Interreg
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H2SHIPS

System-Based Solutions for H2-Fuelled Water Transport in North-West Europe

National regulatory report - Belgium

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List of Abbreviations

CESNI	Comité Européen pour l'Élaboration de Standards dans le Domaine de Navigation Intérieure
EU	European Union
EU ETS)	EU Emission Trading Scheme
GHG	Greenhouse gas
HFC	Hydrogen Fuel Cells
IGF Code	International Code of Safety for Ships using Gases or other Low-Flashpoint Fuel
IMO	International Maritime Organisation
LNG	liquified natural gas
MARPOL	International Convention for the Prevention of Pollution from Ships
NWE	North West Europe
SOLAS	International Convention for the Safety of Life at Sea
UN	United Nations
WP	Work Package
BCN	Belgian Code of Navigation

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1 Executive Summary

In light of the analysis carried out in this report, four general recommendations can be highlighted.

1. Firstly, for project owners intending to start projects involving hydrogen, it is fundamental to coordinate their efforts as much as possible with the relevant authorities. This will serve to both inform civil servants, and to facilitate the approval processes.
2. Secondly, there is a need for further cooperation at the international and European levels for the use of hydrogen in ship propulsion since current instruments provide little guidance.
3. Thirdly, in drafting new legislation a careful balance must be struck, where the technology is allowed to develop, without sacrificing safety.
4. Lastly and most importantly, based on the technological developments and new knowledge in the sector, legislation must be continuously updated.

2 Introduction

Considering the unprecedented effects across the climate system, there is an urgent need to limit human-induced greenhouse gas emissions (hereinafter GHG).[1] Considering that the shipping industry accounted for 1,076 million tonnes of GHG or 2.89% of the global anthropogenic GHG emissions in 2018, the pressure to decarbonize it, is increasing.[2]

In the context of the European Union (hereinafter EU), the European Climate Law sets a binding target to achieve climate neutrality by 2050 and a commitment to cut emissions by at least 55% by 2030.[3] For the shipping sector, this is reflected in the Fit for 55 package, which includes proposals for the inclusion of the maritime sector in the EU Emission Trading Scheme (hereinafter EU ETS),[4] and for a Fuel EU Maritime Regulation on the use of renewable and low-carbon fuels in maritime transport.[5]

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[1] IPCC (2021), Climate Change 2021: The Physical Science Basis: Summary for Policymakers,

[2] International Maritime Organization (2021), Fourth IMO GHG Study 2020: Executive Summary, 2021p. 1.

[3] Art. 2(1) and 4(1) of Regulation 2021/1119 of the European Parliament and of the Council ('European Climate Law').

[4] European Commission (2021), Proposal Directive of the European Parliament and of the Council amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union, Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and Regulation (EU) 2015/757, COM(2021) 551 final.

[5] European Commission (2021), Proposal for a Regulation of the European Parliament and of the Council on the use of renewable and low-carbon fuels in maritime transport and amending Directive 2009/16/EC, COM(2021) 562 final.

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Under these developments, hydrogen (H_2) represents an important tool for decarbonization, since it is a carbon-free carrier, which can be produced from low-carbon or renewable sources.[6] In this light, the H2Ships project intends to demonstrate the added value of hydrogen for water transport in the context of North West Europe (NWE). The partnership intends to lay the ground for the development of a dedicated H_2 value-chain.

This report is part of WP2 of the project: "Defining requirements for uptake of H_2 propulsion in water transport in NWE" and it intends to provide an understanding of the regulatory frameworks of the NWE countries and regions. The focus is on questions related to hydrogen deployment in waterborne transportation.

The report is structured in two main chapters. In the first chapter an analysis of the International and European norms relating to hydrogen deployment in the shipping sector is presented. The report focuses on approval of hydrogen-powered vessels, bunkering and storage of hydrogen for maritime uses. In the second chapter, a closer look is taken to the norms and regulations at the national and regional levels in Belgium.

[6] van Wijk, Ad and Hydrogen Europe (2021), Hydrogen – a carbon-free energy carrier and commodity, p. 3.

3 Applicable rules on international and European level

Starting in a top to bottom approach, in this chapter, the analysis will focus on the international and European rules applicable to hydrogen deployment in maritime transport. In order to understand the context, the analysis will begin with the relevant policies. Subsequently, it will move to the specific questions of vessel approval, bunkering and hydrogen storage.

Generally, the rules for maritime water transport come mainly from regulations developed in the framework of the International Maritime Organization (hereinafter IMO) with European regulations and directives supplementing the IMO rules.

It is important to note that due to the global decarbonization efforts and the burgeoning interest in hydrogen technologies, this is a very dynamic filed of law. At the moment of writing, there are multiple regulatory developments taking place, which although mentioned in the analysis, fall outside its scope. The reason for this is that they are subject to changes and their evaluation would be void of any meaning until their final adoption.

3.1 Policies and Regulations

Starting at the international level, the key actor is the IMO. The IMO is a specialized agency of the United Nations (hereinafter UN). Its purpose is to facilitate the cooperation among governments in the field of governmental regulation and practices relating to shipping in international trade and to encourage the adoption of the highest practical standards in maritime safety and efficiency of navigation.[7] The key instruments for international maritime law and policy are developed under its framework. A notable example is the International Convention for the Prevention of Pollution from Ships (hereinafter MARPOL), among other conventions, regulations codes and guidelines for shipping.

Specifically for the topic of this report, one policy document stands out. This is the Initial Strategy on Reduction of GHG Emissions from Ships. The strategy defines the IMO level of ambition for GHG emissions reduction until 2050. This level is set at a reduction of total annual GHG emissions by at least 50%, when compared to 2008.[8] From a regulatory standpoint the other important document is the International Code of Safety for Ships Using Gases or Other Low-Flashpoint Fuels (IGF Code). The

[7] The Convention on the International Maritime Organization, Geneva, 6 March 1948.

[8] International Maritime Organization (2018), Initial IMO Strategy on Reduction of GHG Emissions from Ships, Res. MEPC.304(72), 13 April 2018.

provisions of which will be discussed in more detail in section 3.2 on shipping approval.

Outside of maritime law, additional guidance for hydrogen deployment in shipping can come from the International Organization for Standardization (hereinafter ISO). Although technical standards are voluntary, they contribute significantly to the removal of trade barriers, market access and sustainability.[9] While at the moment, there are no specific standards for hydrogen vessels, there are several standards which can be relevant. Some have as their subject matter hydrogen use and applications in general, while others are related to different gases, but can serve as guidance for the shipping industry.

While the implementation of the IMO's Initial Strategy on Reduction of GHG Emissions from Ships has been rather slow,[10] the same cannot be said about the developments at the European level. The main policy developments at the European level begin with the European Green Deal, which sets the goal for a carbon neutral society by 2050.[11] The goal is made into a binding target through the already mentioned European Climate Law. The law sets a climate neutrality objective by 2050 and an intermediate target of 55% GHG emissions reduction by 2030, when compared to 1990 levels.[12]

The follow-up of the European Climate Law comes in the form of the Fit-for-55 package. The package represents a revision of the climate, energy and transport legislation at the EU level. More broadly, together with the abovementioned proposed revisions of the EU ETS and a new Fuel EU Maritime Regulation,[13] the package also includes a revision of the Effort Sharing Regulation;[14] a revision of the LULUCF Regulation;[15] a revision of the Renewable Energy Directive;[16] a revision of

[9] European Commission (2022), Benefits of standards, available at WWW < https://ec.europa.eu/growth/single-market/european-standards/standardisation-policy/benefits-standards_en> (last accessed: 11/02/2022).

[10] Psaraftis, Harilaos N., and Christos A. Kontovas. 2021. "Decarbonization of Maritime Transport: Is There Light at the End of the Tunnel?" Sustainability 13, no. 1: 237.

[11] European Commission (2019), The European Green Deal, COM(2021)640 final.

[12] *Supra* note 3.

[13] *Supra* note 3 and 4.

[14] European Commission (2021), Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement, COM(2021) 555 final.

[15] European Commission (2021), Proposal for a Regulation of the European Parliament and of the Council amending Regulations (EU) 2018/841 as regards the scope, simplifying the compliance rules, setting out the targets of the Member States for 2030 and committing to the collective achievement of climate neutrality by 2035 in the land use, forestry and agriculture sector, and (EU) 2018/1999 as regards improvement in monitoring, reporting, tracking of progress and review, COM (2021) 554 final.

[16] European Commission (2021), Proposal for a Directive of the European Parliament and of the Council amending Directive (EU) 2018/2001 of the European Parliament and of the Council, Regulation (EU) 2018/1999 of the European Parliament and of

Energy Efficiency Directive;[17] proposal for a Regulation on Alternative Fuels Infrastructure;[18] amendment of the Regulation for CO_2 emissions of cars and vans;[19] revision of the Energy Taxation Directive;[20] proposal for a Regulation on Carbon Border Adjustment Mechanism and a proposal for a ReFuelEU Aviation Regulation.[21]

This extensive revision of EU legal acts serves to highlight the dynamic situation in which all economic sectors are in light of the European decarbonization efforts. Specifically, for the context of hydrogen deployment in maritime transportation, several EU legal acts are of relevance:

- Directive 2016/2284 on the reduction of national emissions of certain atmospheric pollutants;
- Directive 2014/94 on the deployment of alternative fuels infrastructure, and it's the European Commission delegated act;
    - Commission Delegated Regulation 2019/1745 as regards recharging points for L-category motor vehicles, shore-side electricity supply for inland waterway vessels, hydrogen supply for road transport and natural gas supply for road and waterborne transport;
- Directive 2014/68 on the harmonisation of the laws of the Member States relating to the making available on the market of pressure equipment (recast);
- Directive 2012/18 on the control of major-accident hazards involving dangerous substances (Seveso Directive);
- Directive 2014/34 on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres (ATEX Directive);
- Directive 2001/42 on the assessment of the effects of certain plans and programmes on the environment (SEA Directive);

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the Council and Directive 98/70/EC of the European Parliament and of the Council as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652, COM(2021) 557 final.

[17] European Commission (2021), Proposal for a Directive of the European Parliament and of the Council on energy efficiency (recast), COM(558) final/2

[18] European Commission (2021), Proposal for a Regulation of the European Parliament and of the Council on the deployment of alternative fuels infrastructure, and repealing Directive 2014/94/EU of the European Parliament and of the Council, COM (2021) 559 final.

[19] European Commission (2021), Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2019/631 as regards strengthening the CO2 emission performance standards for new passenger cars and new light commercial vehicles in line with the Union's increased climate ambition, COM(2021)556 final.

[20] European Commission (2021), Proposal for a Council Directive restructuring the Union framework for the taxation of energy products and electricity (recast), COM(2021) 563 final.

[21] European Commission (2021), Proposal for a Regulation of the European Parliament and of the Council establishing a carbon border adjustment mechanism, COM(2021) 564 final and European Commission (2021), Proposal for a Regulation of the European Parliament and of the Council on ensuring a level playing field for sustainable air transport, COM(2021) 564 final.

- Directive 2011/92 on the assessment of the effects of certain public and private projects on the environment (EIA Directive);
- Regulation 2016/1628 on requirements relating to gaseous and particulate pollutant emission limits and type-approval for internal combustion engines for non-road mobile machinery.

The significance of these acts will be discussed in the appropriate sections below. As for the directives however, it is important to note that the specific obligations derived from them, are to be found in the national laws of member-states. The reason for this is that, it is up to the member-states to choose the forms and methods on how to achieve the objectives set out in the directives in their national legal regimes, when transposing them.[22]

Having identified the policy-setting and identified some of the relevant legal acts, it is possible to move on their analysis in the rest of this chapter. After the analysis relating to vessel approval, bunkering and storage, a brief conclusion of the chapter will be presented, before moving to the analysis of national law.

[22] Bradley Kieran (2020), Legislating in the European Union *in* Barnard, Catherin and Steeve Peers (2020), European Union Law, Oxford University Press, p. 104.

3.2 Vessel approval

Moving to vessel approval of ships or class of ships using hydrogen propulsion systems, at the international level the issue is regulated within the IMO framework by the International Code of Safety for Ships using Gases or other Low-Flashpoint Fuels *i.e.* IGF Code.

The code is applicable by virtue of Regulation 56 of the International Convention for the Safety of Life at Sea (hereinafter SOLAS). The regulation states that any ship covered by the SOLAS Convention, that uses low-flashpoint fuels, that is ordered or which has its keel laid on or after 1 January 2017 or any ship which is converted to such fuels after 1 January 2021 must comply with the IGF Code.[23] In this context by low-flashpoint it is meant any gaseous or liquid fuel having a flashpoint lower than 60ºC.[24] Consequently, since hydrogen's flashpoint is -253ºC, the IGF Code is applicable.

Yet, as it stands in its current version, the code contains detailed prescriptive requirements only for ships using liquified natural gas (hereinafter LNG) as fuel. For other types of low-flashpoint fuels, the code refers back to the SOLAS Convention. The approval of vessels using such fuels is to be made under the Alternative Design process.[25] In essence, this means that fuels other than LNG can be used, as long as it is proven that the level of safety is maintained in comparison with a ship running on conventional fuel. It is important to note that national implementations of the code can vary, thus Flag State and its national regulations and relevant certification and classification societies are fundamental for consideration when starting the process.[26]

The Alternative Design assessment process is set out in SOLAS Chapter II, Part F, Regulations 55, 56, 57. Of those, Regulation 55 prescribes the use of the Guidelines for the Approval of Alternatives and Equivalents as Provided for in Various IMO Instruments, [27] which prescribes the proper procedure for approval. The approval itself is based on a risk-assessment approach, instead of the traditional prescriptive and regulations-based approach. The goal of this approach is to demonstrate that the vessel, or class of vessels using hydrogen propulsion, has an equivalent level of safety compared to a conventional ship.[28]

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[23] International Maritime Organization (1974), International Convention for the Safety of Life at Sea, 1184 UNTS 3, Chapter I, Part G, Regulations 56 and 57.

[24] *Id.* Chapter II-2, Part B, Regulation 4.2.1.1.

[25] International Maritime Organization (2015), International Code of Safety for Ships Using Gases or Other Low-Flashpoint Fuels, Resolution MSC.391(95), Art. A.2.3.

[26] DNV (2021), Handbook for hydrogen-Fuelled Vessels, p. 32.

[27] International Maritime Organization (2013), Guidelines for the Approval of Alternatives and Equivalents as Provided for in Various IMO Instruments, MSC.1/Circ.1455.

[28] *Supra* note 26, DNV, p.33.

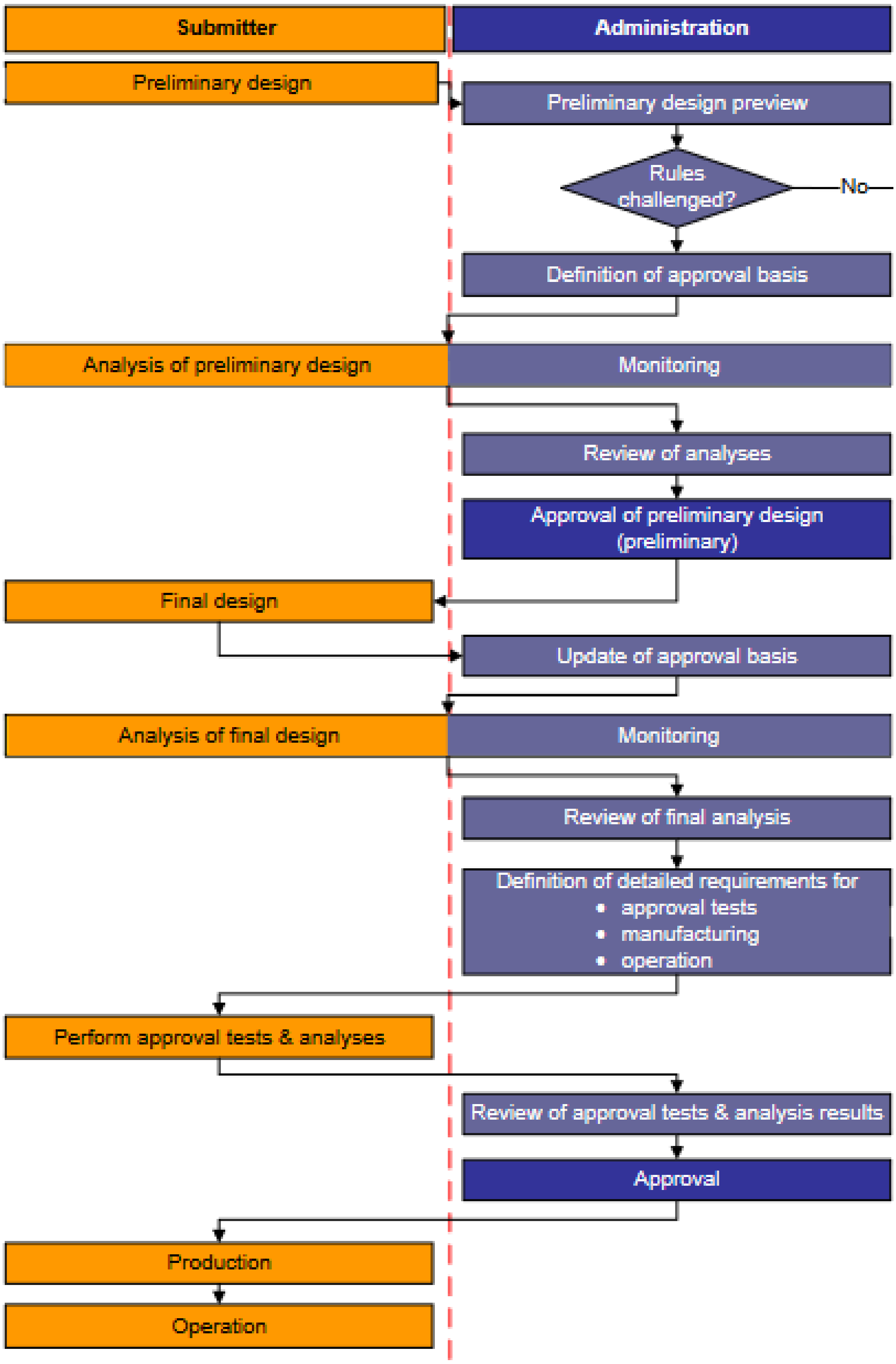

Figure 1 - Design and Approval Process.

Source: International Maritime Organization (2013), Guidelines for the Approval of Alternatives and Equivalents as Provided for in Various IMO Instruments, MSC.1/Circ.1455, p. 7.

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The process has fourteen concrete phases and can be divided according to the five main milestones to be reached. These are:

- Development of a preliminary design;
- Approval of preliminary design;
- Development of final design;
- Final design testing and analysis;
- Approval.

The phases are set out in arts. 4.4 to 4.18 of the Guidelines.[29] These articles describe in detail the steps through which the process must go and what is to be expected from the national authority at each stage. The entire process includes comprehensive technical, risk and environmental assessments with significant stakeholder involvement. Furthermore, the process might include additional prescriptive requirements stemming from national regulation, as is the case for hydrogen ships in Norway and Canada.

Overall, what can be said about the process is that it is not a compliance-based approach, but one modified for the entry of new technologies in the sector. Whilst it is comprehensive, it is also a process with a high degree of uncertainty. For example, despite receiving approval for a preliminary design, it is not guaranteed that a final approval will be given. Additionally, the increased thoroughness equates to increased costs.[30]

A possible simplification in this process can come from technical standards. As hydrogen use is developing, so are standards which serve to increase the acceptance, safety and to facilitate trade. The standards identified below were not developed for the maritime industry, thus until the development of such, these standards can serve as guidelines. Most of them were developed in relation to hydrogen use in land transport, but despite higher technological maturity, this field is still rapidly developing.

The standardization work at the international level comes from Technical Committee 197 in the International Organization for Standardization. This committee is responsible for standardization in relation to systems and devices for the production, storage, transportation, measurement and use of hydrogen. Below are presented some of the relevant standards, as identified by the Handbook for Hydrogen-Fuelled Vessels:[31]

[29] *Supra* note 27, arts. 4.4-4.18.

[30] *Supra* note 26, DNV, p. 32-33.

[31] International Organization for Standardization (2022), ISO/TC 197, available at WWW < https://www.iso.org/committee/54560.html > (last accessed: 14/02/2022).

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ISO Standards with relevance for H_2 systems in shipping		
Standard	Title	Description
ISO/TR 15916:2015	Basic considerations for the safety of hydrogen systems	Guidelines for the use and storage of H_2 in its gaseous and liquid forms. It identifies safety issues, hazards and risks.[32]
ISO 16111:2018	Transportable gas storage devices - Hydrogen absorbed in reversible metal hydride	Requirements applicable to the material, design, construction and testing of transportable hydrogen storage systems[33]
ISO 19880-1:2020	Gaseous hydrogen — Fuelling stations — Part 1: General requirements	Minimum design, installation, commissioning, operation, inspection & maintenance requirements for the safety & operation of HRS for light-duty road vehicles[34]
ISO/TC 220	Cryogenic vessels	Design and safety of insulated vessels for storage and transportation of refrigerated liquefied gases[35]
ISO 26142:2010	Hydrogen detection apparatus — Stationary applications	Performance requirements and test methods of hydrogen detection apparatus[36]
ISO 15649:2001	Petroleum and natural gas industries — Piping	Requirements for design of piping within facilities and for packaged equipment[37]

[32] International Organization for Standardization (2015), ISO/TR 15916:2015 Basic considerations for the safety of hydrogen systems, available at WWW < https://www.iso.org/standard/56546.html > (last accessed: 14/02/2022).

[33] International Organization for Standardization (2018), ISO 16111:2018 Transportable gas storage devices — Hydrogen absorbed in reversible metal hydride < https://www.iso.org/standard/67952.html > (last accessed: 14/02/2022).

[34] International Organization for Standardization (2020), ISO 19880-1:2020 Gaseous hydrogen — Fuelling stations — Part 1: General requirements < https://www.iso.org/standard/71940.html > (last accessed: 14/02/2022).

[35] International Organization for Standardization (1999), ISO/TC 220 Cryogenic vessels < https://www.iso.org/committee/54990.html > (last accessed: 14/02/2022).

[36] International Organization for Standardization (2021), ISO 26142:2010 Hydrogen detection apparatus — Stationary applications < https://www.iso.org/standard/52319.html > (last accessed: 14/02/2022).

[37] *Supra* note 25, p. 46 and International Organization for Standardization (2018), ISO 15649:2001 Petroleum and natural gas industries — Piping < https://www.iso.org/standard/28195.html > (last accessed: 14/02/2022).

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ISO 19882:2018	Gaseous hydrogen — Thermally activated pressure relief devices for compressed hydrogen vehicle fuel containers	Minimum requirements for pressure relief devices intended for use on hydrogen fuelled vehicle containers[38]

Table 1 - List of ISO standards with relevance for hydrogen use in shipping

[38] International Organization for Standardization (2018), ISO 19882:2018 Gaseous hydrogen — Thermally activated pressure relief devices for compressed hydrogen vehicle fuel containers < https://www.iso.org/standard/64655.html > (last accessed: 14/02/2022).

3.3 Bunkering

Moving to the regulatory aspects of bunkering at the international level, the situation is similar to the process of vessel approval. Concrete regulations, requirements and technical guidelines for bunkering of hydrogen are still non-existent.

Once again, the IGF Code is applicable and provides technical and functional requirements on equipment for bunkering. The focus is mostly on the receiving vessel and the preparation for safe bunkering. Issues such as the entire process from start to finish, connections and shore-side bunkering are not covered by the Code. Additionally, the Code is focused mostly on LNG. [39]

In this situation, issues not covered by the international regime are to be covered by national regulations. Specifically, port regulations and health, safety and environmental regulations will apply. National legislation in those fields has extensive provisions on hazardous, flammable, explosive materials such as hydrogen. At the present moment, and similarly to vessel approval, further technological developments, knowledge and testing are required for hydrogen bunkering so that the appropriate procedures and regulatory frameworks can be developed.[40]

It is important to note however, that there are developments taking place. The International Association of Ports and Harbours (hereinafter IAPH) has established IAPH Clean Marine Fuels Working Group.[41] The WG is working together with a wide variety of stakeholders, on adapting the existing tools for port authorities, operators and companies so that hydrogen is included.[42]

Until these developments take place, national regulations applicable to flammable gases or risk-based assessments will have to be used to define safe distances and procedures for H_2 bunkering.

As already established, guidance can be found in technical standards and regulations from other sectors.[43] Examples of such, are the following:

ISO Standards with relevance for H_2 bunkering		
Standard	**Title**	**Description**
ISO 17268:2020	Gaseous hydrogen land vehicle refuelling connection devices	Defines the design, safety and operation characteristics of

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[39] *Supra* note 26, p. 52.

[40] *Ibid.*

[41] International Association of Ports and Harbors (2021), IAPH Clean Marine Fuels WG, available at < https://www.iaphworldports.org/clean-marine-fuel-cmf/ > (last accessed: 23/02/2022).

[42] World Ports Sustainability Program (2022), Hydrogen as fuel, available at < https://sustainableworldports.org/clean-marine-fuels/hydrogen-as-a-fuel/ > (last accessed: 23/02/2022).

[43] *Supra* note 26, p. 52-53.

		gaseous land vehicle refuelling connectors[44]
ISO 4126-1:2013	Safety devices for protection against excessive pressure - Part 1: Safety valves	General requirements for safety valves irrespective of the fluid[45]
ISO/TS 18683:2015	Guidelines for systems and installations for supply of LNG as fuel to ships	Guidance on minimum requirements for the design and operation of LNG bunkering facility[46]
ISO 20519:2017	Ships and marine technology — Specification for bunkering of liquefied natural gas fuelled vessels	Requirements for LNG bunkering transfer systems and equipment[47]
ISO 13984:1999	Liquid hydrogen — Land vehicle fuelling system interface	Characteristics of liquid hydrogen refuelling and dispensing systems on land[48]
ISO 13985:2006	Liquid hydrogen — Land vehicle fuel tanks	Specifies the construction requirements for refillable fuel tanks for liquid H_2 in land vehicles[49]
ISO 21012:2006	Cryogenic vessels — Hoses	Design, construction, type and production testing and marking requirements for non-insulated cryogenic flexible hoses[50]

Table 2 - List of ISO standards with relevance for hydrogen bunkering

[44] International Organization for Standardization (2020), ISO 17268:2020 Gaseous hydrogen land vehicle refuelling connection devices < https://www.iso.org/standard/68442.html > (last accessed: 15/02/2022).

[45] International Organization for Standardization (2019), ISO 4126-1:2013 Safety devices for protection against excessive pressure — Part 1: Safety valves < https://www.iso.org/standard/50826.html > (last accessed: 15/02/2022).

[46] International Organization for Standardization (2015), ISO/TS 18683:2015 Guidelines for systems and installations for supply of LNG as fuel to ships < https://www.iso.org/standard/63190.html > (last accessed: 15/02/2022).

[47] International Organization for Standardization (2017), ISO 20519:2017 Ships and marine technology — Specification for bunkering of liquefied natural gas fuelled vessels < https://www.iso.org/standard/68227.html > (last accessed: 15/02/2022).

[48] International Organization for Standardization (2021), ISO 13984:1999 Liquid hydrogen — Land vehicle fuelling system interface < https://www.iso.org/standard/23570.html > (last accessed: 15/02/2022).

[49] International Organization for Standardization (2021), ISO 13985:2006 Liquid hydrogen — Land vehicle fuel tanks < https://www.iso.org/standard/39892.html > (last accessed: 15/02/2022).

[50] International Organization for Standardization (2006), ISO 21012:2006 Cryogenic vessels — Hoses < https://www.iso.org/standard/34376.html > (last accessed: 15/02/2022).

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At the European level, Directive 2014/94 on the deployment of alternative fuels infrastructure provides standards to be used in public hydrogen refuelling stations and those can serve as guidance for maritime applications. These standards were defined under the framework of the European Committee for Standardization. They are:

Standard	Title	Description
EN 17127:2018	Outdoor hydrogen refuelling points dispensing gaseous hydrogen and incorporating filling protocols	Minimum requirements for interoperability of public hydrogen refuelling points[51]
EN 17124:2022	Hydrogen fuel - Product specification and quality assurance for hydrogen refuelling points dispensing gaseous hydrogen - Proton exchange membrane (PEM) fuel cell applications for vehicles	Specifies quality characteristics of H_2 fuel at hydrogen refuelling stations for use in proton exchange membrane[52]

Table 3 - List of EN standards with relevance for hydrogen bunkering

[51] Bulgarian Institute for Standardization (2018), Outdoor hydrogen refuelling points dispensing gaseous hydrogen and incorporating filling protocols < https://bds-bg.org/en/project/show/cen:proj:60892 > (last accessed: 15/02/2022).

[52] Bulgarian Institute for Standardization (2022), Hydrogen fuel - Product specification and quality assurance for hydrogen refuelling points dispensing gaseous hydrogen - Proton exchange membrane (PEM) fuel cell applications for vehicles < https://bds-bg.org/en/project/show/bds:proj:109478 > (last accessed: 15/02/2022).

3.4 Storage

Lastly, on the issue of storage of hydrogen, the general rules applicable to hydrogen storage and refuelling would be applicable to storage for bunkering. Most of these are to be found in national or regional legislation, yet some common obligations come from the transposition of EU directives in national law. Thus, while the general principles might be the same, significant differences in interpretation and implementation exist across member-states.[53]

It is important to note that depending on how hydrogen storage is defined under national law, different conditions will apply in terms of land-use regulations. In any case hydrogen storage units, can be installed only in places where this is allowed under the applicable land use plans.[54]

At the European level, some of the more relevant legal acts include Directive 2012/18 on the control of major-accident hazards involving dangerous substances (Seveso Directive). This directive prescribes risk assessments for storage facilities that intend to store more than 5 tons of H_2 and additional requirements for facilities storing more than 50 tons. In their transposition of the directive, EU member-states can impose stricter requirements than the ones prescribed by the directive.

Another set of requirements includes the health and safety requirements and conformity assessment procedures under Directive 2014/34 on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres (ATEX Directive). The obligations for hydrogen storage facilities from this directive result due to the nature of hydrogen as flammable gas, since the directive applies to areas where potentially explosive atmospheres can take place.

Lastly, under Directive 2001/42 on the assessment of the effects of certain plans and programmes on the environment (SEA Directive) and Directive 2014/52 on the assessment of the effects of certain public and private projects on the environment (EIA Directive), member-states may decide or not to impose obligations on hydrogen storage projects.[55]

The transposition of these directives under Belgian law will be discussed in the next chapter of this report.

[53] Alexandru Floristean (2019) HyLaw: Production, Storage, and Hydrogen Refuelling Stations, Deliverable 4.3 – Horizontal Position Paper.

[54] *Ibid.*

[55] *Ibid.*

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3.5 Conclusion

In summary, while the development of hydrogen propulsions systems in the shipping sector is developing, it seems that at the international and European levels, the regulatory regimes are lagging behind. Therefore leaving, general, but vague rules for hydrogen propulsion systems in maritime applications, as is the example of the IGF Code. The code in its current state, while applicable, is oriented towards LNG-based propulsion and not hydrogen. While the regulations develop, guidance for the approval of hydrogen systems is to be found mostly in the form of international technical standards, which have as their subject matter either different gases or different hydrogen applications.

This leads to the situation where regulatory regimes and approval processes, like the approval process for vessels powered by H_2, are uncertain, lengthy and costly. While *prima facie* these characteristics certainly represent barriers to the rapid development of hydrogen propulsion systems, it is important to balance them against the interests of safety and avoidance of major accidents. In this light, it becomes clearer that appropriate to have rigorous safety systems that can prevent major accidents, since the latter can sink the development of a technology for a long time, as experience has shown.[56]

Consequently, for the uptake of hydrogen propulsion systems and the development of the wider hydrogen ecosystem in North-West Europe, it is important that two regulatory developments take place. Firstly, in order to reduce barriers and improve legal regimes the use of regulatory sandboxes can be increased.[57] Secondly, as the technology develops and moves from pilot projects to a wider level of acceptance, both in the industry and outside it, legislators and national authorities ought not to lag behind, both in terms of regulation and technical capacity. Technological development ought to be accompanied by an appropriate level of sound regulation that guarantees safety based on experience and knowledge but does not become too costly to implement by the industry, thereby resulting in no technological uptake.[58]

[56] *Supra* note 26, p6.

[57] General Secretariat of the Council (2020), Council Conclusions on Regulatory sandboxes and experimentation clauses as tools for an innovation-friendly, future-proof and resilient regulatory framework that masters disruptive challenges in the digital age, available at < https://www.consilium.europa.eu/media/46822/st13026-en20.pdf > (last accessed 23/02/2022).

[58] *Supra* note 26, p6.

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4 National and regional requirements

Before turning our attention to the Belgian national and regional levels of regulation applicable to hydrogen propulsion systems in waterborne transportation, it is of paramount importance to explain the legal and political framework under which these are developed.

Belgium is a federal state subdivided into Communities and Regions. Federal government, Communities and Regions can all enact legislation for which they are exclusively competent and the legislation of the latter two is on the same level as the federal legislation. The Communities are mainly competent in relation to “personal matters”. The Regions (Flemish, Walloon and Brussels-Capital) have, mainly and exclusively, competence in certain economic matters: environment, agriculture, energy, area development and planning, water policy, public works. The federal government has powers over issues not expressly left to the Regions or Communities. Examples of such are social security, foreign policy, fiscal policy and others.[59]

Considering this arrangement and the fact that in the next chapter the analysis will mostly focus on national and regional legislation related to zoning and health, safety and environment, it becomes clear that the sources of law will be diversified and split across multiple regional jurisdictions. Therefore, in order to achieve some meaningful analysis, the approach taken is to start with the legislation at the federal level. Should there be none, the analysis will move to the regional legislation focusing on the Flemish region. The reason for this is the location of the Oostende Port, which is in Flanders.

As in the previous chapter, the chapter is divided in four different parts. These are Policies and Regulations; Vessel approval, Hydrogen storage in ports and Bunkering.

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[59] Maurice Adams (2014), Disabling constitutionalism. Can the politics of the Belgian Constitution be explained?, International Journal of Constitutional Law, Volume 12, Issue 2, p. 283-284; Toharudin, Tomi (2010), Individualism, Nationalism, Ethnocentrism and Authoritarianism Evidence from Flanders by means of Structural Equation Modeling, available at < https://pure.rug.nl/ws/portalfiles/portal/33279496/10_thesis.pdf >, (last accessed 18/02/2022), p.23-31 and Belgium.be (2022), The powers of the Regions, available at < https://www.belgium.be/en/about_belgium/government/regions/competence#:~:text=So%20the%20Flemish%20Region%2C%20the,credit%2C%20foreign%20trade%2C%20supervision%20of > (last accessed 18/02/2022).

4.1 Policies and Regulations

Starting with the national policies, the long-term climate strategy of Belgium under the Paris Agreement, does not contain concrete commitments for reduction of GHG emissions. This is due to the aforementioned Belgian constitutional arrangement. As part of the national strategy, each of the three regions has developed its own strategy and these three strategies together, cover all national GHG emissions.[60]

At the regional level, the Flemish long-term strategy aims to reduce GHG emissions from sectors not covered by the EU ETS by 85% by 2050 compared to 2005. For the sectors covered by the ETS, the Flemish strategy follows the EU targets.[61]

Specifically for transport, the strategy sets the aim to reduce CO_2 emissions by 23% by 2030 and to have zero emissions by 2050. However, international air and shipping are not included in this target.[62] On the topic of maritime shipping, the strategy calls for cooperation at European and international levels under the scope of the IMO. No other indication for targets or goals is indicated however.[63]

At the time of writing the maritime sector is not included in the EU ETS scheme, yet considering the developments at the European level, this might change in the near future with the proposal for revision of the EU ETS directive.[64]

Another set of relevant policy documents are the national or regional hydrogen strategies. In the case of Belgium, the hydrogen strategy considers that the maritime sector will transition from diesel and heavy fuel oil to ammonia or methanol, based on renewable hydrogen.[65] As for the regional strategy of Flanders, it highlights the role of hydrogen for decarbonization of heavy transport, including shipping either in direct use or through transformation of hydrogen in other molecules. The strategy focuses mainly on research and development and pilot projects located in Flanders. Additionally, the strategy presents a project in the Oostende Port with three developmental phases for the large-scale production of green hydrogen for transport.[66]

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[60] Climat.be (2020), Stratégie à long terme de la Belgique avaliable at < https://climat.be/politique-climatique/belge/nationale/strategie-a-long-terme > (last accessed 16/02/2022), p. 1-2.

[61] *Id.* p. 3.

[62] *Id.* p. 32.

[63] *Id.* p. 36.

[64] *Supra* note 4.

[65] Tinna Van der Straeten (2021), Visie en strategie Waterstof, avaliable at < https://www.tinnevanderstraeten.be/federale_waterstofstrategie > (last accessed: 16/02/2022).

[66] Hilde Crevits (2020), Mededeling aan de Vlaamse Regering: Vlaamse Waterstofvisie "Europese koploper via duurzame innovatie", VR2020 1311 MED.0357/1BIS, p. 10, 14-15.

In general, both hydrogen strategies are rather vague in their specific commitments and even more so in relation to the maritime sector. Yet, it is envisaged that hydrogen or hydrogen derived molecules will play a key role in decarbonizing the sector.

Having identified the main policy documents, it is possible to highlight some of the most important legislation applicable to the subject matter of the report. Regarding vessel approval, a starting point of the analysis will be the new Belgian Navigation Code (hereinafter BCN). It entered into force from 1st September 2020 and applies to all seagoing vessel or transport by such.[67] Additionally, for the vessel approval process there are several decrees which further develop the rules for waterborne vessels. As to the question of hydrogen storage, the main legislation is related to zoning laws and health, safety and environment laws. As to zoning laws, they are spread among the different regional, municipal and local jurisdictions. The health, safety and environment laws are mostly derived from the transposition of the identified directives in section 3.1 of this report. The national instruments which transpose the directive are located at different legislative levels.

Lastly, on the question of hydrogen bunkering the focus will be on legislation applicable to ports, such as the Flemish Port Decree and the Port Regulations in force at the Oostende Port.

[67] Conseil d'Etat (2019), Code belge de la Navigation, available at < https://www.ejustice.just.fgov.be/eli/loi/2019/05/08/2019A12565/justel >, (last accessed 17/02/2022), art. 2.1.1.1.

4.2 Vessel approval

The applicable legislation regarding ship approval and certification starts with the new Belgian Code of Navigation. The new act entered into force in September 2020, replacing the existing code. It provides the general laws and principles applicable to shipping, both maritime and inland.[68]

Below the BCN, there are three royal decrees implementing its provisions. The first is the Royal decree regulating maritime inspection. It regulates the inspection regime, through which all ships must go to receive their certificate of seaworthiness.[69] Unfortunately an analysis of this decree will not be included in the present report, due to the unavailability of a consolidated version, or any version for that matter, in the Belgian legislative database. In lieu of that, as much as possible on the maritime inspection regime will be gathered from secondary sources.

Secondly, the Royal decree relating to the registration of seagoing vessels will be looked at. This decree provides further clarification as to procedure, documents and actors, and their responsibilities, in relation to the registration of vessels.[70]

Lastly, regarding passenger ships, the provisions of the Royal decree laying down safety rules and standards for passenger ships used for national voyages will be analysed.[71]

Starting with the BCN, the code establishes the general provisions regulating maritime and inland navigation. According to art. 2.2.1.2, any ship intending to sail under the Belgian flag must be registered with the Belgian Ship Register.[72] The process of vessel registering is further defined in the recast Royal decree relating to the registration of seagoing vessels.[73] Under the provisions of this decree, all vessels under construction in Belgium must be registered with the abovementioned Register. The responsibility to do so lies with the shipbuilder. As he has to register the ship and provide all necessary documentation pertaining to the registration. For other ships that operate in Belgium, the registration is optional. They can do so, as long as the owner or operator is a natural person having its domicile in Belgium or is

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[68] *Ibid.*

[69] Conseil d'Etat (1973), Arrete royal portant règlement sur l'inspection maritime, available at < https://www.ejustice.just.fgov.be/cgi_loi/change_lg_2.pl?language=fr&nm=1973072013&la=F > (last accessed 17/02/2022).

[70] Conseil d'Etat (2020), Arrêté royal relatif à l'enregistrement des navires de mer, avalibale at < https://www.ejustice.just.fgov.be/eli/arrete/2020/06/26/2020031121/justel >, (last accessed 17/02/2022)

[71] Conseil d'Etat (2002), Arrêté royal établissant des règles et normes de sécurité pour les navires à passagers utilisés pour effectuer des voyages nationaux, available at < https://www.ejustice.just.fgov.be/eli/arrete/2002/03/11/2002014073/justel > (last accessed: 17/02/2022) and Conseil d'Etat (2019), Arrêté royal modifiant l'arrêté royal du 11 mars 2002 établissant des règles et normes de sécurité pour les navires à passagers utilisés pour effectuer des voyages nationaux, available at < http://www.ejustice.just.fgov.be/eli/arrete/2019/03/14/2019030504/justel > (last accessed 17/02/2022).

[72] *Supra* note 67, art. 2.2.1.2.

[73] *Supra* note 70.

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a national of another EU or EEA member state.[74] Should someone intend to register a ship, the registration is made upon the request of the relevant party and under the instructions provided in the decree and in website of the Belgian Ship Register.[75]

For the registration to take place, a series of documents identifying the ship and the owner are required, nonetheless the Ship Register has the authority to request additional information necessary for the registration. Including information regarding the propulsion machinery, manufacturer type and power in kilowatts.[76]

Regarding safety and certifications, the authority entrusted with this task is the Belgian Maritime Inspectorate. Its task is to carry out technical inspections, without which it is impossible to have a certificate of seaworthiness. The necessary documents for such inspections include general information on the ship, copies of all valid certificates, copies of the main construction drawings, plate thickness report, stability data and other relevant data. The result of the inspection is a report. If the latter is positive, the Inspectorate issues the national and international certificates under the Royal decree regulating maritime inspection.[77]

Lastly, regarding ships carrying passengers the situation in relation to hydrogen propulsion systems is clear. The Royal decree laying down safety rules and standards for passenger ships used for national voyages directly addresses the issue of use of gases or other low-flashpoint fuels. By virtue of Annex 1, Chapter II-2, art. 2.2.N1, p. 10.1-4 the use of liquid fuels with a flashpoint lower than 43ºC is forbidden. Fuels with flashpoints between 43ºC and 60ºC are allowed for the use of standby generators. Additionally, vessels constructed after 1 January 2003 can use liquid fuels with flashpoints between 43ºC and 60ºC, as long as they comply with the additional requirements laid down in subsequent paragraphs.[78] These provisions apply to ships which do not travel beyond 20 nautical miles away from the coast i.e. limited to zone B, as defined in art. 3 of the decree.[79]

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[74] SPF Mobilite (2020), Registre des navires de mer, avaliable at < https://mobilit.belgium.be/fr/navigation/registre_naval_belge/navires_de_mer/enregistrement_des_navires_de_mer/registre_des?language=fr >, (last accessed 17/02/2022).

[75] Registre Belge des Navires (2020), Enregistrement de Navires dans le Registre Belge des Navires: Documents A Produire, avaliable at < https://mobilit.belgium.be/sites/default/files/registratie_zeeschepen_fr.pdf > (last accessed: 17/02/2022).

[76] *Supra* note 70, art. 5, 12, 13, 14, 22, 21.

[77] Royal Belgian Shipowners' Association (2020), Technical inspection of the ship, available at < https://kbrv.be/technical-inspection-ship/# > (last accessed 17/02/2022)

[78] *Supra* note 71, art. 2.2.N1, p. 10.1-4.

[79] *Supra* note 71, art. 3.

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4.3 Hydrogen storage in ports

Hydrogen storage can take several forms, but generally can be categorized in two ways: physical-based storage and material-based storage. Physical-based storage consists of storing H_2 as a compressed gas, cryogenically compressed gas or in its liquid state. Material based storage involves adsorbents, liquid organic compounds, interstitial hydrides, complex hydrides or chemical hydrogen storage materials.[80] Despite the different possible ways to store hydrogen, the focus of this section will be only on storage of pure hydrogen in gaseous or liquid form.

The legislation regulating hydrogen storage is separated in land-use planning law and health, safety and environment law. In Belgium, zoning and environmental permits are a regional competence. The regions delegate the responsibility for spatial planning to the regional governments or administrations, and provincial and municipal authorities. In Wallonia and Brussels, the municipal authorities are the ones entrusted with special plans and permitting for Class I installations.[81]

Specifically for Flanders, land use plans exist on different levels (region, province, municipality). In principle, in regional land-use plans there are no general exclusions for hydrogen installations. Thus, irrespective of the land categorization, safety is the most important parameter. In order to obtain an environmental permit, a Quantified Risk Analysis is mandatory. This analysis is used to decide how many and how close industrial installations can be installed in the different area categories. A second requirement is that the function of the installation is compatible with or related to the other functions in the area.[82] Thus, despite the lack of general exclusions hydrogen storage must be located in areas defined as industrial. The criteria are further defined in the Flemish planning codex.[83]

Moving to the health, safety and environment regulations, generally speaking there are several requirements to hydrogen storage installations that come from the transposition of European law into national legislation. Highlighted here are the Seveso directive, the ATEX directive and the SEA and EIA directives.

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[80] Hydrogen and Fuel Cell Technologies Office (2022), Hydrogen /Storage, available at < https://www.energy.gov/eere/fuelcells/hydrogen-storage >, (last accessed: 18/02/2022).

[81] “The classification of the installation depends on the expected environmental burden of an installation. If there is hydrogen storage included in the installation or a hydrogen distribution system, it is always Class I. Class I and II need a permit, for class III a notification is sufficient.” In Isabel François (2018), HyLaw: National Policy Paper – Belgium, available at < https://www.waterstofnet.eu/_asset/_public/HyLaw/National-policy-paper_-Belgium_v2-0.pdf > (last accessed 18/02/2020), p.5.

[82] *Ibid* and Koninklijk Besluit betreffende de inrichting en de toepassing van de ontwerp-gewestplannen en de gewestplannen, available at < https://codex.vlaanderen.be/Portals/Codex/documenten/1000635.html > (last accessed: 18/02/2022).

[83] *Ibid* and Flemish Government (2021), Vlaamse codex ruimtelijke ordening, available at < https://www.ejustice.just.fgov.be/cgi_loi/change_lg.pl?language=nl&la=N&table_name=wet&cn=2009051536 >, (last accessed 18/02/2020).

Firstly, the requirement for risk assessments coming from the Seveso directive apply. These requirements apply for storage facilities that will contain more than 5 tons of H_2 and the installation will be subject to stricter conditions, if the storage capacity is for more than 50 tons of H_2. The directive is transposed into national law under the scope of the Cooperation agreement of between the Federal State, the Flemish Region, the Walloon Region and the Brussels-Capital Region regarding the control of major-accident hazards involving dangerous substances.[84]

Secondly, health and safety requirements and conformity assessment procedures come from the ATEX directive. The directive applies to areas where potentially explosive atmospheres can occur and the fact that hydrogen is a flammable gas. The directive is transposed in national law by virtue of the Royal decree concerning the placing on the market of equipment and protective systems intended for use in explosive atmospheres.[85]

The third requirement is for environmental impact assessment procedures, as envisaged under the SEA and EIA directives. Under the EIA directive, it is for the member-states to determine whether a project shall be made subject to an environmental impact assessment, either on a case-by-case basis or in the form of threshold set *a priori*. The reason for this is that underground storage of combustible gases is included in Annex II (3) of the Directive. The transposition of this directive is spread across multiple national legislative acts.[86]

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[84] Brussels-Capital Region, Flemish Government, Walloon Government Service, Employment, Labor And Social Consultation (2016), Cooperation agreement of 16 February 2016 between the Federal State, the Flemish Region, the Walloon Region and the Brussels-Capital Region regarding the control of major-accident hazards involving dangerous substances, available at < https://www.ejustice.just.fgov.be/cgi_loi/change_lg.pl?language=nl&la=N&cn=2016021613&table_name=wet > (last accessed 18/02/2022).

[85] Service public fédéral Economie, P.M .E., Classes moyennes et Energie (2016), Arrêté royal concernant la mise sur le marché des appareils et des systèmes de protection destinés à être utilisés en atmosphères explosibles, avalable at < https://www.ejustice.just.fgov.be/eli/arrete/2016/04/21/2016011165/justel >, (last accessed 18/02/2022).

[86] EUR-Lex (2021), National transposition measures communicated by the Member States concerning Directive 2014/52/EU, available at < https://eur-lex.europa.eu/legal-content/EN/NIM/?uri=celex:32014L0052 >, (last accessed 18/02/2022).

4.4 Bunkering

As identified before, the land side of bunkering is not covered by the IGF Code and the provisions therein are focused on LNG bunkering. Thus, in general, the port authority is the responsible institution in relation to bunkering, as no uniform approach is to be found. Generally, as established under the international and European law section of this report, the use of other standards for safe bunkering is recommended.[87]

In the case of Flanders, by virtue of art. 4 of the Decree on the policy and management of seaports,[88] only port authorities can exercise port administrative powers. These administrative powers include: the management and operation of the port, the definition and organization of port services and the exercise of special administrative policing in the port area.[89] Furthermore, the harbourmaster's office is the entity responsible for safeguarding public order, tranquillity and security. Lastly, port authorities establish and organize all public port services.[90]

Taking the case of the Oostende Port as an example, bunkering is defined as supplying a ship with fuels such as fuel oil, lubricating oil and liquefied natural gas (LNG).[91] According to the Port Regulations, the Port Authority is the one authorised to provide public port services as bunkering and debunkering and it can decide to grant a concession or authorisation for those services to a third party.[92] Chapter 12 of the Port regulations further stipulates the rules applicable to bunkering in Oostende. Bunkering is only permitted when compliant with the regulations issued by the harbourmaster's office and when it is approved in advance.[93] Bunkering only takes place if a ship is properly moored and the pipes are in good conditions. Additional safety requirements include that the bunkering lines must be suspended properly and have sufficient clearance; all bolts, clamps or quick connectors must be tightened to prevent leakage; there are sufficient ways to prevent any leakage; the quantity, maximum pump flow and pressure are correctly agreed; the measures regarding emergency stops are known; there is continuously agreed communication between vessels and lastly, there is no welding, smoke or open fire or sparks taking place.

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[87] DNV GL (2017), Study on the Use of Fuel Cells in Shipping: EMSA European Maritime Safety Agency, available at < http://emsa.europa.eu/publications/reports/download/4545/2921/23.html > (last accessed: 21/02/2022), p. 68-72.

[88] Vlaamse Gemeenschap (2019), Decreet houdende het beleid en het beheer van de zeehavens, available at < https://www.ejustice.just.fgov.be/eli/decreet/1999/03/02/1999035415/justel > (last accessed 21/02/2020).

[89] *Id.* art. 2(2).

[90] *Id.* art. 14 and art. 16.

[91] Haven Oostende (2021), Politieverordening Haven Oostende, available at < https://www.portofoostende.be/sites/default/files/2021-01/Politieverordening_2021_01_29.pdf > (last accessed: 21/02/2022), art. 1(9).

[92] *Id.* art. 2(6)(1).

[93] *Id.* art. 12(2).

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5 Conclusions and Recommendations

Considering the IMO and EU goals for reducing GHG emissions in the maritime sector, it is fundamental that decarbonized technologies such as hydrogen are implemented as soon as possible. The reason for this lies in the fact that a ship entering service today, will continue to emit GHG emissions for the next 30 years.

In light of the analysis carried out in this report, four general recommendations can be highlighted. Firstly, for project owners intending to start projects involving hydrogen, it is fundamental to coordinate their efforts as much as possible with the relevant authorities. This will serve to both inform civil servants, and to facilitate the approval processes. Secondly, there is a need for further cooperation at the international and European levels for the use of hydrogen in ship propulsion since current instruments provide little guidance. Thirdly, in drafting new legislation a careful balance must be struck, where the technology is allowed to develop, without sacrificing safety. Lastly and most importantly, based on the technological developments and new knowledge in the sector, legislation must be continuously updated.

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Project webpage: http://www.nweurope.eu/h2ships

6 Bibliography

Literature:

- Alexandru Floristean (2019) HyLaw: Production, Storage, and Hydrogen Refuelling Stations, Deliverable 4.3 – Horizontal Position Paper
- Bradley Kieran (2020), Legislating in the European Union *in* Barnard, Catherin and Steeve Peers (2020), European Union Law, Oxford University Press
- Isabel François (2018), HyLaw: National Policy Paper – Belgium, available at < https://www.waterstofnet.eu/_asset/_public/HyLaw/National-policy-paper_-Belgium_v2-0.pdf > (last accessed 18/02/2020)
- Maurice Adams (2014), Disabling constitutionalism. Can the politics of the Belgian Constitution be explained?, International Journal of Constitutional Law, Volume 12, Issue 2
- Psaraftis, Harilaos N., and Christos A. Kontovas. 2021. "Decarbonization of Maritime Transport: Is There Light at the End of the Tunnel?" Sustainability 13, no. 1: 237
- Toharudin, Tomi (2010), Individualism, Nationalism, Ethnocentrism and Authoritarianism Evidence from Flanders by means of Structural Equation Modeling, available at < https://pure.rug.nl/ws/portalfiles/portal/33279496/10_thesis.pdf >, (last accessed 18/02/2022)

Reports:

- DNV (2021), Handbook for hydrogen-Fuelled Vessels.
- DNV GL (2017), Study on the Use of Fuel Cells in Shipping: EMSA European Maritime Safety Agency, available at < http://emsa.europa.eu/publications/reports/download/4545/2921/23.html > (last accessed: 21/02/2022)
- IPCC (2021), Climate Change 2021: The Physical Science Basis: Summary for Policymakers.
- van Wijk, Ad and Hydrogen Europe (2021), Hydrogen – a carbon-free energy carrier and commodity

Interreg North-West Europe H2SHIPS

Project co-funded by European Regional Development Funds (ERDF)
Project webpage: http://www.nweurope.eu/h2ships

Standards:

- Bulgarian Institute for Standardization (2018), Outdoor hydrogen refuelling points dispensing gaseous hydrogen and incorporating filling protocols < https://bds-bg.org/en/project/show/cen:proj:60892 > (last accessed: 15/02/2022)
- Bulgarian Institute for Standardization (2022), Hydrogen fuel - Product specification and quality assurance for hydrogen refuelling points dispensing gaseous hydrogen - Proton exchange membrane (PEM) fuel cell applications for vehicles < https://bds-bg.org/en/project/show/bds:proj:109478 > (last accessed: 15/02/2022)
- International Organization for Standardization (1999), ISO/TC 220 Cryogenic vessels < https://www.iso.org/committee/54990.html > (last accessed: 14/02/2022)
- International Organization for Standardization (2006), ISO 21012:2006 Cryogenic vessels — Hoses < https://www.iso.org/standard/34376.html > (last accessed: 15/02/2022)
- International Organization for Standardization (2015), ISO/TR 15916:2015 Basic considerations for the safety of hydrogen systems, available at WWW < https://www.iso.org/standard/56546.html > (last accessed: 14/02/2022)
- International Organization for Standardization (2015), ISO/TS 18683:2015 Guidelines for systems and installations for supply of LNG as fuel to ships < https://www.iso.org/standard/63190.html > (last accessed: 15/02/2022)
- International Organization for Standardization (2017), ISO 20519:2017 Ships and marine technology — Specification for bunkering of liquefied natural gas fuelled vessels < https://www.iso.org/standard/68227.html > (last accessed: 15/02/2022)
- International Organization for Standardization (2018), ISO 15649:2001 Petroleum and natural gas industries — Piping < https://www.iso.org/standard/28195.html > (last accessed: 14/02/2022)
- International Organization for Standardization (2018), ISO 16111:2018 Transportable gas storage devices — Hydrogen absorbed in reversible metal hydride < https://www.iso.org/standard/67952.html > (last accessed: 14/02/2022)
- International Organization for Standardization (2018), ISO 19882:2018 Gaseous hydrogen — Thermally activated pressure relief devices for compressed hydrogen vehicle fuel containers < https://www.iso.org/standard/64655.html > (last accessed: 14/02/2022)

Interreg North-West Europe H2SHIPS

Project co-funded by European Regional Development Funds (ERDF)
Project webpage: http://www.nweurope.eu/h2ships

- International Organization for Standardization (2019), ISO 4126-1:2013 Safety devices for protection against excessive pressure — Part 1: Safety valves < https://www.iso.org/standard/50826.html > (last accessed: 15/02/2022)
- International Organization for Standardization (2020), ISO 17268:2020 Gaseous hydrogen land vehicle refuelling connection devices < https://www.iso.org/standard/68442.html > (last accessed: 15/02/2022)
- International Organization for Standardization (2020), ISO 19880-1:2020 Gaseous hydrogen — Fuelling stations — Part 1: General requirements < https://www.iso.org/standard/71940.html > (last accessed: 14/02/2022)
- International Organization for Standardization (2021), ISO 13984:1999 Liquid hydrogen — Land vehicle fuelling system interface < https://www.iso.org/standard/23570.html > (last accessed: 15/02/2022)
- International Organization for Standardization (2021), ISO 13985:2006 Liquid hydrogen — Land vehicle fuel tanks < https://www.iso.org/standard/39892.html > (last accessed: 15/02/2022)
- International Organization for Standardization (2021), ISO 26142:2010 Hydrogen detection apparatus — Stationary applications < https://www.iso.org/standard/52319.html > (last accessed: 14/02/2022)
- International Organization for Standardization (2022), ISO/TC 197, available at WWW < https://www.iso.org/committee/54560.html > (last accessed: 14/02/2022)

Legislation & policy documents:

- Brussels-Capital Region, Flemish Government, Walloon Government Service, Employment, Labor And Social Consultation (2016), Cooperation agreement of 16 February 2016 between the Federal State, the Flemish Region, the Walloon Region and the Brussels-Capital Region regarding the control of major-accident hazards involving dangerous substances, available at < https://www.ejustice.just.fgov.be/cgi_loi/change_lg.pl?language=nl&la=N&cn=2016021613&table_name=wet > (last accessed 18/02/2022)
- Climat.be (2020), Stratégie à long terme de la Belgique avaliable at < https://climat.be/politique-climatique/belge/nationale/strategie-a-long-terme > (last accessed 16/02/2022)
- Conseil d'Etat (1973), Arrete royal portant règlement sur l'inspection maritime, available at < https://www.ejustice.just.fgov.be/cgi_loi/change_lg_2.pl?language=fr&nm=1973072013&la=F > (last accessed 17/02/2022)

Project co-funded by European Regional Development Funds (ERDF)
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- Conseil d'Etat (2002), Arrêté royal établissant des règles et normes de sécurité pour les navires à passagers utilisés pour effectuer des voyages nationaux, available at < https://www.ejustice.just.fgov.be/eli/arrete/2002/03/11/2002014073/justel > (last accessed: 17/02/2022)
- Conseil d'Etat (2019), Arrêté royal modifiant l'arrêté royal du 11 mars 2002 établissant des règles et normes de sécurité pour les navires à passagers utilisés pour effectuer des voyages nationaux, available at < http://www.ejustice.just.fgov.be/eli/arrete/2019/03/14/2019030504/justel > (last accessed 17/02/2022)
- Conseil d'Etat (2019), Code belge de la Navigation, available at < https://www.ejustice.just.fgov.be/eli/loi/2019/05/08/2019A12565/justel >, (last accessed 17/02/2022)
- Conseil d'Etat (2020), Arrêté royal relatif à l'enregistrement des navires de mer, avalibale at < https://www.ejustice.just.fgov.be/eli/arrete/2020/06/26/2020031121/justel >, (last accessed 17/02/2022)
- European Commission (2019), The European Green Deal, COM(2021)640 final
- European Commission (2021), Proposal Directive of the European Parliament and of the Council amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union, Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and Regulation (EU) 2015/757, COM(2021) 551 final
- European Commission (2021), Proposal for a Council Directive restructuring the Union framework for the taxation of energy products and electricity (recast), COM(2021) 563 final
- European Commission (2021), Proposal for a Directive of the European Parliament and of the Council amending Directive (EU) 2018/2001 of the European Parliament and of the Council, Regulation (EU) 2018/1999 of the European Parliament and of the Council and Directive 98/70/EC of the European Parliament and of the Council as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652, COM(2021) 557 final
- European Commission (2021), Proposal for a Directive of the European Parliament and of the Council on energy efficiency (recast), COM(558) final/2
- European Commission (2021), Proposal for a Regulation of the European Parliament and of the Council on the use of renewable and low-carbon fuels

Interreg North-West Europe H2SHIPS
Project co-funded by European Regional Development Funds (ERDF)
Project webpage: http://www.nweurope.eu/h2ships

in maritime transport and amending Directive 2009/16/EC, COM(2021) 562 final

- European Commission (2021), Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement, COM(2021) 555 final
- European Commission (2021), Proposal for a Regulation of the European Parliament and of the Council on the deployment of alternative fuels infrastructure, and repealing Directive 2014/94/EU of the European Parliament and of the Council, COM (2021) 559 final
- European Commission (2021), Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2019/631 as regards strengthening the CO2 emission performance standards for new passenger cars and new light commercial vehicles in line with the Union's increased climate ambition, COM(2021)556 final
- European Commission (2021), Proposal for a Regulation of the European Parliament and of the Council establishing a carbon border adjustment mechanism, COM(2021) 564 final and European Commission (2021), Proposal for a Regulation of the European Parliament and of the Council on ensuring a level playing field for sustainable air transport, COM(2021) 564 final
- European Commission (2021), Proposal for a Regulation of the European Parliament and of the Council amending Regulations (EU) 2018/841 as regards the scope, simplifying the compliance rules, setting out the targets of the Member States for 2030 and committing to the collective achievement of climate neutrality by 2035 in the land use, forestry and agriculture sector, and (EU) 2018/1999 as regards improvement in monitoring, reporting, tracking of progress and review, COM (2021) 554 final
- European Commission (2022), Benefits of standards, available at WWW < https://ec.europa.eu/growth/single-market/european-standards/standardisation-policy/benefits-standards_en> (last accessed: 11/02/2022)
- Flemish Government (2021), Vlaamse codex ruimtelijke ordening, available at < https://www.ejustice.just.fgov.be/cgi_loi/change_lg.pl?language=nl&la=N&table_name=wet&cn=2009051536 >, (last accessed 18/02/2020)
- General Secretariat of the Council (2020), Council Conclusions on Regulatory sandboxes and experimentation clauses as tools for an innovation-friendly,

future-proof and resilient regulatory framework that masters disruptive challenges in the digital age, available at < https://www.consilium.europa.eu/media/46822/st13026-en20.pdf > (last accessed 23/02/2022)

- Haven Oostende (2021), Politieverordening Haven Oostende, available at < https://www.portofoostende.be/sites/default/files/2021-01/Politieverordening_2021_01_29.pdf > (last accessed: 21/02/2022)
- Hilde Crevits (2020), Mededeling aan de Vlaamse Regering: Vlaamse Waterstofvisie "Europese koploper via duurzame innovatie", VR2020 1311 MED.0357/1BIS
- International Maritime Organization (1974), International Convention for the Safety of Life at Sea, 1184 UNTS 3
- International Maritime Organization (2013), Guidelines for the Approval of Alternatives and Equivalents as Provided for in Various IMO Instruments, MSC.1/Circ.1455
- International Maritime Organization (2015), International Code of Safety for Ships Using Gases or Other Low-Flashpoint Fuels, Resolution MSC.391(95), Art. A.2.3
- International Maritime Organization (2018), Initial IMO Strategy on Reduction of GHG Emissions from Ships, Res. MEPC.304(72), 13 April 2018
- International Maritime Organization (2021), Fourth IMO GHG Study 2020: Executive Summary, 2021
- Koninklijk Besluit betreffende de inrichting en de toepassing van de ontwerp-gewestplannen en de gewestplannen, available at < https://codex.vlaanderen.be/Portals/Codex/documenten/1000635.html > (last accessed: 18/02/2022)
- Regulation 2021/1119 of the European Parliament and of the Council ('European Climate Law')
- Service public fédéral Economie, P.M .E., Classes moyennes et Energie (2016), Arrêté royal concernant la mise sur le marché des appareils et des systèmes de protection destinés à être utilisés en atmosphères explosibles, avalable at < https://www.ejustice.just.fgov.be/eli/arrete/2016/04/21/2016011165/justel >, (last accessed 18/02/2022)
- The Convention on the International Maritime Organization, Geneva, 6 March 1948

Interreg North-West Europe H2SHIPS
Project co-funded by European Regional Development Funds (ERDF)
Project webpage: http://www.nweurope.eu/h2ships

- Tinna Van der Straeten (2021), Visie en strategie Waterstof, avaliable at < https://www.tinnevanderstraeten.be/federale_waterstofstrategie > (last accessed: 16/02/2022)
- Vlaamse Gemeenschap (2019), Decreet houdende het beleid en het beheer van de zeehavens, available at < https://www.ejustice.just.fgov.be/eli/decreet/1999/03/02/1999035415/justel > (last accessed 21/02/2020)

Other Sources:

- Belgium.be (2022), The powers of the Regions, available at < https://www.belgium.be/en/about_belgium/government/regions/competence#:~:text=So%20the%20Flemish%20Region%2C%20the,credit%2C%20foreign%20trade%2C%20supervision%20of > (last accessed 18/02/2022)
- EUR-Lex (2021), National transposition measures communicated by the Member States concerning Directive 2014/52/EU, available at < https://eur-lex.europa.eu/legal-content/EN/NIM/?uri=celex:32014L0052 >, (last accessed 18/02/2022)
- Hydrogen and Fuel Cell Technologies Office (2022), Hydrogen /Storage, available at < https://www.energy.gov/eere/fuelcells/hydrogen-storage >, (last accessed: 18/02/2022)
- Registre Belge des Navires (2020), Enregistrement de Navires dans le Registre Belge des Navires: Documents A Produire, avaliable at < https://mobilit.belgium.be/sites/default/files/registratie_zeeschepen_fr.pdf > (last accessed: 17/02/2022)
- Royal Belgian Shipowners' Association (2020), Technical inspection of the ship, available at < https://kbrv.be/technical-inspection-ship/# > (last accessed 17/02/2022)
- SPF Mobilite (2020), Registre des navires de mer, avaliable at < https://mobilit.belgium.be/fr/navigation/registre_naval_belge/navires_de_mer/enregistrement_des_navires_de_mer/registre_des?language=fr >, (last accessed 17/02/2022)

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