opportunity to object to alterations or relocations of pipelines.

Article 5:20 paragraph 1(e) of the DCC provides that a landowner in principle owns everything that is – permanently – fixed to the land. However, an exemption now applies for subsoil pipelines as Article 5:20 paragraph 2 of the DCC provides that the person who has lawfully[337] constructed the pipeline used to transport, for example, gaseous substances or energy is to be considered as the legal owner of that pipeline.[338]

5.4 Conclusions

The Gas Act prescribes that it is applicable to the injection of other gases into the natural gas network, insofar as it is technically feasible and safe to inject such gases. It is thus necessary to seek guidance in the Ministerial Decree on Gas Quality in order to determine the admissible concentration levels of hydrogen admixture into natural gas networks. Although it may be technically feasible and safe to blend hydrogen into natural gas networks, the Decree does not permit high admixture levels. As for now, the highest admixture level in the Netherlands is 0.5mol% (and even then, only for certain parts of the natural gas network). However, ongoing projects indicate that it is technically feasible and safe to raise the permitted concentration level of hydrogen well beyond the current limit. For the injection of hydrogen into the existing natural gas network to be commercially viable, it is important to adapt these admixing restrictions to bring them into line with the levels proven to be technically feasible and safe in practice.

There is no general law regulating the construction and use of subsoil gas pipelines in the Netherlands. Hence, anyone who wishes to construct and operate such pipelines needs to comply with all other relevant laws such as planning, environmental and safety laws but also the Gas Act. Pursuant to the unbundling rules in the Gas Act, producers and suppliers of hydrogen only have the right to construct and manage hydrogen pipelines that are in no way connected to the natural gas system. In the case of TSOs and DSOs, the main rule is that these parties cannot invest in and manage hydrogen infrastructure. A distinction must however be made between the activities of TSOs and DSOs active in the gas sector, and companies within the same corporate group as a TSO or DSO. The ACM is of the opinion that companies within the same corporate group as a TSO or DSO are allowed to be involved in the transport of hydrogen and the construction and management of hydrogen infrastructure. Given that the transport of hydrogen through pipelines is expected to increase in the coming years, it is necessary to provide clear rules for hydrogen pipeline owners and operators.

The construction of a hydrogen pipeline is only permitted if the pipeline is laid in accordance with the local zoning plan, or if the pipeline is granted an environmental permit to deviate from the zoning plan in place. The same rules apply to the replacement or modification of an existing pipeline. If the intention is to repurpose a natural gas pipeline for hydrogen transport, various options are available for the relevant enabling municipalities. First, a so called ‘stamp zoning plan’ can be drawn up for the route of the pipeline. Secondly, an environmental permit can be granted, giving the pipeline operator permission to deviate from the applicable zoning plan(s). Finally, the relevant municipality(-ies) can proceed to partially revise the applicable zoning plan(s) and amend the applicable regulation(s). Consideration must be given to provide guidelines that clarify which approach is appropriate.

Pipeline operators who intend to modify existing pipelines are furthermore obliged to report such modifications to the competent authority. Modifications are understood to include adjustments to the substance transported or the operating pressure of the pipeline. Pipeline operators are required to determine the effect of such modifications on the site-specific risk and the group risk. In cases where operators of natural gas pipelines intend to repurpose their pipelines for hydrogen transport, a new safety distance on either side of the pipelines must be taken into consideration. Since the risk contour is larger when transporting hydrogen than natural gas in pipelines, the calculation method must be

[337] Lawfully means that the performed activity is allowed or permitted by law.
[338] The person who owns the pipelines (the "lawful owner") retains ownership of the subsoil pipelines after construction; it is thus the person who instructed the construction who is the lawful owner and not, for example, the constructor.

adjusted to enable reuse of natural gas pipelines for hydrogen transport. Before a natural gas pipeline can be repurposed for hydrogen transport, either the zoning scheme must be updated or the pipeline operator must be granted permission to deviate from the applicable zoning plan. Furthermore, an EIA is required for the construction of hydrogen pipelines with a diameter of more than 80 centimetres and a length of more than 40 kilometres. The modification or extension of a hydrogen pipeline may be subject to an EIA in cases where the pipeline is located or projected in a sensitive area over a length of one kilometre. In the latter case, it is the competent authority that assesses whether an EIA is necessary.

6. Conclusions

The Port of Amsterdam, the Port of Den Helder and Groningen Seaports have entered into a partnership. The aim of the long-term collaboration between the ports is to become the hydrogen hub of Europe, and thus to develop an extensive hydrogen infrastructure in the northwest of the Netherlands. Due to their access to large-scale renewable electricity generation (offshore wind), chemical clusters, and gas infrastructure – which can be retrofitted to transport hydrogen – these ports are uniquely positioned for the development of the hydrogen industry. This is also recognised by the Dutch Government, which has emphasised that ports and their industrial clusters will play an important role in the development of a green hydrogen economy. The successful production and transportation of hydrogen in port areas requires access to the necessary hydrogen infrastructure and/or the existing electricity and gas infrastructure. This is to ensure that electrolysers are supplied with requisite electric power to produce hydrogen, and that the hydrogen produced can be transported to end-users. Clarification of the legal framework applicable to any technology is important from economic, technological and policy-making perspectives. Legal certainty allows for the promotion of research and development of the technology, as well as opening the door to significant private sector investment. This report therefore sought to provide a more in-depth review of potential legal barriers to the development of hydrogen infrastructure in port areas.

This report has identified several legal barriers to the development of hydrogen infrastructure. Legislation governing three of the main stages of the PtG process was analysed: (i) development and operation of PtG installations (production of green hydrogen); (ii) electricity input for hydrogen production; and (iii) hydrogen transport. From this analysis, it can be concluded that existing regulatory frameworks do not provide the legal certainty necessary to sufficiently support the conversion of wind energy to hydrogen onshore. This conclusion is based on three factors: first, the legislative instruments pertaining to the development and operation of a PtG installation contain no direct reference to PtG, which means that their applicability to PtG remains (at least in part) open to interpretation, creating legal uncertainty for both the competent authorities and the developers and operators of PtG installations; secondly, it is questionable whether it is legally permissible to establish a direct electricity connection between an offshore wind farm and an onshore electrolyser; and finally, strict blending concentrations for hydrogen in the existing natural gas networks have been imposed, and the rules pertaining to the repurposing of natural gas pipelines for hydrogen transport are unclear (especially regarding spatial integration and safety). Furthermore, there is little guidance for the development of dedicated hydrogen pipelines.

To facilitate the development of hydrogen infrastructure in port areas, it is therefore necessary to provide clear rules and guidelines for the development and operation of PtG installations, and for the establishment of electricity lines connecting such installations directly to offshore wind farms. Moreover, in the interests of promoting safety, there is a need for clear rules and guidelines on the transportation of hydrogen and certainty in spatial integration. These rules and guidelines should provide the scope for future hydrogen initiatives. Specifically, guidance must be given to the competent authorities, to the developers and operators of PtG installations, and to the developers, operators and owners of natural gas and hydrogen pipelines, and direct electricity lines. The pervasive problem is that legislatures are rarely proactive, with legislation often playing catch-up with technological developments. Although the use of hydrogen in the energy sector is not a completely new phenomenon, it has not gained a great deal of attention until recently. As a result, specific provisions on PtG have not been incorporated into substantive EU and national law. Drafting a clear definition for PtG, and more generally addressing the use of green hydrogen in the energy sector, should be prioritised by EU and national legislators: doing so would provide more clarification regarding which legal frameworks apply to the development of hydrogen infrastructure. For future research, it is thus important to further investigate whether it is sufficient to incorporate provisions pertaining to PtG and the use of hydrogen in the energy sector into existing legislation (*e.g.* gas and electricity legislation), or whether it is necessary to adopt a more specialised hydrogen law.