HyLAW

National Policy Paper
Hungary

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1. Introduction and summary

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

Through extensive research, interviews and legal analysis, the HyLaw partners have identified the legislation and regulations relevant to fuel cell and hydrogen applications and also the legal barriers preventing their commercialization.

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

1.2 Policy Summary at national level: (Category-1) Hydrogen Production

At present there are some existing hydrogen production plants in Hungary with largely different production capacities. Nevertheless all of these plants serve chemical installations: refinery, chemical industry, fertilizer plant, and some smaller final users. Huge hydrogen production plants (HPP) like refinery, chemical, fertilizer plants use large scale on-site production process, while the smaller users (e.g.: glass manufacturing, hydrogen as cooling agent for generators) obtain the required hydrogen quantity from some industrial gas manufacturing companies which produce hydrogen at their own site and then deliver it by tracks to the endusers. It is common in both cases that at present hydrogen is produced via steam methane reforming (SMR) process in Hungary. This method can have considerable environmental impact moreover refinery's hydrogen plant can fall even under Emission Trading Scheme (EU ETS). Only very few domestic hydrogen is produced now via electrolysis: these are only laboratory scale productions and/or R&D phase prototype equipment. Hydrogen is produced for chemical purposes, and – except very few and small scale prototypes – not for energy storage, nor for fuel. A small scale, grid independent power-to-gas demo project is operating since about one and a half year and a relatively considerable power-to-gas demo project is under preparation, too. Therefore the resolving of the unintended legal-administrative barriers in this field might be a key issue in Hungary.

The most important legislation determining or influencing hydrogen production (and their EU correspondence) are: i) disaster protection (Seveso directive); ii) environmental impact assessment (EIA directive), iii) integrated environmental permitting and industrial emissions (IPPC/IED directive); and land use planning, with zone limitations for HPPs. Present legislation's common and probably most important problem is the lack of differentiation between the production methods. From the point of view of the mentioned orders and laws it is absolutely indifferent whether a traditional SMR method (with considerable environmental emissions) is used or a non-emitting method like water electrolysis with possibly renewable electricity. Land use zone classification does not differentiate according to the production method of H2 either. According to the land use zone limitations a HPP could only be installed in an industrial GIP zone, which could be seriously prohibitive for a smaller scale on-site hydrogen production application (like hydrogen refueling stations with on-site hydrogen production). Changing the land use zone classification at a given settlement is possible, but if it has to be made in every

case, it can be prohibitive, as modification of local land use plans is a very long and costly process.

The lack of clarity/inadequacy of these relevant national legislations is partly deriving from the lack of clarity/inadequacy of the relevant EU directives. An other reason is the historical assumption that production of hydrogen (as an industrial gas) is a chemical process, accompanied by harmful environmental emissions (which is not the case when hydrogen is produced via electrolysis).

Furthermore, there is no simplified process for small quantity H2 production in the authority procedures, which leads to a restrictive (environmental) procedure.

However good practices are existing in several Western European member states and already in several cities. Small or medium scale on-site hydrogen production plants could be permitted even in city centers (e.g. a 1 MW electrolyzer operates in Hamburg at a hydrogen refueling station in the city center.)

1.3 Policy Summary at national level: (Category-2 & 3) Hydrogen Storage and Transport

There is no large scale (centralized) hydrogen storage facility in Hungary at present. Huge industrial plants (like refinery) usually produce hydrogen but it will be used up immediately and no storage is needed. Storage of small or medium amounts (few hundred kilos) of hydrogen occurs in some domestic industrial plants. Compressed H2 gas storage in cylinders (and their road transport) is relatively common in Hungary and is task of some industrial gas companies like Linde and Messer at their production and commercial sites. Liquid hydrogen storage is not present in Hungary nowadays, and there is no LH2 trailer, no hydrogen liquefaction plant either. Hydrogen storage in metal hydride cylinders occurs in laboratory scale or in few hydrogen technology prototypes.

From legal point of view hydrogen storage is regulated mainly by disaster protection legislation, which implements the EU Seveso-III directive, but fire codes, technical safety (pressure equipment) and environmental permitting can be also relevant.

Considering hydrogen transport, ADR rules must be applied in Hungary, which is completely in line with ADR's international (EU) rules. The only and minor deviation from the international ADR rules is a lightening, which regards only the language of accompanying documents in case of domestic transport of dangerous goods (including hydrogen as well). None of the market players indicated, that there is worthwhile issue with the legal and administrative background of hydrogen transport. Besides, there are no ADR restricted tunnels or bridges in Hungary at the moment which could adversely affect the hydrogen transport routes.

There are no simplified processes for permitting small quantity H2 storage or demo projects in the disaster protection authority procedures. A simplified permitting procedure exist in the case of pressure equipment only but this is a general possibility and not hydrogen-specific.

Legislations in force are considering hydrogen storage as storage of a chemical substance only and not as energy carrier, fuel or as energy storage media.

Good examples can be seen in several Western European member states, where small or medium scale on-site hydrogen production plants and the connected on-site hydrogen storage were permitted even in busy city centers. It is important to understand that these on-site equipments are neither harmful nor dangerous to the environment.

1.4 Policy Summary at national level: (Category-4) Hydrogen as a fuel and refueling infrastructure

At present there is no hydrogen fuelled vehicle (neither fuel-cell, nor internal combustion engine) in operation in Hungary, and there isn't any hydrogen refueling station (HRS). Only very few academic or university prototypes of hydrogen vehicle existed (like HyGo, Orca), which were built by university students and were used only in special vehicle competitions (e.g. Eco-

marathon). Beside these a prototype of a HFC bicycle and an inland HFC boat was manufactured by a domestic SME, but these remained prototypes.

Hungary has one large oil refinery where large scale hydrogen production happens based on SMR method, but this hydrogen is completely used up in the refinery processes. Clean hydrogen is not in use as a fuel at present.

However the Hungarian National Policy Framework (NPF) elaborated the hydrogen refueling infrastructure to a modest extent in the frame of 2014/94/EU Directive (AFID: Alternative Fuel Infrastructure Directive). Therefore Hungary belongs to those 14 EU member states, which incorporated hydrogen refueling infrastructure into their NFP (and not just electric charging, CNG, LNG, LPG – as alternative fuels).

Considering that hydrogen refueling infrastructure should form a well-established international network, therefore Hungary should pay attention to the locations of existing (and planned) HRSs in its neighbor countries, when designating the location of the first domestic HRS. At present there are existing HRSs in Austria among which 2-3 are well within the driving range of a hydrogen vehicle from Budapest and/or from the western part of Hungary (Transdanubia). Slovenia also has or plans in the near future to install some HRSs, which can be also within driving range. Hungary should take these into account when planning the location of the first HRSs. (From Serbia, Croatia and Romania early news can be heard about some intentions of installing the first HRS, but no concrete plan or location is known.)

Hydrogen as a fuel can be found partly in the national legislation, but in a non-consistent way, which means that fragmented references on hydrogen are scattered in several legislations. For hydrogen there is no Guarantee of Origin (GO) scheme in Hungary. (GO scheme exist only for renewable electricity in Hungary at the moment and negotiations are in progress on a possible GO scheme for bio-methane.)

In Hungary the renewable ratio of transportation fuels consists practically exclusively of first generation bio-fuels at the moment: bio-ethanol, bio-diesel. Innovative renewable fuels like renewable electricity, bio-methane and renewable hydrogen is not used. (Some fleets of bio-methane fueled vehicles are in operation and green electricity can be bought for charging, but not widespread.) Reaching the compulsory 10% renewable transportation fuel ratio by 2020 will be hard just by conventional bio-fuels (and similarly 14% by 2030), so there would be a quite huge playing field for innovative renewable fuels and among them for hydrogen as well.

1.5 Policy Summary at national level: (Category-5) Hydrogen Vehicles - cars, taxis, buses, trolleybuses, trucks; motorcycles (and bikes) and quadricycles

At present there is no hydrogen fueled vehicle (neither fuel-cell, nor internal combustion engine) in operation in Hungary, partly because there isn't any hydrogen refueling station (HRS) either. Only very few academic or university prototypes of hydrogen vehicle existed (like HyGo, Orca), which were built by university students and were used only in special vehicle competitions (e.g. Eco-marathon). Beside these a prototype of a HFC bicycle and an inland HFC boat was manufactured by a domestic SME, but these remained prototypes. There are no hydrogen fueled forklifts or similar material handling vehicles, which are already quite frequently used in Western-Europe and mostly in North-America.

However the Hungarian National Policy Framework (NPF) elaborated the hydrogen refueling infrastructure and the forecast for HFC vehicles to a modest extent in the frame of 2014/94/EU Directive (AFID: Alternative Fuel Infrastructure Directive). The domestic NPF indicates a small amount of busses (even from 2020), passenger cars and a few lorries, but does not forecast heavy duty vehicles. NPF does not mention the category of motorcycles, bikes and quadricycles.

Hungarian politicians focus nowadays on "traditional" E-mobility (electric battery and plug-in hybrid vehicles). A well-established strategy document, the Jedlik Ányos Plan (JÁP, the national Electro-mobility Plan named after the inventor Ányos Jedlik) was elaborated to promote E-mobility and was adopted by Government Resolution 1487/2015. Some organizations were established to support E-mobility. These are both governmental (E-Mobi) and cluster type

(Jedlik Ányos Cluster) and the Hungarian E-mobility Association was also funded. The legal background of traditional e-mobility, as well as its supporting system and incentives are developing considerably. Jedlik Ányos Plan does not cover hydrogen fuel cell mobility, just mentions it tangentially. There is a bit less focus now on CNG/LNG mobility, however quite considerable fleets of busses, taxis, passenger cars are running since years in Hungary and their refueling station network is also spreading. CNG based mobility papers do not cover hydrogen mobility they just mention it tangentially.

According to the relevant national legislation (Ministerial Decree of KöHÉM No. 6/1990.) hydrogen vehicle can be classified now – actually unintentionally - as "gas" vehicle, as there is no self-standing "hydrogen vehicle" category in the Hungarian legislation at present. Legal definitions of "hybrid" and "plug-in" vehicles are also obsolete, as these are considering only the battery electric and diesel/gasoline drivetrains and not the fuel cell electric ones. There is legal uncertainty in this classification issue, as current definitions are not accurate enough and do not follow the technical developments closely. The lack of clear legal definitions for hydrogen fuel cell vehicles (and the hybrids) can hinder elaboration of incentives, development plans, traffic or other rules. Type approval process of any hydrogen fuel cell vehicle has not been initiated yet at the relevant authority in Hungary. However the legal transposition of the relevant EU directive has happened.

Though in the last year some attention was focused on hydrogen mobility and fuel cell vehicles, as the Hungarian Hydrogen Association organized a fuel cell car showcase and workshop in Budapest in 2018 with the possibility of test-driving. Invited guests were mainly policy makers, authority leaders, managers of energy utilities, so hopefully the FCEVs and hydrogen mobility will become much more policy support in the near future.

2. Category-1: Hydrogen Production (Centralized & localized)

2.1. Overview and assessment of current legal framework

- Gov.Decree 219/2011 on protection against serious accidents using dangerous materials.
- Gov. Decree 31/2014. on the rules of building permitting procedures for certain specific industrial facilities.
- Gov. Decree 314/2012. on the settlement development concept, the integrated settlement development strategy and on settlement (spatial) planning tools.
- Gov.Decree 314/2005. on Environmental Impact Assessment and Integrated Pollution Prevention and Control (IPPC) procedures.
- Government Decree 253/1997 (OTÉK) on national settlement planning and construction requirements. Deriving from these generic and national-level rules the local land–use plan (Local Spatial Planning Plan, LSPP) determines the exact rules of setting the adequate location of a hydrogen production plant on an investment area.
- National Fire Codes (Decree of Ministry of Interior 54/2014, OTSZ).
- Decree of Ministry for National Economy No. 35/2016 on examination and certification of equipment, and protective systems intended to use in potential explosive area.

2.2. Conclusions

Summarizing a hydrogen production plant is considered now by all relevant legislation as a traditional chemical production facility, without regard to the type of H2 production (SMR, water electrolysis…) or the presence (or absence) of hazardous substances involved in the process.

Considering land use planning (determined by OTÉK) there is no explicit zone prohibition for hydrogen production facilities, but the legislation states that hydrogen production facilities (or similar facilities) can be located in the "industrial area" only ("Ipari terület" – "Gip"code). The problem is on one hand that hydrogen production is not nominated explicitly in land–use zones by OTÉK and on the other hand no differentiation is made according to production method and capacity. It would be important to differentiate between the small scale localized production and the large scale centralized production. Theoretically it is possible to change a local land-use plan in order to make a site (plot) adequate to install a hydrogen production facility (to change the zone classification), but this process takes very long time and is very expensive. Land use planning, especially the country level regulation (OTÉK) is not an EU harmonized area.

While this situation might be an intended policy choice in some of the jurisdictions studied, it may also be the unintended outcome of the misunderstanding of the processes involved and/or the lack of clarity on the scope of application of legislation, in particular those stemming from the EIA, SEA, IED and SEVESO directives. The lack of clarity/inadequacy connected with these directives may be the result of the historical assumption that production of hydrogen (as an industrial gas) is a chemical process involving emissions (which is not the case when hydrogen is produced via electrolysis).

From the point of view of environmental permission, especially in the case of IED/IPPC (integrated environmental permitting by Gov.Dec. 314/2005), and partly in case of EIA, the present situation is very disadvantageous and could be even prohibitive for small scale hydrogen production. A small scale (on-site) H2 production must be considered now the same way as a huge centralized production facility, as there is no lower limit for production capacity. So theoretically the same permitting procedure should be conducted – from environmental point of view – for small H2–production installations as for the huge ones (like a refinery). It has simply no practical sense to conduct an Environmental Impact Assessment (EIA) and/or Integrated Environmental (IPPC) Permitting as electrolysis has no or very small environmental

impacts. (Of course, production of electricity used for electrolysis can have significant environmental impacts, but these must be assessed in the EIA/IPPC of the given power plant.) The problem occurs mostly from the fact, that the mentioned EU directives' (and their Hungarian correspondent legislation's) wording is not unequivocal and mentions hydrogen production just as "production of inorganic based materials". Furthermore there is no stated lower limit for H2 production.

Similar situation experienced with the Hungarian TEÁOR system (TEÁOR = Economic Activities United Sectoral Classification System), which corresponds to EU's NACE code system (NACE = Statistical Classification of Economic Activities). TEÁOR's point "20.13 - manufacture of inorganic chemicals" covers hydrogen production at this moment, and unfortunately this TEÁOR class does not differentiate either whether hydrogen is produced for traditional chemical purposes or for energy carrier/fuel. This is likely a consequence of the NACE system which includes only the same eligible category for hydrogen production.

Seveso permission (dangerous plant permission according to Gov.Dec 219/2011) can be also necessary, but it depends not on production capacity (t/day), but on the stored maximum amount of hydrogen (t). This is why we deal in detail with this very important issue in the NPP of Category-2 (hydrogen storage).

Fire protection is also an essential issue, which is not an EU harmonized professional field either. Fire protection authority is part of the Directorate General of Disaster Management, also responsible for dangerous plant permission and ADR permitting. Fire Brigade (as local authority) – with few exceptions – does not issue separate permits, but its approval (as contributing authority) is essential for other permits like building permit. The National Fire Codes (Min. Decree 54/2014) contains more than 200 pages but the term "hydrogen" is not to be found anywhere. It operates mostly with categories (classes) like "flammable gases", "explosive gases" but there are no hydrogen specific rules. Only the more widespread fuels and energy carriers are mentioned explicitly: CNG, LPG. Explicit and clear prescriptions usually make permitting procedures easier and quicker.

In general the lack of hydrogen-specific prescriptions in the above cited legislation can cause – mostly in the initial phase of hydrogen technologies – longer permitting procedures with more uncertainties requiring more consultancy work. As a consequence some risk can occur that the local authorities will not interpret the legal and procedural rules in the same way in each part of the country.

Good news that there are some hydrogen production plants in operation in Hungary already and these were permitted of course. May be these permissions could serve as practical experience for hydrogen production even in the case of fuel and/or energy purposes.

2.3. Policy Recommendations

From the point of view of land use planning OTÉK (Gov.Dec 253/1997) should be updated in order to allow small scale and environmentally sound hydrogen production methods in more land use zones. After that this country level modification should be made known and conscious at settlement level among the notaries, who are liable for the Local Land Use Plans and their application. This modification should be carried out with regard to the necessary changes associated with hydrogen refueling stations. (This later issue is discussed in NPP of Category-4, please read that chapter as well for a full understanding.)

As currently defined production of hydrogen by electrolysis is not distinguished from other means of producing hydrogen (e.g. steam-methane reforming), neither in environmental permitting legislation nor in TEÁOR (statistical system). The lack of possibility to distinguish water electrolysis from traditional industrial methods of hydrogen production further increases the likelihood that the production of hydrogen through electrolysis would only be allowed in industrial zones. Further on Gov.Dec No 314/2005 (on IPPC permitting and EIA) should be modified to cover small scale, and environmentally sound hydrogen production plants. Possible prerequisite for this is that the corresponding directives (IED, EIA) should be modified as well.

HyLaw Project also targets this by EU-level recommendations. At least a simplified permitting process should be elaborated for decentralized H2 production methods in these legislations.

If possible, more hydrogen-specific rules, prescriptions (like fire protective distances) should be elaborated and incorporated into National Fire Codes (BM Decree 54/2014) for small scale hydrogen production.

Organization of training or site visits to existing (on-site) hydrogen production facilities would be useful for the representatives of relevant authorities (especially environmental inspectorates, fire brigades, disaster protection authority, and spatial planning officer). In parallel with the IPPC(IED)/EIA modification, a new – corresponding – category of small scale, environmentally sound hydrogen production method should be established in the TEÁOR (and of course in NACE system). As hydrogen technologies will become more widespread these new kinds of economic activities will become more important and should be managed by the statistical systems (especially by TEÁOR/NACE) as well.

3. Category-2 & 3: Hydrogen Storage and Transport

3.1. Overview and assessment of current legal framework

- Act CXX of 2007 on proclamation of European Agreement concerning the international carriage of dangerous goods by road (ADR) and amendments to Annexes A and B of ADR 2007
- Gov. decree 178/2017. on proclamation of Annex A and Annex B of the European Agreement concerning the international carriage of dangerous goods, as well as on some aspects of its domestic implementation
- NFM Decree No 61/2013. on domestic application of Annex A and B of the European Agreement concerning the international carriage of dangerous goods by road (ADR)
- Gov.Decree 219/2011 on protection against serious accidents using dangerous materials.
- Gov.Decree 314/2005. on Environmental Impact Assessment and Integrated Pollution Prevention and Control (IPPC) procedures.
- National Fire Codes (Decree of Ministry of Interior 54/2014).
- NGM Decree 2/2016 on technical safety supervision of pressure equipment, refuelling equipment.
- MSDS (Material Safety Data Sheet) for Hydrogen - Hungarian language version available from several sources

3.2. Conclusions

Transportation: general ADR rules must be applied for hydrogen just like for flammable or explosive gases. There are no hydrogen-specific rules at the moment. Transportation of gaseous hydrogen does not need any specific, designated and permitted route. Liquid hydrogen transport (LH2) would require route permission, but LH2 transport is very rare in Hungary, actually it does not even exist. Beside ADR the general Highway Code (KRESZ) must be kept of course, e.g.: total weight limitation of trucks, which indirectly determines the maximum amount of transportable hydrogen as well. National (ADR) legislation does not directly limit the pressure of transported hydrogen, but the pressure must not exceed the nominal (validated) pressure of the given storage cylinder or vessel, which is usually max. 200 barg. (These cylinders have usually the maximum test pressure of 300 barg.) It can be seen that pressure or quantity limitation is not an issue at this moment. In summary, road transport of hydrogen is not unreasonably restricted in Hungary there is no considerable legal or administrative barrier in this field. As hydrogen technologies, vehicles and filling infrastructure will deploy, the

compulsory ADR trainings – held by a dangerous goods transport safety consultant – should focus a bit more specifically on transportation of hydrogen in the future.

Dangerous plant permission (Seveso–permit) is necessary for hydrogen storage – and granted by the Disaster Management Inspectorate – for installation and later for the operation phase, if the stored amount of H2 exceeds 1,25 tons. Above 5 tons of stored H2 a more complex dangerous plant permitting is necessary. Above 50 tones the most complex permitting process is required. Hungarian specialty is the so-called "dangerous plant under the threshold" category in the legislation, which defines the 1,25 tones lower limit. In this field the domestic regulation is a bit stricter than the corresponding EU practice. As there are usually no special hydrogen storage permitting requirements, case-by-case modeling and/or other unique calculations can be necessary to determine e.g. the protective zones, safety distances, etc., which can create uncertainty and long permitting procedure time. The applicable safety distances are deriving from the risk and safety analysis and usually depend on the stored capacity. (The EU SEVESO III Directive is the umbrella legislation, but the Member States had the right to choose between consequence based assessment or risk based assessment at the national adaptation procedure. Hungary has chosen the risk based assessment. Therefore there are no prescribed ("ready to use") protective distances. This means that a risk assessment model has to be worked out and the necessary size of the protection zone has to be determined one by one for every given case. This means quite a lot of expert/consultancy work, which means a lot of time and extra costs.)

Fire protection is of course also an essential field for H2 storage. At this point National Fire Codes (Min. Decree 54/2014) is the most important, but conclusions already discussed in NNP for Category of hydrogen production are relevant. National Fire Codes operate mostly with categories (classes) like "flammable gases", "explosive gases", but there are no hydrogen specific rules, which could make the application easier.

From the point of view of environmental permitting Preliminary Environmental Impact Assessment (pEIA) is necessary for "the underground storage of flammable gases" in the case of more than 10.000 m3 storage capacity. Legislation does not refer explicitly to hydrogen, but mentions "flammable gas" only. Hydrogen belongs obviously under this category. It is not clear whether the cited legal storage capacity (m3) refers to the absolute (real) volume of the storage vessel or to the volume (in normal-cubic-meter) of the stored gas? These kinds of uncertainties in the legislation are typical examples of reasons, which extend the duration of procedures and require a lot more consultation.

Similarly to hydrogen production, there is no explicit land-use zone prohibition for hydrogen storage facilities but the relevant legislation (OTÉK) states that hydrogen storage facilities (or similar facilities) can be located only in "industrial areas" zones ("Ipari terület" – "Gip" code). Local Spatial Planning Plans (LSPPs) are driven by the generic national level rules of OTÉK. For more details in this context please see the NPP for hydrogen production.

Material Safety Data Sheet (MSDS) for Hydrogen is available in Hungarian language without any problem. Several sources are available even in the Internet.

Good news that there are some applications in Hungary, which already require small amounts of hydrogen (like fuel cells as emergency power supply units at phone cell stations). Their service would be impossible, if the hydrogen transport wouldn't have been solved already according to ADR on public roads. The storage of the necessary hydrogen cylinders has been solved adequately as well, and is operating since years.

3.3. Policy Recommendations

From the point of view of land use planning OTÉK (Gov.Dec 253/1997) should be updated in order to allow small scale and environmentally sound hydrogen storage methods in more land use zones. At this point a harmonized implementation is necessary with hydrogen production and hydrogen refueling stations – see in those NPP Chapter-4. After this country level modification has been made, it should be made known and conscious at settlement level among the notaries, who are liable for the Local Land Use Plans and their application.

Uncertain wording in definition of (hydrogen) storage capacities, like in the list of installations obliged to (preliminary) environmental impact assessment (in Gov.Decree 314/2005) should be resolved, and/or simplification and lightening should be established in the permitting process of small scale hydrogen storage, especially, if hydrogen is produced in an environmentally safe manner. According to this demand the Environmental Impact Assessment Directive should be modified as well, which is part of HyLaw's EU-level recommendations.

Hydrogen storage would require more hydrogen-specific rules and prescriptions (e.g. protective distances) similarly to hydrogen production. Modifications would be useful especially in the following legislations: National Fire Codes (BM Decree 54/2014), pressure equipment and hydrogen refueling stations (NGM Decree 2/2016), environmental permitting (Gov.Dec. 314/2005) and disaster protection (Gov.Dec 219/2004).

Hydrogen transport: in the frame of compulsory trainings (according to section 1.3.2 of the ADR Regulation) more ADR rules of hydrogen transport should presented. Training for the first respondent organization should be organized (like how to manage hydrogen fire, how to rescue a hydrogen trailer, etc).

4. Category-4: Hydrogen as a fuel and refueling infrastructure

4.1. Overview and assessment of current legal framework

- Act No CXVII. of 2010 on promoting the use of renewable energy for transport purposes and on reducing GHG emissions from use of energy in transportation.
- Ministerial Decree NFM 17/2017. on the quality requirements for propellants. However, this legislation is the "general" fuel (propellant) quality legislation, which covers – beyond the traditional fuels like gasoline and diesel – also alternative fuels like CNG/LNG, electricity, but does not incorporate hydrogen.
- Ministerial Decree 2/2016 NGM on the technical and safety supervision of pressure equipment, filling equipment, low-powered filling equipment and periodic inspection of car gas tanks. This legislation incorporates hydrogen, but there are no or very few hydrogen-specific prescriptions for e.g. on applicable safety distances, etc. Safety distance (zone) must be established within the borders of the own plot of the HRS. If this is not possible, safety distance can be reduced by building protective (safety) walls, but these have to be non-combustible. Hydrogen-specific distances do not exist in the legislation and in special cases safety distance can be decreased to some extent.
- Government Decree 253/1997 (OTÉK) on national settlement planning and construction requirements. OTÉK does not differentiate according to fuel type. Its wording recognizes only the generic "refueling station" definition. The preferred land-use zone for fueling stations (including HRS) is in the so called "traffic zone". OTÉK now prohibits the installation of new refueling stations in the following land use zones: "metropolitan residential areas", "city centre", "institutional area". OTÉK does not know, does not refer HRS with on–site production and/or H2 storage, which would be an essential technology in this field.
- Ministerial Decree 3/2003. (III. 11.) FMM–ESZCSM minimum work safety requirements for jobs in potentially explosive atmospheres. The operator of the HRS (employer) is obliged to prepare explosion protection documentation (EPD) for the installation. Employees working in a (potentially) explosive workplace must be trained, and have to know this EPD in detail and they do have to have some practice in the escape routes. From the point of view of hydrogen and hydrogen-technology there isn't any notable barrier in this legislation.

4.2. Conclusions

Ministerial Decree NFM 17/2017. means a real barrier in hydrogen technologies, because dealing with the quality requirements for propellants it does not recognize hydrogen as a "fuel", and consequently does not determine the applicable hydrogen fuel quality prescriptions (standards). As fuel quality requirements are fragmented, it takes a lot of time to identify hydrogen fuel quality requirements.

Hydrogen can be recognized also as "bio-fuel" or "renewable liquid" or "gaseous fuel from non-biological origin" depending on the primary energy source of its production (according to Government Decree No 279/2017). Theoretically renewable hydrogen could be take into account in the obligatory renewable energy ratio (10% by 2020) in the transport sector, but without guarantee of origin scheme and without a methodology how to account RES-hydrogen in the renewable transport energy ratio, widespread application is inhibited.

Organizational barrier could be in the future, that there in no adequate, technically feasible, accredited domestic organization (laboratory), which would be able to sample, measure and certify hydrogen fuel quality.

In general it can be stated that the different aspects of hydrogen (fuel) can be found in several different legislations at the moment, so prescriptions are fragmented and not unequivocal. This creates uncertainty and can make the permitting processes longer. Further on it could occur that the different local authorities may misinterpret the different legislations and may practice the permitting processes in different ways.

Legislation on land use planning does not know new types of fueling stations like CNG or hydrogen. Differentiation between the types of refueling stations (fuel types) is missing, so legislation does not reflect to the technology development. As legal rules are non-unequivocal and hard to apply in practice, permitting procedures can take a lot more time than necessary and this leads to rising costs as well. Further on the different regional authorities could use different interpretations within the country. As OTÉK does not know "HRS with on-site hydrogen production and storage" and as this should be considered as "industrial activity" (with considerable environmental impact and/or danger of fire/explosion) at present, such a facility could be located only in an "industrial zone" ("Ipari terület" – "Gip" code). This could be a significant land-use type barrier in future development. It could prohibit HRSs with on-site hydrogen production from city areas (from "living area" zones) while only zero emission vehicles would be present at the refueling station (not causing such environmental loads as the attracted traffic of a gasoline/diesel fueling station).

Permission of a hydrogen refueling station is covered by Min. Decree 2/2016 NGM, but this legislation was elaborated primarily for permitting CNG/LNG refueling stations. Probably this is the reason why it contains only very few hydrogen–specific information and requirements. There is no real practical experience on how to apply this legislation for hydrogen refueling stations in real life, because no HRS was permitted till now.

If hydrogen storage exceeds 1,25 tones at a HRS, a self-standing disaster protection permission is required according to Gov.Dec. 219/2011. If H2 storage capacity of the HRS exceeds 5 tones, a more complex disaster protection permission is necessary based on the same Government Decree. Besides this an integrated environmental permission can be necessary according to Gov.Dec. 314/2005, if hydrogen is produced on-site. The present form of this legislation is unreasonably strict and inflexible in this field. More details on hydrogen production and storage can be found in NPP Category 1 & 2.

The state of the art is that a self-standing legal definition of hydrogen refueling stations is missing and rules regarding their placement (in OTÉK and in LSPPs) do not exist. Moreover, legal definition and rules on HRS with on–site hydrogen production are also missing. If on–site hydrogen production at a HRS is interpreted strictly according to the existing legislation, the refueling station could be built on very few places and in industrial zones only.

According to Gov.Dec. 314/2005 an integrated environmental permission is required even in the case of an on-site hydrogen production plant at a HRS. The present form of this legislation is unreasonably strict and inflexible from this point of view. If the letter of the law is kept, a time killing, complex and expensive environmental permitting process has to be completed. The

decree does not deal with the question, whether hydrogen was produced by an environmentally sound and safe method (like electrolysis using renewable electricity) without any emissions, or not. This barrier is discussed more detailed in the NPP of Category 1.

Insufficient or non–unequivocal legal regulations on hydrogen technology increase the duration of the permission processes for both parties, for the involved authorities and the engineering companies. This increases the costs as well. Nevertheless a secondary effect may occur, namely that the different regional authorities of the same professional field will use different implementations.

4.3. Policy Recommendations

It can be stated as a general recommendation, that the elaboration of every new and relevant legislation should keep an eye on the "new" fuels and alternative refueling infrastructure (including hydrogen). This is necessary to make the given permission processes easier and smooth. Legal background of hydrogen as a fuel should be made less fragmented and logically consistent. Clear consistency should be established between the different legislations, especially between Decrees 17/2016 NFM and 2/2016 NGM. Hydrogen (fuel) quality requirement should be built in into the existing and "generic" fuel quality legislation, into Decree 17/2016 NFM.

Regarding to land-use issues, OTÉK should be modified and made compatible and supportive to the new (alternative/renewable) fueling infrastructure. A self-standing legal definition of "hydrogen refueling station", and "hydrogen refueling station with on-site hydrogen production (and storage)" should be established in OTÉK, and the land-use-zone designations should be made more permissive for these plants. Hydrogen cars are zero (local) emission vehicles, therefore HRS (with on-site production) could be installed even in city centers. This type of refueling station does not cause such environmental loads (air pollutants, noise emissions), which necessarily appear in the case of traditional gasoline vehicles, when approaching their traditional refueling station. Therefore legislation should be more compliant to zero emission HRSs in different land-use zones, than to traditional refueling stations.

Integrated environmental permission (so called IPPC/EKH permission) is necessary at the moment for the small scale, onsite hydrogen production, too, even if it happens at a HRS (and even if it is based on electrolysis, with renewable electricity). This is an unnecessary, senseless and exaggerated requirement. Government decree 314/2005 on IPPC/EKH permission should be modified by withdrawing small scale (and environmentally sound) hydrogen production from its scope.

The commitment incorporated into the Hungarian National Framework Policy (in the frame of AFI Directive) on developing hydrogen refueling stations should be started and planned in a complex and harmonized way. This means that the first hydrogen vehicle fleet should be planned together with the first HRSs, and their location should be chosen according to the availability from the existing HRSs of the neighbor countries. This would necessary in order to increase the utilization of the HRSs and to create an even extending European network of hydrogen corridors.

It is recommended, that even the first hydrogen mobility, hydrogen fueling demo project in Hungary should be installed with the ability on on-site hydrogen production, and possibly with using renewable and/or low-carbon electricity. Legal background of guarantee of origin (GO) scheme for renewable hydrogen and/or low-carbon hydrogen should be elaborated, as well as the method for accounting the use of renewable hydrogen in the country's transportation energy ratio (to help to contribute the obligatory 10% renewables in the transportation energy by 2020 and beyond).

Technical Safety Authority (TSA) will play a key role in permitting HRSs. Therefore a training is suggested to be organized for TSA experts (and for other contributing authorities), how to apply the relevant Ministerial Decree 2/2016 NGM for permitting HRSs. An on-site visit is also suggested for TSA colleagues to an existing and permitted HRS, as a kind of cross border cooperation.

5. Category-5: Vehicles – cars, taxis, buses, trolleybuses, trucks; motorcycles (and bikes) and quadricycles

5.1. Overview and assessment of current legal framework

- Ministerial Decree KÖHÉM 6/1990. on technical conditions of placing in service road vehicles. This legislation defines "electric vehicle", "gas vehicle" categories, but there is no self-standing "hydrogen vehicle" category. However, hydrogen vehicles could be classified as "hydrogen vehicles" according to Commission Regulation (EU) No 406/2010 implementing Regulation (EC) No 79/2009 on type-approval of hydrogen-powered motor vehicles. (The regulations are directly applicable in the member states.) There is a bit legal uncertainty in this classification issue, as current definitions are not accurate enough and in some aspects obsolete (e.g. definition of "plug-in hybrid" refers only to battery electric and diesel/gasoline hybrid drivetrains and not to battery electric - hydrogen fuel cell hybrids). In several EU member states a self-standing definition for "hydrogen vehicle" can be found even today in their national legislation.
- In connection to type approval process the above mentioned Ministerial Decree 6/1990. KöHÉM is the authoritative. This refers explicitly in case of hydrogen vehicles to 79/2009/EC and 406/2010/EU. However 6/1990. KÖHÉM seems to be an old legislation (dated 1990) its latest modification is dated in 2018.
- The competent authority in case of type approval processes is the National Transport Authority (belonging under Deputy Secretary of Ministry for National Development). Latest development is 2018 by Ministry for Technology and Innovation (MTI). Later is the successor of the Ministry for National Development. This authority is competent in all type approval processes: for cars (incl. taxis), busses, trolleybuses, trucks, motorcycles, quadricycles. EU-level, national and individual approval processes exist at the same time.
- Ministerial Decree KöHÉM 5/1990. is relevant in context of technical examination of road vehicles and their periodic technical inspection.
- Regarding the process, there is no difference in the type approval procedure between conventional drivetrain vehicles and hydrogen vehicles. The same process framework is applicable in both cases. At this moment there is no domestic experience in type approval of hydrogen vehicles, as no such procedure was initiated at the Hungarian authority.
- Government Resolution 1487/2015. on the legislative tasks related to the Jedlik Ányos Plan (national Electro-mobility Plan). This prescribes the applicable incentives for battery electric vehicles (and hybrids), but does not cover hydrogen vehicles. Very few provision exist for hydrogen vehicles, but practical legislative act has not happened yet in this field.

5.2. Conclusions

Vehicles' type approval process is common for all vehicles and is theoretically well regulated in Hungary. The process could be managed, but there is no practical experience with hydrogen vehicles at the moment. The question is rather whether there are adequate domestic laboratories, test laboratories available for the specific hydrogen components of the vehicles (hydrogen tank, pipes, fuel cell)? It seems to be that there are some economic and/or operational barriers in this field.

Restrictions are not in force at this moment in Hungary, mostly because the national legislation is simply not prepared to refer to hydrogen vehicles. One typical example for lack is the OTSZ (National Fire Codes: Decree of Ministry of Interior 54/2014), which restricts only the underground and/or not well-ventilated (confined) parking places and refers only to LPG and CNG vehicles. The OTSZ simply does not refer to hydrogen vehicles. Therefore they are not

restricted theoretically, but this is a typical uncertainty in the legislation. Moreover, neither an inland ferry company, nor the Hungarian Railway Company could provide information whether hydrogen fueled vehicles could be transported by ships, or rail (e.g. RoLa transport).

Incentives are not in force directly for hydrogen vehicles (cars, motorbikes, quadricycles, etc.), which is deriving partly from the fact that domestic legislation does not know hydrogen vehicles. However, accidentally hydrogen vehicles (as zero emission vehicles) would be allowed to hold green license-plates, similarly to battery electric cars or some kind of plug-in hybrids. Green license-plate vehicles are entitled for free parking in many huge Hungarian cities. Motorcycles, bicycles can use bus lanes, but irrespectively what their fuel is (hydrogen or gasoline, etc.), so this is not a hydrogen specific lightening either.

Explicit tax incentives and registration fee discounts are in force only for battery electric cars and plug-in hybrids and for different electric bikes. Public procurement rules can cover also battery electric vehicles, but could be very indirectly interpreted to hydrogen vehicles. Nevertheless it is very important to note, that creation of incentives for FCEVs only would not make much sense without incentives for hydrogen refueling infrastructure (especially in the early adaption phase).

In general, existing incentives are quite widespread, but are focusing only to battery electric vehicles and hybrids and are described by Gov. Resolution 1487/2015. Unfortunately the mentioned resolution is not dealing with hydrogen vehicles, or any type of hydrogen vehicle categories. Missing incentives for hydrogen FCEV cars, bikes, motorcycles can hinder their procurements as well.

5.3. Policy Recommendations

Fundamental recommendation is that a self-standing definition of "hydrogen vehicle", "hydrogen fuel cell vehicle" should be created in the relevant domestic legislation (basically in Min. Decree 6/1990. KöHÉM). This could be the basis for the possibility of every further incentive. Moreover, the existing definitions for "plug-in vehicle", "vehicle with range extender" should be modified to incorporate fuel cell plug-in hybrid drivetrains as well, or rather a self-standing definition should be created for "fuel cell plug-in hybrids" and/or "range extender fuel cell vehicles".

Consistency should be created among Decree KöHÉM 6/1990. and Decree NGM 2/2016. in the context that the existing "autogas" category should cover hydrogen as well, or (rather) a self-standing "hydrogen fuel" and "hydrogen fuel vehicle" definition should be established. It can be seen, that the present situation is unclear and partly contradictory. Similar clarification is necessary in OTSZ (Decree 54/2014. BM). It has to be cleared whether hydrogen vehicles could be allowed to drive in into deep garages, closed parking houses. The exact conditions must be stated.

Similarly to the battery electric vehicles carefully considered incentives (tax credits) should be established for hydrogen vehicles as it is now prescribed in Gov. Resolution 1487/2015. Missing incentives for hydrogen vehicles (every category of vehicles) can hinder their procurements, but this lack of incentives is just delaying the spread of FCEVs. It must be kept in mind, that the more serious problem is the lack of hydrogen refueling infrastructure at the moment. The issue of hydrogen vehicles should be managed together and in a complex approach with hydrogen refueling stations. (Therefore, please see the National Policy Paper for Category-4 of hydrogen refueling infrastructure also.)

It is highly recommended to create a first demo project for hydrogen vehicles, preferably including cars and buses as well, in cross border cooperation with those neighbor countries where hydrogen refueling is existing already or will be installed soon. Hydrogen vehicles in the public transport systems would be more effective and could reach more visibility during the fist phase of deployment. Nevertheless people would probably better accept these expensive vehicles, if they served the general public.

National Transport authority (NTA) will play a key role in permitting hydrogen vehicles. This is why a training is suggested to be organized for NTA's experts in how to apply the relevant and

directly applicable EU legislation (Commission Regulation 406/2010 implementing Regulation (EC) No 79/2009 on type–approval of hydrogen–powered motor vehicles. Regulation (EC) No 79/2009 on type-approval of hydrogen-powered motor vehicles.)

3. Appendix

3.1 Abbreviations

CGH2:	Compressed Hydrogen Gas
CNG:	Compressed Natural Gas
FCEV:	Fuel Cell Electric Vehicle
HRS:	Hydrogen Refueling Station
IED:	Industrial Emissions Directive (including IPPC Directive also)
EIA:	Environmental Impact Assessment
SEA:	Strategic Environmental Assessment
IED:	Industrial Emissions Directive (incorporating IPPC Directive)
KÖHÉM:	(former) Ministry for Transport and Info-communication
KRESZ:	Highway Code (general rules of roads)
LH2:	Liquid Hydrogen
LPG:	Liquefied Petroleum Gas
NACE:	Statistical Classification of Economic Activities
NFM:	Ministry of National Development
NGM:	Ministry for National Economy
NTA:	National Transport Authority
PED:	Pressure Equipment Directive
(p)EIA:	(Preliminary) Environmental Impact Assessment
SEA:	Strategic Environmental Assessment
SEVESO:	Directive on the control of major-accident hazards involving dangerous substances
OTÉK:	Gov. Dec. 253/1997 on national settlement planning and construction requirements
OTSZ:	National Fire Protection Codes (Ministerial Decree 54/2014 BM)
TEÁOR:	Economic Activities United Sectoral Classification System