HyLAW

National Policy Paper – Belgium

Main Author(s): Isabel François

Contributor(s): Hylaw project team

The HyLAW project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 737977. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme, Hydrogen Europe and Hydrogen Europe Research.

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.

Disclaimer: The national policy papers reflect the views of the partner organisation (WaterstofNet), but does not necessarily reflect those of individual members. The organisation makes no representation or warranty, express or implied, in respect to the contents.

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 en 80-95% in 2050. This requires a deep decarbonisation of our energy supply and hence a massive transition from fossil to renewable energy. Two energy carriers promise to have the greatest possible impact when it comes to decarbonizing different sectors: electricity and hydrogen.

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 unknown.

For decades, hydrogen is used in industrial applications such as refineries or fertilizer production. In Belgium and the Netherlands, one of the largest hydrogen networks in the world is located.

In recent years, also in Belgium the first demonstration projects have been realized.
These projects were mainly focused on the use of hydrogen in transport: refueling stations, cars, forklifts, buses, garbage trucks. Currently three hydrogen refuelling stations are available in Belgium, in Antwerp, Halle and Zaventem; two of them are publicly accessible.
The first heavy duty trucks will be demonstrated in Flanders in 2018. The first hydrogen ship has been launched in 2017.
Belgium has a relatively large number of industrial players that are active in the hydrogen or renewable energy sector.

The ambition is to install a network of hydrogen refuelling 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, 22 hydrogen publicly accessible hydrogen refuelling stations (both 350 and 700 bar) are planned by 2020, 20 in Flanders, 2 in Wallonia and none in the Brussels-Capital Region.

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 and hydrogen refueling stations in particular
- The quality requirements for hydrogen fuel in fuelling stations
- The type 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 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.

2. Hydrogen refuelling infrastructure: permitting procedure and requirements

Hydrogen refuelling stations may exist in different configurations in terms of producing hydrogen as well as its delivery. Hydrogen can be supplied to the station by centralized supply of hydrogen by pipeline or transported to the station in tanks; it could also be locally produced by water electrolysis.

To obtain a permit for setting up and operating a hydrogen refuelling station, both the location (land use planning) and the environmental/safety aspects of the operation have to be dealt with.

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

2.2 Overview and assessment of the current legal framework in Belgium

2.2.1 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 a relevant level, with specific spatial plans and the responsibility for permitting for Class I installations[1]; in Wallonia and Brussels the province has no specific responsibility.

Flanders:

Land use plans exist in Flanders on different levels i.e. the region, province, municipality (GRUP, PRUP..).

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 a living area (question: is there a limitation in quantity?). However, the function of the installation should be compatible with or related to the functions in the area[2]. As a consequence, 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 living area. The criteria to assess the compatibility with the other functions in the area are described in the Flemish spatial planning codex[3] .
Also in industrial areas there should be compatibility with the functions in the area; 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 CNG stations.

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1 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.

2 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.

3 Vlaamse Codex Ruimtelijke ordening, artikel 4.3.1, §2 VCRO.

2.2.2 Permitting procedure

The permitting process for the development and operation of a hydrogen production plant is different in the different regions. In Flanders there is one “environmental permit” that unifies urban planning and environmental permits. In Wallonia and Brussels there are different permits.
The throughput time of the environmental permitting procedure on itself is limited in time – 5 months after submission of the request – 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. Furthermore, there are no simplified procedures available for small scale or temporary/mobile installations (e.g. mobile hydrogen refueling equipment).

A clear framework and specific requirements for hydrogen installations is missing, hydrogen is considered as a “dangerous gas” (cfr “VLAREM[4]” 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, for the Air Liquide station in Zaventem and the Colruyt station in Halle). This is un-efficient, 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[5]. 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 and the permitting process carries some “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, such as PGS35 in the Netherlands, will make this ad hoc safety assessment redundant. 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…

Currently a BBT study (“Best available techniques) is running in Flanders, that focuses on the measures required to operate a hydrogen refuelling 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.
The main goal of the study - to be finished in 2019- is to deliver solid advise for a specific hydrogen chapter within the VLAREM legislative framework.
This study is commissioned by the Flemish department of environment and is carried out by the Flemish knowledge centre for “best available techniques”, an initiative of the Flemish region and VITO. A stakeholders committee consisting of the department of environment, HRS operators and WaterstofNet ensures regular follow-up of the project.
Also mobile refuelers for demonstration purposes are taken into account.

2.3 Conclusions

There is **no principal restrictions for hydrogen refueling stations in land zoning plans** – even if it concerns on-site hydrogen production. A hydrogen refuelling station can be built in a living area, since it can be considered as compatible to the living function. However, the assessment of the compatibility allows room for interpretation. On the other hand, there is also no clear recognition of a hydrogen installation (based on water electrolysis) as an environmentally friendly production site, such that it is still considered as an

[4] "Vlaams Reglement betreffende de Milieuvergunning"

[5] PGS35: “Publicatiereeks Gevaarlijke Stoffen: Afleverinstallaties van waterstof voor wegvoertuigen

industrial installation. This limits the potential of HRS with on-site production to be located anywhere else other than industrial zones.

Currently there is no uniform procedure w.r.t. permitting requirements for hydrogen refuelling 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 this issue is running, with the BBT study commissioned by the department of environment that will deliver direct input for a specific hydrogen chapter in the VLAREM legislation.

2.4 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) have little environmental impact and generate little to no emissions, in contrast to large scale hydrogen production from natural gas through steam methane reforming .
It should be ensured that hydrogen refueling stations (with or without on-site production) are explicitly treated in the same manner as conventional refueling stations from the perspective of land use plans and zone prohibitions.
In order 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 production.

The BBT study running in Flanders should be finalized as planned and implemented in the VLAREM legislation. The same results should be implemented in the Walloon and Brussels' relevant legislation.

3. Hydrogen quality requirements and -monitoring in hydrogen refuelling 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 in order 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 has to have a very “robust” and performing quality assurance system. The companies engaged in proposing new H2 production technologies and / or HRS technologies have to invest in high performance “quality assurance” for the H2 produced and / or delivered.

ISO 14687:2018 Standard is currently under development and is expected to be published in late 2018. This standard is a revision of the ISO 14687 – 2:2012 which was judged to be too restrictive.

In practice measurement is done on key contaminants which are checked continuously, 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 cannot be present in a specific production process (SMR, byproduct from chlorine electrolyis, water electrolysis). Also certain components in the system can prevent the occurrence of certain elements in the hydrogen, to such low levels that measuring is not required anymore : e.g. a DeOxo (removes oxygen by adsorption) adsorbs also Sulphur.

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 is dependent on the production method of the contaminant.

In Belgium, the quality control of hydrogen in refueling stations is not legally mandated; in the Belgian translation of the AFID, there is no mentioning to any standard.

There is also no organization appointed that will check the compliance of the hydrogen quality with the standard ISO 14687-2.

3.3 Policy Recommendations

All EU-MS legally should 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.

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.

4. Shipping

The Commitment by the IMO to reduce CO_2 (50% reduction by 2050) and the rules on other emissions such as Sulphur (0.1%-0.5% limits) 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[6], 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
- The procedures surrounding individual vehicle registration
- The requirements for landing and bunkering installation
- The requirements for operation and maintenance
- The rules surrounding on-board transport of hydrogen

4.1 International framework

4.1.1 Type approval of ships

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, (i.e. under the scope of the International Maritime Organisation), the International code for safety of ships using gases or other low-flash point fuels (**IGF Code**)[7] contains mandatory provisions for arrangement; installation; control and monitoring; equipment and systems using low flashpoint fuels.

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 (natural gas as fuel is specifically covered).

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. This includes agreeing on the definition of the fuel cell system (n.b. natural gas fuel cells), however this does not include hydrogen powered fuel cells, which are not currently not on the agenda of the IMO.

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**[8].

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

[7] Resolution MSC.391(95) (adopted on 11 June 2015)

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

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-fuelled 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 fuelled 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).

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

Vessels operating on inland waterways

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). Special inland vessels are to be approved and periodically surveyed by a class society e.g. inland vessels carrying dangerous goods, passenger vessels, ferries, high speed crafts.

Although very little practical experience exists, the legal situation of type 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 characterised by the absence of specific rules which allow the type approval of such vessels. In the absence of clear and transparent rules, hydrogen fuel cell vessels require individual risk assessment in order to prove equivalence of safety, a process that is **expected to be lengthy and costly, therefore unsuitable for commercial deployment**

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 stemming from storage of hydrogen (see category 2) and rules covering HRS's (see category 4.4) 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 tonnes, hence hydrogen storage facilities would likely be subject to significant obligations and requirements (SEVESO).

Existing rules for safe handling of inflammable, reactive and pressurized substances (e.g. which cover *inter alia* LNG) currently apply, however, it is not certain how these would be adapted to hydrogen. From this point of view, this process is characterized by a clear **regulatory gap**.

When considering **liquid Hydrogen**, according to the EMSA Study on the use of fuel cells in shipping[9], current procedures for bunkering of LNG are based on cryogenic insulation, and double piping when going inside the vessel. Together with the experience from hydrogen filling stations for cars, this will be the first knowledge basis for all cases. **Further risk studies and technology qualification is needed**, both for liquid and compressed gaseous hydrogen. All pressurized components, such as tanks, piping and equipment, must be in compliance with EU Directive 97/23 – PED.

According to the EMSA Study, it is possible that nitrogen filling of voids/double pipes may be required or necessary. A water curtain on the ship side is required for bunkering of LNG according to IGF, and this will

[9] STUDY ON THE USE OF FUEL CELLS IN SHIPPING, EMSA European Maritime Safety Agency, DNV-GL 2017

likely be expected for liquid hydrogen as well. Material certification for the low temperatures is required for liquid hydrogen storage as well as gas dispersion, and safety analyses are also needed. The potential vapour dispersion in case of accidental LH2 release is another topic that needs further study.

For **compressed hydrogen,** the technology available for land transport needs to be qualified for larger filling volumes and relevant marine impacts. Further risk studies (including evaluation of gas leaks, gas dispersion and relevant consequences) are needed.

4.2 Specific situation in Belgium

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.

Existing legislation in Belgium:

For maritime transport : Maritime shipping inspection regulation ("Zeevaart-inspectiereglement"), including all criteria for marine equipment as defined by the IMO and the European normalization institutes.

For inland navigation:

Required: Exploitation permit and certificate of Belgian fleet or Rhine commission.

One existing ship in Belgium (Hydroville) has been approved as a sea-going vessel.
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).

In Belgium, the FOD mobility ("Directoraat-Generaal Maritiem Vervoer") is responsible for checking the compliance with applicable legislation.

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[10], 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 serious 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 in order to meet the demand for new, greener, vessels and have a chance to realistically meet the commitments made.

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

However, given the extremely 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 a) 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 in order 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 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, as agreed by the EU Marine Directive (70% reduction of GHG emissions by 2050) and the IMO (50% reduction of GHG emission by 2050).

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 develop a specific code covering 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 the adoption of an international code as soon as possible.

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 studies, 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 refuelling 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.
Incentives are required to motivate different mobility users (cars, buses and heavy duty) to switch to hydrogen.
Public authorities can lead by example by choosing clean vehicles over traditional ones. These vehicles have a strong visibility and can demonstrate to the general public that e-mobility is not anymore a vision but a reality.

A hydrogen vehicle is a vehicle that uses hydrogen as a fuel for motive power. The power engines of such vehicles convert the chemical energy of hydrogen to mechanical energy either by burning hydrogen in an internal combustion engine, or by reacting hydrogen with oxygen in a fuel cell to run electric motors.

5.1 European framework

At European level 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 [11]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 authorisation 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.

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

Another EU legislative act concerning this matter is **Directive 2009/33[12] (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[13]. However, an evaluation carried out in 2015 showed that the results have been limited. Public bodies are on average not using public procurement well enough to boost the market uptake of clean vehicles. Furthermore, the scope of the Directive is insufficient and definition of clean vehicles is lacking. Provisions for vehicle purchase are either vague (technical specifications) or overly complex (monetization of external effects). The Clean Vehicle Portal (www.cleanvehicles.eu) has been set up

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

[12] 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

[13] 20 december 2010 - Koninklijk besluit inzake de bevordering van schone en energiezuinige wegvoertuigen in het kader van overheidsopdrachten.

to support public procurement of vehicles, as well as to help private users in buying a cleaner and more energy-efficient car.

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).
The proposed revision would ensure that the Directive covers all relevant procurement practices, that it provides clear, long-term market signals, and that provisions are simplified and effective. 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 a number of 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 regional incentives.

	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		
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 for 2020)	On city level: Liège (announced for 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 environmental friendly vehicles for **public acquisitions** has been defined in the KB of December 20,2010 (cfr chapter 2.1). The circular 307 Sexies[14] 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 states and per vehicle segment are given for 2025 and 2030. For Belgium is says that 35% of the light duty vehicles should be below the threshold emission level[15] 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**[16] 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

Several financial incentives exist 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 one 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.

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

[15] 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.

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

5.4 Policy Recommendations

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 may be a significant and positive driver for vehicles sales. The implementation of zero-emission vehicles by public bodies creates the initial demand for refuelling stations which are pre-conditions for making FCEVs more popular among individual car users and private fleet managers.

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 CO2 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.

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; and setting up related minimum procurement targets for all vehicles.

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[17] 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.

Support the installation of hydrogen infrastructure (as also described in H2 Flanders and H2 Wallonia roadmaps)[18]:

- A covering network of refueling stations should be installed the coming years and
- Extensive pilot projects should be started for buses and heavy duty vehicles, with financial support of the authorities.

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

[18] H2 Flanders study by WaterstofNet and Hinicio, to be published ; Wallonia roadmap

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 H2 to CH4 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 computability with compression station equipment. In several EU countries an upper limit for the hydrogen content in the gas in 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[19] 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 effected 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.
  For higher contents and especially for pure hydrogen networks, significant adaptations to end-user installations are necessary.

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

- The legal framework for injection of injection in the gas network is not defined; many operational questions have to 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 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.

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.