HyLAW

National Policy Paper – Belgium

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Content

1. Introduction

1.1 HYLAW summary and methodology

HyLaw stands for Hydrogen Law and removal of legal barriers to the deployment of fuel cells and hydrogen applications. It is a EU flagship project aimed at boosting the market uptake of hydrogen and fuel cell technologies providing market developers with a clear view of the applicable regulations whilst calling the attention of policy makers on legal barriers to be removed.

The project brings together 23 partners from Austria, Belgium, Bulgaria, Denmark, Finland, France, Germany, Hungary, Italy, Latvia, Norway, Poland, Romania, Spain, Sweden, Portugal, the Netherlands and United Kingdom and is coordinated by Hydrogen Europe.

Through extensive research, interviews with industrial actors and public authorities and legal analysis, the HyLaw partners have identified the legislation and regulations relevant to fuel cell and hydrogen applications and legal barriers to their commercialization.

This National Policy Paper provides public authorities with country-specific benchmarks and recommendations on how to remove these barriers.

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1.2 Potential and status of hydrogen in Europe and Belgium

Hydrogen has the potential to play an important role in the energy transition.
The European targets for decrease of the greenhouse gas emissions are ambitious: 40% in 2030 and 80-95% in 2050. This requires a firm decarbonization of our energy supply and hence a massive transition from fossil to renewable energy. Two energy carriers, electricity and hydrogen promise to have the greatest possible impact when it comes to decarbonizing different sectors.
Hydrogen can play different roles in the future energy system:

- It can contribute to the decarbonization of sectors that are hard to electrify: transport, industry, high-graded heat;
- Combining hydrogen with captured carbon creates hydrocarbons that lead to a decarbonization of the chemical industry. Thus, hydrogen may also help to put carbon capture and utilization into practice;
- Hydrogen enables large scale integration of intermittent renewables in the energy system. Electrolysis produces hydrogen by using (excess) power supply and enables to valorize it either in other sectors (transport, industry, residential heat) or to store it for future re-use.
- Hydrogen can provide long term storage of large energy volumes;
- Hydrogen enables distribution and transport of energy over large distances. Transport of hydrogen, either pure or bound into molecules, will help to re-distribute renewable energy from regions with an excess to regions with a shortage.

Hydrogen technology is not new.
For decades, hydrogen has been used in industrial applications such as refineries and fertilizer production. Belgium and the Netherlands are home to one of the largest hydrogen networks in the world.

In Belgium the first pilot projects have been realized and interest is growing.
These projects were mainly focused on the use of hydrogen in transport: refueling stations, cars, forklifts, buses and garbage trucks. Currently three hydrogen refueling stations are available in Belgium, specifically in Antwerp, Halle and Zaventem; two of them are publicly accessible.
The first heavy duty trucks will be demonstrated in Flanders in 2019. The first hydrogen ship has been launched in 2017.
The interest in hydrogen is starting to extend beyond transport applications: the plan for a large scale power-to-gas installation to convert offshore wind energy into hydrogen at the Belgian coast has been announced recently.
Belgium has a relatively large number of industrial players that are active in the hydrogen or renewable energy sector. In the "Power-to-Gas cluster, supported by the Flemish government, more than 30 companies are gathered to build knowledge on hydrogen and develop projects to implement the technology.

The ambition is to install a network of hydrogen refueling stations in Belgium.
In the framework of the Directive on the deployment of alternative fuels infrastructure (2014/94/EU), Belgium has set up a National Policy Framework "Alternative fuels infrastructure" in which the policies and ambitions of the different government levels (federal and regional) are brought together. Regarding hydrogen infrastructure, the ambition in this document was to install twenty publicly accessible hydrogen refueling stations by 2020. At present, at least four extra stations are planned to be realized in 2019-2020.

Hydrogen is getting a legal status in European legislation and the principle of guarantees of origin will be extended to renewable gas including green hydrogen.
The updated Renewable Energy Directive, REDII, states that by 2030 almost a third of the total energy consumption in Europe must originate from renewable sources and 14% of the fuel consumption for road and rail transport must be renewable. Within this 14% target, there are specific sub-targets defined for 1st gen. biofuels that are capped to 7%. This opens the way for other fuels such as hydrogen, either as direct fuel in FCEV's, as feedstock for hydrogen based e-Fuels and via the use of renewable hydrogen in refineries (upstream CO2 reduction in fuels).

1.3 Content of this policy paper

This national policy paper summarizes the main legislative gaps identified for Belgium in the Hylaw project related to.:

- the procedure and requirements for hydrogen production sites in general[1] and hydrogen refuelling stations in particular;
- the quality requirements for hydrogen fuel in fuelling stations;
- the approval of ships on hydrogen and the hydrogen bunkering installations;
- incentives for hydrogen based mobility;
- the injection of hydrogen in the natural gas grid.

The topics listed above are the most obvious gaps, but this list is not exhaustive.

The paper formulates recommendations to solve these gaps and serves as a basis for further discussions with the responsible authorities.

[1] Including hydrogen production sites for all possible applications, i.e. transport , heating and industrial use

2. Hydrogen refueling infrastructure: permitting procedure and requirements

Hydrogen refueling stations exist in different configurations in terms of hydrogen production as well as the delivery method. Hydrogen can be supplied to the station by a centralized supply of hydrogen by pipeline, transported by trucks to the station or locally produced on-site by water electrolysis (or SMR).

To obtain a permit for setting up and operating a hydrogen refueling station, both the location (land use planning) and the environmental/safety aspects of the operation have to be dealt with. The concrete conditions to be met are formulated in the environmental permit procedure.

In this section the specific framework is discussed for the different Belgian regions regarding the permitting procedure for hydrogen refuelling stations.

2.1 Overview and assessment of the current legal framework in Belgium

2.1.1 Land use planning

Land use planning and environmental permits are a **REGIONAL competence** in Belgium. The three Belgian Regions delegate the responsibility for spatial planning to the regional governments or administrations, the provincial authorities and the municipal authorities. In Flanders the province is playing a role in land use planning and permitting, with specific spatial plans and the responsibility for permitting for Class I installations[2]; in Wallonia and Brussels the municipal authorities hold the full responsibility.

In Flanders, land use plans exist on different levels i.e. the region, province, municipality (GRUP, PRUP[3]..).
In principle, there are no general exclusions for hydrogen installations in the regional land use plans. They can be built in industrial, commercial or even residential areas. **Safety** is the most critical parameter to decide on the possible location: the QRA ("Quantified Risk analysis") that is mandatory to obtain the environmental permit is used to decide how many and how close industrial installations can be installed in the different area types. Another requirement is that the function of the installation should be **compatible with or related to the other functions in the area**[4]. In other words, hydrogen production and storage *as such* are restricted to industrial areas; if they are *part of a hydrogen refuelling station* they can be built in a residential area. The criteria to assess the compatibility with the other functions in the area are described in the Flemish spatial planning codex[5] .
Also in industrial areas compatibility with the functions in the area is required; hydrogen installations are accepted only if they are useful for surrounding companies or functions.
An additional element that is critical when locating a hydrogen refuelling station in a living area is the regulation regarding noise. In a living area (without industry nearby) the allowed noise levels are very low and difficult to comply with for a compressor installation. This is currently also an issue with the installation of service stations with compressed natural gas[6].

[2] 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.

[3] GRUP = "Gemeentelijk Ruimtelijk UitvoeringsPlan" (Municipal spatial plan); PRUP = "Provinciaal Ruimtelijk UitvoeringsPlan" (Provincial spatial plan).

[4] As indicated in the Royal Decree on the organization and the implementation of regional spatial plans https://codex.vlaanderen.be/Portals/Codex/documenten/1000635.html.

[5] Vlaamse Codex Ruimtelijke ordening, artikel 4.3.1, §2 VCRO.

[6] Source DATS24

2.1.2 Permitting procedure

The permitting process for the development and operation of a hydrogen production plant is different in the Belgian regions. In Flanders there is one "environmental permit" that unifies urban planning and environmental permits. In Wallonia and Brussels there are different permits to handle the spatial and environmental aspects.

The typical throughput time of the environmental permitting procedure on itself is limited in time - in Flanders this is 5 months after submission of the request, in Brussels this is 160 days - but the preparation of the request is a very time consuming and costly process because of the lack of specific legislation and available procedures for hydrogen refueling stations.

A clear framework and specific requirements for hydrogen installations is missing and hydrogen is considered as a "dangerous gas" (see e.g. in the "VLAREM[7]" legislation in Flanders). An ad hoc safety study has to be done by an accredited external expert for each HRS to be built (this has been done twice so far, for the Air Liquide station in Zaventem and the Colruyt station in Halle). This is inefficient, costly and the outcome is dependent on the consulted expert. Since there are no specific rules for hydrogen concerning e.g. safety distances, a mix is used from rules for dangerous gases (VLAREM) and the Dutch procedure for hydrogen stations PGS35[8]. The risk in this approach is that the authorities involved will "combine" both the permitting process of conventional refueling stations as well as the regulations applicable for H_2 storage and H_2 production. This method of working might generate unreasonably severe requirements, well beyond those applicable to conventional stations. The permitting process carries also "regulatory risks" for the operator, as the interpretation and demands from the regional administrative authority can be different from one region to another.

Having a specific procedure for Belgium will make this ad hoc safety assessment redundant or at least much less complex. A uniform assessment of the risks and a procedure to deal with these risks would create unambiguity towards the different instances that are involved in the permitting procedures: province, municipalities, fire brigade…

Germany, Denmark and the UK are the countries with the highest degree of maturity when it comes to the HRS permitting process (Germany having, by far the highest number of HRSs in Europe). The German National Organization Hydrogen and Fuel Cell Technology (NOW) has developed approval guidelines for HRS, these have been made publicly available[9] The Netherlands[10] and the UK59[11] have since then developed and published similar guidelines, thus providing more support to project developers seeking to build and operate HRSs.

Currently a BAT study ("Best available techniques") is running in Flanders, that focuses on the measures required to operate a hydrogen refueling station in a safe and environmentally friendly manner. Besides the definition of a range of safety measures, a calculation tool for the internal and external safety distances will be developed. Both stations with on-site hydrogen production and with trucked-in hydrogen are considered.

This study is commissioned by the Flemish government and is carried out by the Flemish knowledge center for "best available techniques", an initiative of the Flemish region and VITO. This study is ongoing and

[7] "Vlaams Reglement betreffende de Milieuvergunning"

[8] See PGS 35 (Hazardous Substances Publication Series 35, Hydrogen: Installations for delivery of hydrogen to road vehicles available at: http://www.publicatiereeksgevaarlijkestoffen.nl/publicaties/PGS35.html

[9] See https://www.h2-genehmigung.de/Index/Index?lang=1 for approval guidelines for Hydrogen refuelling stations, prepared by the national organization for Hydrogen and Fuel Cell Technology.

[10] PGS 35

[11] See: Guidance on hydrogen delivery stations for refuelling of motor vehicles, co-located with petrol fuelling stations (APEA, BC GA, EI guidance) available at: https://publishing.energyinst.org/topics/petroleum-product-storage-and-distribution/filling-stations/guidance-on-hydrogen-delivery-systems-for-refuelling-of-motor-vehicles

incorporates the expert inputs from both relevant governmental and HRS-industry/business experts. The goal of this study is twofold:

- to define, describe and select those measures that are the best available techniques to exploit a HRS on a safe and environmental friendly way (e.g. distance rules); from this selection in the BAT-study a concrete advice to the Flemish government (environmental department) will be defined, as a direct input for the formulation of a specific hydrogen refuelling chapter in the Flemish environmental legislation (VLAREM).
- to give advice to the Flemish department for innovation and entrepreneurship for which of the defined techniques subsidies are needed in order to help breaking the 'chicken-and-egg-trap'.

More info on this study can be found at www.emis.vito.be.

There is no quick procedure foreseen for temporary or test installations, e.g. mobile refuellers. The same lengthy procedure to obtain an environmental permit is required as for a large-scale fixed installation and this is mandatory **for each single location** on which the mobile refueller is to be used.

2.2 Conclusions

There are **no principal restrictions for hydrogen refueling stations in land zoning plans** – even if it concerns on-site hydrogen production. In theory, a hydrogen refueling station can be built in a residential area, since it can be considered as compatible with the residential function. In practice however, the assessment of the compatibility allows room for interpretation. Furthermore, the safety risk assessment and often leads to restrictions or requirements (e.g. safety distances) that limit the options for building the HRS.

Currently there is **no uniform procedure with permitting requirements for hydrogen refueling stations**: an ad-hoc safety study is required for each station which leads to a time consuming, costly and variable process. However, in Flanders the required action to solve these issues is running. The Flemish government asked the Flemish knowledge center on Best Available Technologies (BAT) from VITO to perform a BAT-study for hydrogen (re)fueling stations. The main goal of the study - to be finished in 2019- is to deliver a comprehensive advice for a specific hydrogen chapter within the VLAREM legislative framework.

There is **no quick or flexible procedure foreseen for temporary or test installations**, e.g. mobile refuellers.

2.3 Policy Recommendations

It is important to distinguish and recognize that hydrogen production can take place in different ways and that some of these methods (e.g. electrolysis) generate little to no local emissions, in contrast to large scale hydrogen production from natural gas through steam methane reforming.

It should be ensured that hydrogen refuelling stations (with or without on-site production) are explicitly treated in the same manner as conventional refuelling stations from the perspective of land use plans and zone prohibitions.

For such a treatment to be possible, a clear distinction between large scale (industrial) and small-scale production should exist in legislation and the latter applied to HRS with hydrogen production.

The BAT-study that VITO is performing for the Flemish region should be finalized as planned and should be implemented in the VLAREM legislation afterwards, as quickly as possible. Attention should be payed to the specific case of a multi-fuelling station in which hydrogen is supplied in combination with conventional fuels. Similar exercise outcomes should be implemented in the Walloon and Brussels' relevant legislation.

For mobile refuellers or other test equipment, a quick procedure should be developed. For a mobile refueller that is to be used at different locations, one single environmental permit together with a short procedure to check the feasibility of the exact location would help a lot.

3. Hydrogen quality requirements and -monitoring in hydrogen refueling stations

3.1 Overview and assessment of the current legal framework

The purity requirement for hydrogen varies according to the use for which it is intended. Fuel cells used in road transport require high hydrogen purity to prevent catalyst poisoning. There are two international standards covering the subject:

- ISO 14687–2:2012 specifies the quality characteristics of hydrogen fuel to ensure uniformity of the hydrogen product as dispensed for utilization in proton exchange membrane (PEM) fuel cell road vehicle systems. Currently the quality standard has 13 gaseous impurities levels specified.
- SAE J2719_201511 provides background information and a hydrogen fuel quality standard for commercial proton exchange membrane (PEM) fuel cell vehicles

The AFID (**Alternative Fuels Infrastructure Directive)** makes a direct reference that the hydrogen purity dispensed by hydrogen refueling points shall comply with the technical specifications included in the ISO 14687-2 standard. However, this standard is costly to implement, measure and enforce, since only a few independent laboratories in the world can perform all measurements necessary. In other words, the purity of hydrogen for FCEV cannot be guaranteed because the required measurements to show compliance with the standard are expensive/not available.

It is in the interest of all those involved in building the market for hydrogen and FCEVs to develop standards accepted by everyone and develop and improve technologies

Following ISO 14687–2:2012, the H2 provider must have a very “robust” and performing quality assurance system. The companies engaged in proposing new H2 production technologies and/or HRS technologies must invest in high performance “quality assurance” for the H2 produced and/or delivered.

Three new standards are currently under construction:

- **ISO 14687:2018** - expected to be published in late 2018- revision of the ISO 14687 – 2:2012 which was judged to be too restrictive.
- **ISO 19880-8** which is specifying the quality assurance and control protocol for ensuring the requirements of the ISO:14687 norm.
- **EN 17124:** Hydrogen fuel - Product specification and quality assurance (European scope), which is currently in prEN phase.

In practice measurement is done on key contaminants which are systematically monitored, however, due to the associated costs, not all contaminants named in the norm are checked.

The presence of contaminants is dependent on the source or the production method of the hydrogen. Some contaminants are not expected in a specific production process (SMR, byproduct from chlorine electrolysis, water electrolysis). Also, certain components in the installation can prevent the occurrence of certain impurities in hydrogen gas, so that measurement of these components becomes redundant:: e.g. a DeOxo removes oxygen but also adsorbs Sulphur (Sulphur acts as a catalyst poisoner in FCEV).

In the European projects EPMIR and MetroHyVe, the search for better analytical measuring methods is currently under investigation.

3.2 Conclusions

In practice quality measurement is done on key contaminants, however, due to the associated costs, not all contaminants named in the norm are checked.
The risk for presence of contaminants depends on the production method of the contaminant.
In Belgium, the quality control of hydrogen in refueling stations is not legally mandated.
The “Alternative Fuels Infrastructure Directive” (AFID)” has been transposed for Belgium into “the National Policy Framework Alternative Fuels Infrastructure Belgium”[12]. This is a plan for rolling out infrastructure but does not contain any binding targets or legislation (yet). There is no mentioning of any standard.
There is also no organization appointed to check the compliance of the hydrogen quality with the ISO-standards.

3.3 Policy Recommendations

All EU-MS should legally recognize the same standard within their national legislation, ideally by reference to the Alternative Fuels Directive. This will create a clear, stable and coherent regulatory environment.

Specifically for Belgium, a clear legislative framework should be set up regarding hydrogen quality: the appropriate standard should be recognized in the national legislation regarding alternative fuels

The number/type of contaminants to be monitored might be prescribed differently for different production methods of the hydrogen, in case this production method is uniquely defined, and the source of externally supplied hydrogen is guaranteed.

[12] National Policy Framework Alternative Fuels Infrastructure Belgium 16/11/2016

4. Shipping

The Commitment by the IMO to reduce CO_2- emissions (50% reduction by 2050) and the rules on other emissions such as sulphur[13] requires the maritime sector to look at hydrogen or hydrogen-based fuels, along with other low emission alternative fuels to power the world shipping industry of the future. As stated in a study carried out by the UMAS consultancy for environmental association Transport & Environment[14], the alternative option of LNG can help to meet the 2020 sulphur cap. However the resulting GHG reduction is only in the order of 6% (not including methane slip).

The regulatory and administrative issues related to the use of Hydrogen and Hydrogen fuel cells for maritime applications comprise the:

- design and type approval of Hydrogen (fuel cells) vessels
- procedures for individual vessel registration
- requirements for landing and bunkering installation
- requirements for operation and maintenance
- rules surrounding on-board transport of hydrogen

4.1 International framework

4.1.1 Approval of ships

The regulatory framework is different for the maritime (sea-faring) sector compared to the inland shipping sector. Regulation in the maritime sector is governed at international level by the IMO (International Maritime Organization), while inland shipping is regulated on European, interregional and regional level.

MARITIME (sea-faring) SHIPS:

The responsible authorities providing design/type approval for vessels are, in most cases, the National Maritime Authorities of each individual flag state (or in other cases, Coast Guard or any other designated authority under the national ministry of transport). Their approval, however, is often based on the assessments performed by international classification societies. Classification societies approve vessels in accordance to their own rules and regulations on behalf of the flag state, drawing *inter alia* upon the legislation in place at IMO level, international standards and national / regional regulations.

At the International level, the International code for safety of ships using gases or other low flash-point fuels (**IGF Code**)[15] contains mandatory provisions for arrangement, installation, control and monitoring, equipment and systems using low flashpoint fuels. The Code is mandatory under the International Convention for the Safety of Life at Sea (SOLAS).

As Hydrogen has a flashpoint below 60°C, the IGF code generally applies. Nevertheless, Hydrogen as a fuel and Fuel Cells are not specifically addressed in the IGF code; the code is initially focusing on LNG.

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13 Sulphur content in the fuel is already limited to <0.1% in SECA (Sulphur Emission Control Areas) zones and will be limited to < 0.5% worldwide from 2020 on. To reach these targets 3 options are available: (1) use of current high sulphur-containing fuels combined with scrubbers to "wash" the exhaust, (2) "new fuels" i.e. conventional fuels that are further desulphurized and (3) alternative fuels

14 https://mobile.worldmaritimenews.com/archives/255779/study-lng-as-marine-fuel-expensive-distraction-for-eu/

15 Resolution MSC.391(95) (adopted on 11 June 2015)

As such, the use of hydrogen as a fuel and hydrogen fuel cells is not explicitly covered by IMO rules. The regulatory gap applies to both propulsion (main or auxiliary) as well as the use of HFC for heating, cooling and other power generation purposes. Continued work has been agreed under the IGF Code working group, on E.g. fuel cells and methanol.

In the absence of specific provisions, according to the IGF code, the use of other low flashpoint fuels including hydrogen can be **approved based on alternative design**[16].

The **Alternative Design Assessment** is regulated by the convention of life at Sea (SOLAS II-1/55). The alternative design is the process by which the safety, reliability and dependability of the systems must be demonstrated to be equivalent to that achieved with new and comparable conventional oil-fueled main and auxiliary machinery. The equivalence of the alternative design shall be demonstrated by a risk-based approach as specified in SOLAS regulation II-1/55 and approved by National Maritime Authorities.

The absence of specific rules for the type/design approval of hydrogen fuel cells vessels is a major obstacle for the commercial deployment of hydrogen fueled vessels in the maritime sector. The "alternative design process" is currently the only means for approval of hydrogen vessels. This process implies much higher cost, regulatory uncertainty and delays (estimation of more than one extra year for approval, as compared with other, more established technologies).

<u>Vessels operating on inland waterways</u>

In contrast to the maritime sector, the regulation for inland operating ships is defined on **European level**:

- The **Rhine Vessel Inspection Regulation** (RVIR) issued by the **Central Commission for the Navigation of the Rhine (CCNR**), for the navigation on the River Rhine. The CCNR- with central office in Strasbourg- includes 5 member states: the Netherlands, Belgium, France, Germany and Switzerland.
- **EU Directive 2016/1629/EU**[17] defines the technical rules and requirements for inland waterway vessels to be allowed to navigate on the Rhine and main other EU waterways. The technical requirements for inland vessels in EU are aligned with the requirements that are valid on the Rhine.
- The **European Agreement Concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN)** specifies the conditions for the transportation of dangerous goods via inland waterways (including LNG).

The European Standard for Transport on inland navigation vessels elaborated by CESNI[18], ES-TRIN provides general provisions for low-flashpoint fuels (Ch. 30; Annex 8).
EU Directive 2016/1629/EU refers to the **recommendations of the CESNI Working Group** to issue special permits for new technologies such as hydrogen.
The equivalence of safety shall be demonstrated by a **risk assessment**.

As a result, the legal situation of design approval of inland vessels containing hydrogen as a fuel and hydrogen fuel cells used for propulsion or auxiliary power appears to be similar to that described in the previous section on maritime vessels in the sense that it is characterized by the absence of specific rules which allow the design approval of such vessels. In the absence of clear and transparent rules, hydrogen fuel cell vessels require **individual risk assessment to prove equivalence of safety**, a process that is **expected to be lengthy and costly, therefore unsuitable for commercial deployment.**

[16] IGF code chapter 2; 2.3.2 and 2.3.3 "

[17] This directive replaces the Directive 2006/87/EC as of October 2018.

[18] CESNI is the European committee for drawings up standards in the field of inland navigation. It was established in June 2015 as the European Committee of the Central Commission for the Navigation of the Rhine (CCNR)

4.1.2 Bunkering

In most countries, requirements for bunkering of hydrogen as a fuel on-board the vessel are not yet developed. It is likely that, for now, general rules for storage of hydrogen and rules covering HRS would apply. It is worth noting that, given the high energy demand of medium to large vessels, the **quantities involved will be in the order of several tons**, hence hydrogen storage facilities would likely be subject to significant obligations and requirements (SEVESO).

In the **IGF code** (IMO) **only bunkering of LNG** is described.

Further risk studies and technology qualification is required for the establishment of specific regulatory guidance covering liquid and compressed gaseous hydrogen for landing and bunkering installations, hence **specific regulatory solutions to this regulatory gap are years away**.
Although there is limited practical experience, the lack of clarity as to the applicable rules further reinforces the **severity of the administrative barriers faced by the introduction of hydrogen as a fuel in the maritime sector.**

4.2 Specific situation in Belgium

The maritime sector is a federal competence, whereas inland shipping is a regional competence since Jan 1, 2015 (due to the 6th state reformation).

For the maritime sector:
Belgium has been an IMO (International Maritime Organization) council member for many years.

Consequently, our country is directly involved in shaping and designing maritime transport conventions.
The Belgian regulatory framework for sea-going vessels is the "Maritime shipping inspection regulation" [19], including all criteria for marine equipment as defined by the IMO and the European normalization institutes.
As explained in the European framework paragraph, the alternative design approval procedure is accepted by the IMO as a valid procedure for ships with alternative fueling technology.
In Belgium, the **Federal Public Service for mobility**[20] is responsible for checking the compliance with applicable legislation.

For inland navigation:

Due to the transfer of competences from the federal level to the regions concerning inland navigation, the regions have to take up an active role in the central commission for the navigation of the Rhine. The **regional departments of mobility** are responsible.

The procedure for approval of a ship with alternative fuel such as hydrogen is as follows:

For each individual ship **recommendations from the CCNR and the ADN safety commission** are required.
First a risk analysis and design optimization has to be done, with the help of a classification company.
Then the responsible representatives from the regional inland shipping commissions have to request for approval in the CCNR and subsequently at the ADN safety commission.
Since these commissions only meet a few times a year, the whole procedure costs a lot of time.

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[19] Cfr KB of July 20, 1973; "Zeevaart-inspectiereglement" / "règlement sur l'inspection maritime"

[20] "Directoraat-Generaal Maritiem Vervoer"/"Directorat General Transport Maritime"

Pilot projects

One existing passenger ship in Belgium (Hydroville)- operating on the Scheldt between Antwerp and Kruibeke- has been approved as a sea-going vessel. The choice for the categorization under "maritime" vessels was made because of the less complex legal requirements, i.e. the option to go for an alternative design process, that allowed a shorter throughput time. The Scheldt officially has a semi-maritime character, such that the maritime legislative framework can apply.

Additionally, the ship is also approved as a vessel that operates 100% within national waters, such that international rules are not applicable and it can be categorized as a "national passenger ship" for which a specific set of requirements and norms defined[21].

An independent classification society has reviewed the complete design and investigated the risks. They have investigated the risks (HAZID), and all identified risks are included in the design (HAZOP).

4.3 Conclusions

Hydrogen vessels:
The absence of specific rules for the type / design approval of hydrogen fuel cells vessels is a **major obstacle for the commercial deployment of HFC in the maritime and inland navigation sectors**.

The alternative design process is currently the only means for approval of HFC vessels for maritime use. This process implies much higher cost, regulatory uncertainty and delays (estimation of more than one extra year for approval[22], as compared with other, more established technologies).

In the absence of specific rules, the deep decarbonization of the maritime sector, as agreed by the EU Marine Directive (70% reduction of GHG emissions by 2050) and the IMO (50% reduction of GHG emission by 2050) is in danger of becoming unattainable, as LNG and LPG technologies cannot achieve such a deep reduction in GHG on their own.

Considering an average lifetime of 30 years of vessels, the deployment of HFC vessels needs to take off, at an accelerated pace, from 2020 to meet the demand for new, greener, vessels and have a chance to realistically meet the commitments made.
However, given the lengthy procedures at IMO level and the absence of any on-going procedure to negotiate codes covering hydrogen fuel cells, a specific, international regulation for the sector is years away.

A concerted effort is necessary by all regulatory actors involved to put the matter on the agenda of the IMO and establish codes and regulations in time for commercial deployment of the technologies.

Similarly, the development of specific rules allowing for the type approval of hydrogen and HFC vessels for inland transport in EU waterways is needed for this sector to develop.

Bunkering:

The lack of clarity of the application of existing rules (e.g. bunkering / landing of low flashpoint fuels; general rules for the storage of hydrogen, etc.) has significant time and cost implications, which may discourage

[21] KB of nov 12, 1981 on requirements for passenger ships that do not make international trips and only operate in a limited zone along the coast.

[22] Estimation based on the experience of the Maranda project (Finland)

ports and shipping companies from establishing landing/bunkering facilities. Lack or slow development of such facilities will hinder the deep decarbonization of the maritime sector.

If the deployment of HFC vessels is to take off and accelerate from 2020, it is urgent to make provisions to remove this barrier and facilitate development of land-side infrastructure.

A concerted effort at national and international level is necessary to address this challenge and enable commercial deployment of hydrogen and fuel cell technologies in the maritime sector.

4.4 Policy Recommendations

Vessels:

Efforts to **adapt the IGF code to cover explicitly hydrogen fueled** vessels should be accelerated. All relevant stakeholders should come together for a concerted effort to put the topic on the agenda of the IMO and aim for **hydrogen specific amendments to the IGF-code** as soon as possible. Belgium can help as IMO member to accelerate the process.

For inland shipping, representatives of the three regions should actively promote development of hydrogen specific legislation in the CCNR. Realization of pilot projects on hydrogen fueled inland vessels are required to accelerate the process.

Bunkering installations:

Efforts to develop specific procedures and documentation requirements for hydrogen landing/bunkering installations should be put higher on the agenda. Legal-administrative procedures should be developed in parallel with technical pilot projects, to facilitate safe deployment and wider uptake of the new technologies.

5. Incentives for hydrogen vehicles: cars, buses, trucks

The ambition is to install a network of hydrogen refueling stations for road transport, but at the same time the number of hydrogen mobility users should grow to provide a sound customer base for these stations.
A strong environmental policy and supportive legal conditions are key in facilitating the market entry of hydrogen powered vehicles.
Quantitative targets on renewables in transport at European level, transposed to national legislation, are developed to stimulate the roll-out of zero emission vehicles and related infrastructure.
Specific support measures and grants for the acquisition and use of zero emission vehicles are required at national level to motivate different mobility users (cars, buses and heavy duty) to make the switch from conventional vehicles.

Public authorities can lead by example by choosing clean vehicles over traditional ones. These vehicles can have a strong visibility (e.g. by decorating them with pictures and promotional lettering to encourage the public) and can demonstrate to the general public that e-mobility is not a vision anymore but a reality.

5.1 European framework

Quantitative targets on renewables in transport at European level are put forward in the **Renewable Energy Directive**[23], of which the revision (REDII) is nearly finalized (final text at the end of 2018).
The RED sets targets for renewable energy consumption, including a **sub-target mandating 14% of energy used in transport** to be produced with **renewable sources by 2030** (in each member state).
Given the overall sub-target of 14% renewable fuels and the maximum on conventional biofuels set at 7%, the implicit target for advanced alternative fuels is 7%. “Advanced fuels” comprise bio & waste-based fuels of the second generation, electricity, all types of e-fuels including hydrogen and recycled carbon fuels. The REDII will be transposed into national legislation by mid 2020.

The most important directives aimed at creating framework for granting various financial- and non-financial incentives for hydrogen powered vehicles are the **Alternative Fuel Infrastructure Directive** and the **Clean Vehicle Directive**.
Directive 2014/94/EU [24]**on deployment of alternative fuels** infrastructure aims at developing a market for alternative vehicle powertrains, fuel technologies and infrastructure and mandates the Member States to grant direct or tax incentives for the purchase of private and public alternative fuel vehicles (AFVs) and the building of infrastructure, facilitating fuel supply authorization processes and preferential access to parking and lanes for AFVs. Each Member State shall submit to the Commission a report on the implementation of its national policy framework by 18 November 2019, and every three years thereafter. Those reports shall include inter alia information about the undertaken policy measures, such as:

- direct incentives for the purchase of AFVs or for building the infrastructure,
- availability of tax incentives to promote AFVs and the relevant infrastructure,
- use of public procurement in support of alternative fuels, including joint procurement,
- demand-side non-financial incentives, for example preferential access to restricted areas, parking policy and dedicated lanes.

For Belgium this is “the **National Policy Framework Alternative Fuels Infrastructure Belgium**”[25].

[23] Clear description of REDII proposal can be found in https://www.theicct.org/sites/default/files/publications/EU_Fuels_Policy_Update_20180719.pdf

[24] Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure

[25] National Policy Framework Alternative Fuels Infrastructure Belgium 16/11/2016

The Alternative Fuel Infrastructure Directive does not oblige Member States to build hydrogen refueling infrastructure, it is up to national policy makers to include hydrogen refueling points in their national policy frameworks and promote hydrogen powered vehicles.

Another EU legislative act concerning this matter is **Directive 2009/33**[26] **(Clean vehicles Directive)** that aims at incentivizing different procurers to invest in environmentally friendly vehicles. The Directive is transposed into national legislation of the partner countries[27]. However, an evaluation carried out in 2015 showed that the results have been limited. In November 2017, the EU Commission proposed a **revision** of this Clean Vehicles Directive (COM 2017(653)). The proposal provides a definition for *clean* light-duty vehicles based on a combined CO_2 and air-pollutant emissions threshold; for heavy-duty vehicles, it gives a definition based on *alternative fuels* (electricity, hydrogen, natural gas including biomethane). It sets out **minimum targets for clean vehicle procurement** by 2025 and by 2030 differentiated by Member State and by vehicle segment categories according to combined CO_2-air pollutant emission-thresholds (light-duty vehicles) and alternative fuels (heavy-duty vehicles).

The **support measures** in the different members states mainly consist of **tax and registration fee reductions and exemptions and purchase grants**. Toll charge exemptions are in place only in a few countries. The public procurement rules for acquisition of low emission vehicles are also not a widespread used support instrument. In several countries, the local authorities may provide privileges for FCEVs such as access to bus lines and free/reduced parking in public parking spaces.
The existing support mechanisms are fragmented and mainly aimed at battery electric cars.

5.2 Overview and assessment of the current legal framework in Belgium

5.2.1 Incentives on regional level

For purposes of achieving their energy and climate policy goals, most EU members states have adopted several support schemes for stimulating the market of electric, or low (zero) emission vehicles. The FCEVs are legally defined as low (zero) emission vehicles and can benefit from the same financial and non-financial incentives established for electric vehicles.
In the table below, an overview is given of the incentives in the three Belgian regions.
On the next page the existing zero-emission measures and targets are compared for the regions.

	Flanders	Wallonia	Brussels
Incentives			
Exemption from registration tax for cars	x (zero)	x (min. rate)	x (min. rate)
Exemption from annual circulation tax for cars (unlimited in time)	x (zero)	x (min. rate)	x (min. rate)
Purchase grant for zero-emission cars (5000€)	x		
Ecology Premium for companies for investments in environmentally friendly and/or energy-efficient technologies (www.ecologiepremie.be).	x		

[26] Directive 2009/33/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of clean and energy-efficient road transport vehicles

[27] 20 december 2010 - Koninklijk besluit inzake de bevordering van schone en energiezuinige wegvoertuigen in het kader van overheidsopdrachten.

	Flanders	Wallonia	Brussels
Zero-emission (ZE) targets			
Public transport	From 2025 all new buses ZE in 13 Flemish center cities	From 2030 all new vehicles on alternative fuel (ZE + CNG)	From 2030 all new vehicles are ZE.
Low emission Zones (LEZ)	On city level: Antwerp (installed) Gent, Mechelen (announced 2020)	On city level: Liège (announced 2020)	On regional level. (installed)

5.2.2 Framework and incentives on federal level

The **deductibility rate from corporate income of expenses related to the use of company cars** is 120% for zero-emissions vehicles and 100% for vehicles emitting between 1 and 60g CO_2/km. Above 60g CO_2/km, the deductibility rate decreases from 90% to 50% progressively.
The “benefit in kind” calculation is dependent on the CO_2 performance of the car.

The Belgian toll system for vehicles over 3,5 ton currently has no exemptions for clean vehicles.

The principle of promoting environmentally friendly vehicles for **public acquisitions** has been defined in the KB of December 20, 2010 (cfr chapter 2.1). The circular 307 Sexies[28] of April 21, 2007, gives quantitative targets for the purchase of low-emission vehicles by the federal government: for departments with more than 20 vehicles, at least 5% of the new vehicles should be electric, hybrid or CNG. Every year this percentage increases with 5% until a percentage of 25% is reached.

In the **revision of the Clean Vehicles directive**, the minimum public procurement targets per Member State and per vehicle segment are given for 2025 and 2030. For Belgium it says that 35% of the light duty vehicles should be below the threshold emission level[29] in 2025 and 2030; for buses at least 50% in 2025 and 75% in 2030 should be below the threshold; for heavy duty it should be 10% in 2025 and 15% in 2030.

In the **inter-federal energy agreement**[30] as signed between the three regions at the end of 2017, there are also targets concerning mobility and public transport, which are more stringent than those put forward for the different regions, i.e. buses and public transport should be zero-emission from 2025 on. Implementation of this agreement, which is a vision document, is not translated yet into specific targets or action plans for the regions.

5.3 Conclusions

The implementation of the REDII targets on renewable energy consumption in transport in Belgium during the coming years will be crucial for hydrogen (and derived e-fuels). If hydrogen as a technology for mobility can prove to have distinctive advantages compared to the other “advanced” fuels, these targets will help to further develop the market.

[28] https://gidsvoorduurzameaankopen.be/sites/default/files/content/download/files/20170511_307sexies.pdf

[29] A combined CO2 and air-pollutant emissions threshold as can be found in http://www.ipex.eu/IPEXL-WEB/dossier/document/COM20170653.do. In 2030 the threshold is zero, both for CO2 and other pollutants. For 2025 intermediate values are put forward.

[30] https://www.tommelein.com/wp-content/uploads/bsk-pdf-manager/Visienota_-_BE_Interfederaal_Energiepact_209.pdf (Dutch text)

Several financial incentives exist in Belgium for hydrogen cars, identical to those for electrical cars. In Flanders more incentives are available than in Brussels or Wallonia (purchase grant and ecology premium).

Zero emission targets for public transport exist in the three regions, with the most stringent one being the target for Brussels (all new vehicles in public transport are zero emission by 2030). A recent inter-federal agreement puts forward the date of 2025 for public transport to become zero-emission.

The first low emission zones are appearing, Antwerp and Brussels already have it installed, other cities will follow around 2020.

The main driver however for further uptake for hydrogen mobility is the availability of fueling infrastructure.

5.4 Policy Recommendations

Transpose the Renewable Energy Directive II to national Belgian legislation in such a way that the different technologies are equally treated and can develop properly in their target segments.

Maintain a consistent implementation of **incentives for zero emission vehicles** and infrastructure for a sufficiently long period.

Green public procurement policies favouring zero emission vehicles should be a significant and positive driver for vehicles sales. The implementation of zero-emission vehicles by public bodies creates the initial demand for refueling stations which are pre-conditions for making FCEVs more popular among individual car users and private fleet managers.
Support the EU Commission proposal COM 2017(653) for revision of Clean Vehicles Directive, strengthen the public procurement and introducing a common definition of clean vehicles based on a combined CO2 and air-pollutant emissions threshold for light-duty vehicles and on alternative fuels for heavy-duty vehicles. Additionally, set up related minimum procurement targets for all vehicles.

The use of **alternative fuel vehicles in captive vehicle fleets** (utilities, taxis, postal operators or delivery companies) is another option to increase the share of FCEVS in the total vehicle fleet since technical or logistical problems of supplying vehicles with hydrogen fuel are easier to solve. Companies possessing fleets normally have the capacity to develop a purchasing policy for clean vehicles.
Specifically for Belgium with its large number of **company cars**, setting stringent targets on the number of zero emission cars in the fleet or making the fiscal regime much more dependent on the CO_2-performance of the cars, can be a good way to increase the number of zero-emission vehicles.

Put in place **demand-side non-financial incentives**, for example preferential access to restricted areas, parking policy and dedicated lanes.

For heavy goods traffic the **toll charge is a decisive cost factor**. The use of low-emission trucks could be made more attractive by a significant toll charge reduction compared to diesel trucks.

In Flanders there is the **Zero Emission Bus platform**, that unites market players and local authorities in the total eco system (transport operators, bus manufacturers, energy suppliers, electrical loading infrastructure and research institutes) to exchange best practices from all over Europe and to develop a vision for Flanders regarding Zero Emission bus transport. Recently, a number of recommendations have been published[31]

[31] http://platformzeb.be/2017_05_01/wp-content/uploads/2018/07/20180316-Beleidsaanbevelingen-ZEB-def.pdf

mostly focused on battery-electric buses. In the next phase, **hydrogen buses should be explicitly part of the platform** and the complementary character with respect to the BEV's (increased autonomy for longer distances) should be specifically addressed in the plans.

For the other regions (Brussels and Wallonia) a similar platform can be set up.

Support the installation of hydrogen infrastructure (as also described in H2-Flanders and H2-Wallonia roadmaps)[32]: A covering network of refuelling stations should be installed the coming years.

Enable and support extensive **pilot projects** on buses and heavy-duty vehicles.

[32] H2 Flanders study by WaterstofNet and Hinicio, https://www.energiesparen.be/sites/default/files/atoms/files/Rapport-Vlaams-potentieel-groene-waterstof.pdf

Wallonia roadmap by Cluster Tweed, https://www.slideshare.net/cluster_tweed/roadmap-hydrogne-pour-la-wallonie-cluster-tweed/cluster_tweed/roadmap-hydrogne-pour-la-wallonie-cluster-tweed

6. Injection of hydrogen from renewable energy sources in the gas grid

The Power to Gas (P2G) process chain links the electric power grid with the gas grid by converting (surplus) electric power into hydrogen and direct injection of H2 into the gas grid at either the Transmission level (TSO) or Distribution level (DSO). The alternative to direct H2 injection is to create a grid compatible gas via a conversion of H_2 to CH_4 via methanation to create substitute natural gas (SNG), which can be injected into the existing gas grid (or into gas storage systems, used as CNG motor fuel, or utilized in natural gas facilities).

In all cases, the main limitation at present is typically the concentration of hydrogen allowed in the natural gas streams entering and carried in the national gas grid networks.

6.1 Overview and assessment of the current legal framework

There is no legal framework existing in Belgium for the injection of hydrogen into the gas transmission and distribution network. There are gas quality requirements in place defining the characteristics of the natural gas in the transport grid (PCS, Wobbe density..), but the hydrogen content is not specified in these requirements and no measurement/detection of hydrogen is in place.

The following legislative gaps have been identified:

- **The maximum allowed H_2 concentration in both the transmission and the distribution grid is not defined**:

  As a general principle, under current TSO grid network operation at higher pressures and using metal pipes, the allowed level of hydrogen will be relatively low (and lower than local distribution networks) for operational safety and avoidance of embrittlement effects on metal pipe and compatability with compression station equipment. In several EU countries an upper limit for the hydrogen content in the gas is defined; values vary from 0,01 to 10 volume-percent. In Belgium there is no limit defined.

  On DSO level, the allowed hydrogen concentration might be substantially higher. A recent study of KIWA for the Netherlands[33] indicated that the current gas distribution network would not experience any significant influence of hydrogen. Under the typical DSO conditions, the used materials (steel, PE and PVC) are not expected to degrade. The main attention point is the low energy density of hydrogen that would lead to a significantly higher volume to be transported (at equal energy demand), which requires adaptation of the gas meters. In Belgium, we expect similar conclusions but there is no clear analysis done yet.

  Also the end-user applications connected to the distribution network, ranging from domestic cooking and heating appliances to industrial equipment and mobility applications (CNG), are affected by a higher hydrogen content. The key concern for gas network operators (primarily the DSO) and appliance makers is the threshold at which overall appliance design and individual component changes will need to be made. A variety of studies have recently been made around this issue and research results in Germany have shown that operation of gas appliances with hydrogen admixture up to 10 vol.% is possible without adaptation of the devices. Only for CNG tanks of the older generation a limit of 2 vol% should be adopted.

[33] https://www.netbeheernederland.nl/_upload/RadFiles/New/Documents/Kiwa%20-Toekomstbestendige%20gasdistributienetten%20-%20GT170272%20-%202018-07-05%20-D.._.pdf

For higher contents and especially for pure hydrogen networks, significant adaptations to end-user installations are necessary.

- **The legal framework for injection of injection in the gas network is not defined; many operational questions must be answered as for example:**
    - Who is the owner of the injection facility?
        - The opportunity for a TSO/DSO to take ownership and control of connection/ injection facilities is specifically restricted under the unbundling arrangements implemented through EC legislation. A TSO/DSO is currently not allowed to be a producer of hydrogen or to be the power to gas injection facility owner. Currently, a P2G plant cannot become part of the regulated asset base of a TSO or DSO. However, with the permission of the regulator, the TSO could own & operate the P2G plant as long as it is not involved in the commercial hydrogen activity (buying electricity to convert into hydrogen & then selling that hydrogen).
        - Additionally, the draft of the new electricity directive indicates that the TSO is allowed to operate a P2G plant if the market is not interested
    - How to obtain permission to inject hydrogen?
        - As the whole regulatory framework for injection of hydrogen into the natural gas grid is non-existing, there is no obligation for the TSO to accept injected hydrogen.
    - Interconnection with other countries
        - Regulation must also be adapted for cross-border acceptance of hydrogen in the grid.
    - What are the specific responsibilities of the injecting party and the DSO/TSO?
    - What are specific requirements or additional equipment needed compared to a (regular) connection for natural gas injection in the grid? What is the impact on the rest of the grid and downstream consumers?
    - How are costs attributed between the parties?

- **There is no uniform, binding guarantee of origin certification system for hydrogen established at European level.**
    - The certification of the green character of hydrogen made from renewable energy is important for its further valorization. If GoO's for green hydrogen production can be traded, this will improve the business case for hydrogen projects. Especially for hydrogen injected in the natural gas grid for which the value is relatively low (= value of natural gas) this is essential.
    - Private initiatives exist in some countries: in Belgium there is Air Liquide that supplies "green" hydrogen certified by Vinçotte i.e. hydrogen as a byproduct from the chlor-alkali production process which is supplied by green electricity.
    - The CertifHy project is the first attempt to create an EU-wide guarantee of origin (GoO) scheme for low-carbon (i.e. "blue") and renewable (green) hydrogen.
    - In Belgium, a GoO & green gas register is currently being developed to accommodate the first biomethane injection which is planned in Q4 2018. This register will be able to manage GoO for renewable hydrogen as well.

Some of these legislative gaps require coordinated actions across the borders, other issues can be solved on regional/national level.
As a benchmark, Germany has the clearest technical framework for hydrogen gas supply.

6.2 Conclusions

A legal framework for injection of hydrogen in both the transmission and distribution gas grid is missing in Belgium. Both the technical aspects -what is the allowed hydrogen concentration in the grid- as the operational aspects are not defined.

A system of "guarantees of origin" for green hydrogen is not yet established but is essential for the valorization of renewable hydrogen injected in the gas grid.

6.3 Policy Recommendations

- **Follow-up the CertifHy project and ensure a quick implementation** of the certification of origin system into National Legislation once the system has been established at European level. Make sure it is in line with the needs of other green gasses (SNG; biomethane)

- **Review relevant technical and gas quality issues for injection in the Belgian gas network** and establish legal pathways to support Power-to-Gas operations and increased hydrogen use in gas networks.
  In some countries, such as France and Germany, demonstration projects regarding gas injection are running and more experience with legislative issues is available. They can serve as an example for Belgian legislation for this topic.

- **Follow-up of the normalization activities** in this field is essential (establishment of international standards regarding all technical, quality and safety aspects).

- Establish a **coordinated review of billing arrangements, measurement and administrative requirements across EC Member States** to identify a coherent basis for modified billing arrangements for hydrogen – which would need to take account of the differing calorific value of hydrogen blends and potentially pure hydrogen in the gas grid.

7. Other topics

7.1 Measurement of hydrogen quantities

In addition to the measurement of hydrogen purity, there is a need for **accurate measurement of the mass of hydrogen** dispensed into the hydrogen vehicle. This is a very important measurement as it will allow the refuelling station operator to calculate the amount of hydrogen displaced into the vehicle to provide an accurate cost to the customer. **No methodology currently exists for calibrating flow meters for hydrogen** provided by refuelling stations (up to 875 bar and temperatures between -40 degrees Celcius and 85 degrees Celsius).

OIML R 139-1[34] provides guidelines for the accuracy and approach for testing flow meters at refuelling stations applicable to compressed gaseous fuel measuring systems for vehicles:

- The MPE (maximum permissible error) of mass indication *at verification* is +/- 1% of the measured quantity for the meter and +/- 1,5% for the complete measuring system.
- The maximum permissible errors apply for all gases to be metered, all possible ambient conditions of temperatures and pressures, and all flow rates for which the system or the meter is intended to be used.
- The MPE *during in-service inspection*[35] under rated operating conditions, is equal to 2 % of the measured quantity for the complete measuring system.

This is independent of gas, i.e. the same for hydrogen as for e.g. CNG, but due to the lack of experience with metering hydrogen at challenging refuelling conditions, **no existing primary standard or verified method is available.** Furthermore, due to hydrogen presenting very different characteristics compared to other gaseous fuels, OIML R 139-1 cannot be used for hydrogen as it is and a revision will be needed. Until these methods are developed there will be no traceability for hydrogen metering and thus no legal metrological control of hydrogen dispensers; this means that customers cannot be correctly charged and it is very likely that each station will have no real judgement of how much hydrogen they are dispensing. While metering of hydrogen is also an important issue, it has not been assessed by the Hylaw project in detail. The FCH-JU funded **project MetroHyve covers flow metering and is currently developing a metrological framework for testing hydrogen meters** used to measure the mass of hydrogen dispensed into a fuel cell vehicle from a refuelling station[36].

As long as this problem is not solved, the hydrogen filling stations are "semi-public" stations and only accessible for registered users (with a member card).

Alternatively, an arrangement with the federal public service of economy can be made to define the conditions under which the station can be fully public, even if the metering does not yet comply with the existing accuracy requirements. This approach has been chosen for one of the two existing HRS in Belgium.

7.2 Legislation concerning hydrogen pipelines

Legislation concerning transport of hydrogen via pipelines has not been studied in the Hylaw project. The reason for not including this subject is that today only two private players are involved in the construction and exploitation of H2 pipelines in Europe.

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[34] OIML = Organisation Internationale de Métrology Légale; International Organisation of Legal Metrology. The metrological and technical requirements stipulated in OIML R 139-1 and international standard SAE J2601 – Fueling Protocols for Light Duty Gaseous Hydrogen Surface Vehicles should be followed.

[35] "In service" refers to any period of time between verifications (refer to OIML D16, 2.25); National authorities may decide whether in-service inspections should be conducted and whether a different maximum permissible error should be applied during in-service inspection.

However, in a changing context with very large scale power-to-gas installations being announced, the need for new and larger H2-pipelines will come up and a legislative framework will be required.

Regulation of hydrogen transport through pipelines should be similar to regulation of natural gas and electricity transport today. This implies a clear **distinction between hydrogen transport activities and commercial hydrogen (buying and selling) activities**. Transport would be a regulated activity for which the tariffs are approved by the regulator (CREG) and the **Third Party Access principle**[37] is valid.

Regarding **technical requirements for hydrogen pipelines**, hydrogen is covered by the gas law[38] that defines the technical requirements for gas transport.

For the permitting of new pipelines the regional permitting procedures applies.

[37] Under the EU gas and electricity directives, each member state must introduce a system guaranteeing access by third parties to the gas and electricity transmission and distribution networks, a process known as third-party access. The member states are required to regulate such access. Ownership and operation of the networks is transferred to separate companies and independent network operators - a process known as "unbundling". The companies that are designated network operators are obliged to make third-party access available.

[38] The Gas Law, federal law of April 12, 1965 concerning the transport of gaseous products and others by pipelines