

Assessment of the Regulatory Framework

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1. Introduction

The development of electricity from renewable sources has shown that in Europe, when electricity production has exceeded local needs, in a scenario without available electricity storage capacity, it leads to a standstill of electricity generation. This problem should occur more and more frequently as the deployment of intermittent renewable electricity generation is boosted. According to the European Commission's targets published in the Green Deal, the aim is to achieve a 40% share of renewable energy sources in the total EU energy mix by 2030.¹

In this context, hydrogen technologies are presented as one of the pillars of the future European energy and transport systems, enabling the storage of the excess renewable energy, making a valuable contribution to the transformation of the European Union towards a low-carbon economy by 2050.² Therefore, to define the scope and potential of hydrogen in Europe, the European Commission published in July 2020 *A hydrogen strategy for a climate-neutral Europe*.³ In this document, it is highlighted that one condition for the widespread use of hydrogen as an energy carrier in the European Union is the availability of energy infrastructure to connect supply and demand. In that sense, hydrogen can provide storage, cyclical or seasonal in underground storages, to produce electricity to cover peak loads, secure hydrogen supply and allow electrolysers to operate flexibly. Renewable hydrogen, when combined with large scale underground storage in aquifers, depleted fields, or salt caverns, enables transportation of energy through time balancing out the impacts of variable energy production from renewable energy sources.

While storing pure hydrogen in salt caverns has been practiced since the 70s in Europe, pure hydrogen storage has not yet been carried out anywhere in depleted fields or aquifers. Hystories will deliver technical developments applicable to a vast range of future aquifer or depleted field sites, will conduct techno-economic feasibility studies and provide insights into underground hydrogen storage for decision makers in government and industry.

Nowadays, underground natural gas storage facilities are key infrastructures in energy systems. The first one dates to 1915 and today there are more than 700 in the world, including one under the city of Berlin. These natural gas storage facilities make it possible to adjust supply to demand and to cope with peaks in consumption due to seasonal variations, among other scenarios, it is necessary to store large quantities of gas in strategic locations.⁴

When addressing the legal status of underground storage, two concepts should be distinguished: regulation and legislation.

The concept of regulation is a market concept. States can regulate an activity when free competition can hardly function. This is typical of large infrastructures or energy. The State



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can guarantee operators an income or a market but fix the price at which the activity is carried out. The State can fix obligations, which creates a captive market, but fix the price at which storage operators can sell the storage service. Thus, in Europe this issue is regulated by common directives that aim to unify the gas market: Directive 2009/73/EC on gas and Regulation (EC) No 715/2009 on gas. New proposals for European harmonisation of the gas market are already being developed. The European Commission has announced that it will publish a legislative proposal for the decarbonisation of hydrogen and gas to enable the development of hydrogen infrastructure by the end of 2021.

The revision of the Gas Directive 2009/73/EC and Gas Regulation (EC) No 715/2009, common in the European Union for the regulation of the natural gas market, is called the Hydrogen and Decarbonised Gas Market Package.

As a first step, the Commission published a roadmap on the initial impact assessment to gather stakeholders' views.

On 26 March 2021, a public consultation on the review was launched. In addition, a workshop was organised on 18 May to gather stakeholders' views on a wide range of aspects. The results of the consultation and the workshop will feed into the Commission's preparations of legislative proposals for a new decarbonisation package for the hydrogen and gas markets.

In parallel, the Commission will carry out an evaluation of the relevant gas market rules. The evaluation will assess the effectiveness, efficiency, relevance, coherence, and benefits of the rules at EU level and for achieving the EU's decarbonisation objectives.⁵

These regulation proposals will have to address many crucial regulatory issues around horizontal and vertical unbundling of natural gas and hydrogen system operators, the regulated asset base, cross-subsidisation, and the valuation of natural gas assets when reused for hydrogen, for example. of natural gas assets when reused for hydrogen, to name a few. More recently, the importance of hydrogen markets and hydrogen infrastructure, including storage, distribution and import infrastructure, in a more integrated and flexible energy system.^{6,7}

On the other hand, the term legislation refers to the set of legislation necessary to obtain licences to operate in an environmentally safe manner and to organise the rights of economic uses of the subsoil. Nowadays, there is no uniform European approach to the legal framework for underground gas storage depending on the country. Current legal requirements can be part of mining law, energy law, construction law, environmental law, labour protection law, health, and safety regulations. Therefore, the legal framework varies in each EU member state. Therefore, the starting point of the present work for the analysis of the legal framework



for large-scale hydrogen storage will be the existing regulations for the advanced natural gas industry, thus presenting a scheme of responsible bodies for the Member State studied in the present work.

In this context, Hystories addresses the main technical feasibility issues of underground storage of pure hydrogen in depleted aquifers or reservoirs, and will provide market, societal and environmental information on the deployment of underground hydrogen storage in Europe and expanding the possibility of underground hydrogen storage from that presented only with salt caverns as shown in Figure 1, the potential hydrogen storage capacity estimated for some Europeans countries.⁶



Figure 1. Potential hydrogen storage capacity. Data from: Picturing the value of underground gas storage to the European hydrogen system, Gas Infrastructure, 2021.⁶

To gather as much information as possible on the legal status of underground storage of natural gas and hydrogen, in the framework of Task 6.1 "Assessment of the Regulatory Framework" a survey was launched to Hystories partners and Stakeholders Advisory Board, SAB, members. This survey consisted of 9 questions organised in 4 different sections: Survey Data, Regulatory framework, Standards related to the integrity of underground storages and wells and Other related issues. The questions asked in the survey can be found in Annex 1. Figure 2 shows the countries of the participating experts as well as the number of responses received, a total of 39 responses from 17 different countries. The entities participating in the consultation can be found in the Acknowledgements of this document.





Figure 2. Percentage of responses obtained in the survey for each Member State. Source: FHA.

From the information gathered in the survey, most of the information in this deliverable has been compiled, specifically, sections: 2. Regulation, 3. EU-framework, 4. Standards.

Furthermore, to collect the current permits needed to develop underground gas storage, a questionnaire was developed, completed, and reviewed by experts from France (Geostock, Teréga), Germany (Uniper, Storengy Deutschland), Spain (FHa, Enagas) and Poland (MEERI-PAS, Gaz System). These four countries were selected as they are the ones in which potential business models will be analysed in the framework of WP8, so the present information in this deliverable is intended to complement and support them. The questionnaire on permits can be consulted in Annex II.



1.1. EU hydrogen strategies

The European Commission already identifies the important role of an infrastructure capable of storing large quantities of hydrogen.³ This commitment expressed on the European Union Hydrogen Strategy leads the path to be followed by the Member Countries that already have their own published hydrogen strategy, as shown in Figure 3, and many others have announced the hydrogen strategy development phase.



Figure 3. European map of hydrogen strategies and planned installed electrolyser capacity in 2030 in EU27 and UK. Source: Picturing the value of underground gas storage to the European hydrogen system, Gas Infrastructure Europe, 2021.⁶

In Belgium, the Flemish region, which is leading the implementation of hydrogen pilot projects, identifies underground alternatives such as salt mines or depleted gas fields as optimal for large-scale hydrogen storage. Unfortunately, Flanders has only a limited supply of such large-scale hydrogen storage facilities.

However, there is a potential alternative in the Loenhout underground natural gas storage facility, which is an aquifer, i.e., a groundwater storage facility. Aquifers are geologically similar to depleted oil and gas fields, but their suitability must first be confirmed on a case-by-case basis. First simulation results from the Loenhout aquifer are promising, and a test injection of natural gas and hydrogen mixture into the peripheral control well is planned for 2021.⁸



France is one of the countries that seems to be one step ahead in the development of blending and underground storage. Its national hydrogen strategy elaborates on this issue and even addresses the details of authorisation (mining titles) to promote the underground hydrogen storage. The electricity transmission grid operator (RTE) plans to manage the intermittency of renewables by storing large quantities of electricity in the form of hydrogen, but not before around 2050.⁹

Germany is a frontrunner in the development of a hydrogen market and started to implement the national hydrogen strategy and wider changes to the regulatory environment to support the Germany hydrogen market. Germany, it does not define a clear blueprint in its national hydrogen strategy regarding large-scale underground hydrogen storage. However, storage is considered as an important subject, but no special attention has been carried out about caverns, aquifers, or others. ¹⁰

Portugal, in a national strategy, incorporates as an objective in the period 2020-2024, to promote hydrogen storage solutions, including large-scale underground storage on national territory, by assessing the potential and structural conditions of underground storage to ensure high levels of hydrogen incorporation in safe and reliable conditions.¹¹

The hydrogen strategy in Spain states that the effort on underground hydrogen storage should focus on research to ensure that its potential long-term use is realised in a manner that is completely safe for people and the environment.¹²

The Swedish strategy includes the implementation of a project, HYBRIT, demonstrating the entire hydrogen value chain in 2021. Materials and technology have been selected for a pilot (100 m³) underground hydrogen storage facility, based on Lined Rock Caverns (LRC) technology, which is planned to start construction in Luleå in early 2021. The storage facility can advantageously be used on a large scale (approximately 1,000 times larger than the pilot), as a complement to hydropower, to significantly balance and regulate the energy in the electricity grid and, at the same time, reduce the total cost of steel production by adapting the hydrogen production to the current electricity price.¹³

The Norwegian hydrogen strategy include the possibility of storing hydrogen in underground storage as a line of investigation. The strategy includes the long Norwegian experience in CCS (Carbon, Capture and Storage) projects, which highlights the possibility of obtaining hydrogen from non-renewable sources and CCS.¹⁴

The hydrogen strategy in United Kingdom echoes the experience of hydrogen storage in salt caverns in Teesside since the 1970s. It also highlights the potential for reusing caverns currently used for natural gas storage. The British Geological Survey has already identified



significant rock salt formations with the potential for thousands of terawatt hours of future storage as a tool to provide a large volume of storage at the lowest cost per unit of energy stored. This is an important strategic advantage for the UK compared to many other countries. Storage in gas or oil fields (offshore), although available in the UK, is specified as requiring further testing to be used for hydrogen.¹⁵

1.2.EU Hydrogen injection in NG

Hydrogen could be directly blended and injected into the natural gas stream of the existing natural gas network. Underground Gas Storage (UGS) are usually connected to the gas grid and that is the reason why the consequences of the injection and storage of hydrogen/natural gas admixtures for all UGS types must be assessed.¹⁶

While research programs are needed before standardization on hydrogen content in natural gas before injection in underground storage facilities, an assessment regarding national legal frameworks must be conducted in parallel to pave the way towards its deployment across Europe.

The major discrepancy in the European regulatory framework linked to injection lies in the hydrogen concentration admissible by the different NG networks, varying significantly from one country to another within the EU. This is since, when the existing regulations were defined, the possibility for NG networks to transport hydrogen was not considered.

So much so that the technical restrictions for gas network operators in the EU vary from a hydrogen impurity concentration. The admissible percentages in European gas networks are shown in Table 15.

	SPAIN	GERMANY	FRANCE	NETHERLANDS	ITALY	BELGIUM
DISTRIBUTION	5%	20 %*	6%	0,5%	0,5%	2%
NETWORK				0,2%**		
TRANSMISSION	5%	20%*	6%	0,5%	-	2%
NETWORK				0,2%***		

 Table 1. Admissible percentages in European gas networks. Source: Hydrogen regulation/standards survey, Marcogaz, 2020.

*An examination on a case-by-case basis is required. If the grid and the entire infrastructure and applications downstream proof suitable, up to 20% hydrogen will be permitted



** The TSO is allowed to accept gas with a hydrogen content of < 50 mol-% if it is possible to bring to required exit specification (0,02 mol-%) by blending. Gas with a hydrogen content of \leq

0,02 mol-% needs to be accepted by the TSO

*** In a closed transmission network conveying refinery gas a hydrogen content of 40 mol-% is allowed.

It is also noted that even in cases of higher percentages, the maximum allowable hydrogen concentration is small. The differences in regulation in the EU countries on the percentage of hydrogen allowed in the NG network, make a "bottleneck" for the development of this hydrogen transport route.

A consensus on the percentage to be allowed in the European grid would facilitate the implementation in the member states, which should be implemented through transposition. Projects such as GRHYD,¹⁸ HyDeploy,¹⁹ and HIGG²⁰ which are allowing to inject up to 20% hydrogen into an isolated grid, are developing the technical basis for increasing these limits, as well as implementing new regulations and greater harmonisation across Europe.

The HyLaw²¹ project identified the legal and administrative barriers facing hydrogen on various issues, including hydrogen injection into the NG grid, at EU level to provide initial information. This information was captured in databases, and national and European documents were developed, detailing the barriers that the hydrogen sector faces at administrative and regulatory level and proposing solutions.

A change in NG quality regulation will involve reviewing safety requirements, metering, billing and administration mechanisms and the corresponding legal frameworks. A joint assessment of the need to modify NG fuelled devices to allow safe operation with hydrogen concentrations is needed.

Usually, underground gas storage is designed and constructed for the storage of natural gas. In case the admixture of hydrogen into the injected natural gas is foreseen all consequences of the hydrogen admixture especially on the integrity of the underground gas storage must be investigated before any hydrogen injection.¹⁶



2. Regulation

As mentioned above, the concept of regulation is a market concept. A large part of the regulation currently in force in the natural gas sector in each member state is the result of the transposition of Directive 98/30/EC, which established a series of common rules for all European Union member states, with the main objective of laying the foundations for the orderly liberalisation of the gas sector, based on the principles of separation of activities and free and non-discriminatory access to networks by all operators.

In 2003, with the publication of what is known as the Second European Gas Directive (Directive 2003/55/EC), progress was made in the effective liberalisation and opening of national gas markets to competition, thus contributing to the creation of a true internal gas market in the European Union. In practice, this Directive established that from 1 July 2004 industrial consumers (and from 1 July 2007 domestic consumers) could freely choose their gas supplier. In addition, this Directive introduced rules aimed at strengthening free access to networks and other infrastructure (e.g., liquefied natural gas), security of supply and consumer protection. The Directive considers gas supply to be a service of general interest and therefore provides for the possibility for Member States to impose public service obligations on undertakings to guarantee security of supply, the objectives of economic and social cohesion, regularity, quality and price of supply and environmental protection. The deadline for transposition in the Member States of the measures contained in this Directive expired on 3 March 2011.

In 2009, Directive 2009/73/EC, commonly known as the "Third Package", was adopted, amending Directive 2003/55/EC, or the "Second Package", on common rules for the internal market in natural gas, which aims to give a definitive boost to the creation of the internal energy market through the following principles: the effective separation of production and supply activities from transmission system management, either based on ownership unbundling or through an independent system operator, increasing the powers and independence of national regulators, who should cooperate through an Agency for the Cooperation of Energy Regulators (ACER), with the capacity to take binding decisions and impose sanctions, the creation of a supranational transmission system operator (ENTSO-G); and, the improvement of the functioning of the gas market and increased transparency and effective open access to storage facilities and LNG terminals.

Country-specific legislation, or details of the implementation of Directive 2009/73/EC and Gas Regulation (EC) N0 715/2009 have been analysed by some global institutions such as United Nations. In close cooperation with International Gas Union published a study in 2013 named *Study on Underground Gas Storage in Europe and Central Asia* in which through surveys of gas network operators in different countries the regulatory aspects of each country can be compared.



Regarding the entry of hydrogen into this regulation, the European Commission is expected to publish the revision of the Gas Directive 2009/73/EC and Gas Regulation (EC) No 715/2009, common in the European Union for the regulation of the natural gas market, called the "Hydrogen and Decarbonised Gas Market Package", by the end of 2021.

In the framework of the collection of information and opinion of the sector experts of this work, the question was asked about this issue of regulation of the hydrogen market and what is expected from this possible regulation, which is still to be defined. The specific question was: "Do you think that regulation of underground hydrogen storage would be necessary?" The answers to this question can be seen in Figure 4.



Figure 4. Expert opinion consulted about underground hydrogen storage regulation. Source: FHa.

Thus, 95% of the experts believe that a market regulation for underground hydrogen storage parallel to the regulation for underground natural gas storage already in place would be the most optimal solution. In other words, leaving Member States the choice of negotiated or regulated third party access. Only 5% of the experts concluded that regulation is necessary, but it should not be directly available to the market itself and should be used by the operators for network operation purposes. It should be noted that none of the experts pointed to the option that regularisation of this situation is not necessary.

By the end of 2021, the revised Gas Directive 2009/73/EC and Gas Regulation (EC) No 715/2009 will be available for consultation, which provides an early response to this issue and is an essential step towards the promotion of underground hydrogen storage infrastructures.²²



3. Legal framework

The starting point for the analysis of the legal framework for large-scale hydrogen storage will be the existing regulations for the natural gas industry, as there is no uniform set of legislation on natural gas storage in Europe.

Due to the lack of such a uniform approach in the countries' legal framework, legal requirements may be part of mining legislation, construction legislation, environmental legislation, labour protection legislation, health and safety regulations or similar associated legislation.

This section aims to show this information based on the expert responses obtained through the survey. In particular, the information provided relate to the legislation in force in each country for natural gas underground storage facilities, the bodies responsible for permitting, the opinion on the need to adapt the Directive 2012/18/EU (SEVESO III)²³ or other industrial safety standards applicable to hydrogen storage, as well as the existence of specific regulations for natural gas and, finally, the possible existence of hydrogen underground storage facilities that have undergone legal procedures.

3.1. Austria

3.1.1. Legal framework

Austria has specific legislation for the underground storage of natural gas. Specifically, the Mining Act, *MinroG Mineralrohstoffgesetz*,²⁴ defines the exploration, extraction, and processing of hydrocarbons as well as the exploration and investigation of hydrocarbon storage sites in geological structures.

Hydrocarbons in Austria are considered national resources, which means that they are the exclusive property of Austria, irrespective of the claims of landowners. The responsible government agency is the Federal Ministry of Agriculture, Regions and Tourism, *Montanbehörde,* is the competent mining authority. Exploitation and exploration rights can be transferred to appropriate third parties in accordance with Section 69 (1) of the Mining Act. Austria taxes the exploration, extraction, and storage of hydrocarbons according to the quantity and value of oil and gas imported into the country. Production of hydrocarbons is only permitted in a valid production licence. For specific locations (facilities) several additional permitting may be applicable (forest management, nature protection).

In terms of safety, the question of whether Directive 2012/18/EU (SEVESO III) should be adapted for underground hydrogen storage is a matter of differing opinions. This directive is transposed by *Gewerbeordnung GewO* 1994 *Mineralrohstoffgesetz MinroG* 1999



Abfallwirtschaftsgesetz AWG 2002 Eisenbahngesetz EisbG 1957 Emissionsschutzgesetz für Kesselanlagen EG-K 2013 LuftfahrtgesetzLFG 2017 Umweltinformationsgesetz UIG Further implementing orders effected by SERVERSO III Bergbauunfallverordnung Bergbau-UV 2015 Abfall-Industrieunfallverordnung A-IUV 2018 Emissionserklärungsverordnung EVV 2013 Emissionsmessverordnung-Luft EMV-L2013 Industrieunfallverordnung IUV 2015 Störfallinformationsverordnung StIV 1994: § 2.²⁴

As for the current legislation for hydrogen storage, in Austria, the Mining Act has an extension allowing the storage of non-fossil gases, including hydrogen, for scientific research purposes. A commercial application is not possible at this stage.

Currently, this regulation is used for research activities but is not suitable for any commercial activity. Some companies such as RAG have experience in going through these legislative processes for their storage pilots in Upper Austria.

3.2. Czech Republic

Czech Republic has no specific underground gas storage legislation, although the competence on permits related to regulate underground natural gas storage permitting would lie with the Mining Ministry.

On the other hand, in the field of industrial safety Directive 2012/18/EU (SEVESO III) is transposed by Act No. 224/2015 Sb.²⁵

Finally, there is no current legislation for underground hydrogen storage nor has any underground hydrogen storage project passed through a legalisation process.

3.3. Denmark

In Denmark, the storage of hydrogen underground is regulated in section 23 of the Danish Subsoil Act.²⁶

According to this section, the Minister for Climate, Energy and Utilities may, for a specific part of the subsoil and under specific conditions, grant a permit with an exclusive right to explore and use the subsoil for storage or for purposes other than extraction.



And, according to Article 23b, permits may be granted according to three different procedures following a public call for applications.

Where the procedure under No. 1 is not deemed appropriate, the Minister for Climate, Energy and Public Utilities may grant permits within specific areas and possibly within specific periods without initiating the procedure under No. 1. 1. The executive order can only enter into force when a notice of initiation of the procedure has been published, stating at least which areas may be applied for and where further information on the conditions can be obtained. Amendments to the executive order are announced in the same way.

Where geological or storage considerations justify it, the Minister for Climate, Energy and Utilities may grant permits for an area to permit holders for an adjacent area without applying the procedures in numbers 1 and 2. Permit holders in all other adjacent areas must in such cases be given the opportunity and sufficient time to submit applications and have access to information on the conditions, etc. that apply to those permits.

If the Minister chooses to initiate the above procedures, an environmental assessment of the hydrogen storage plan must be carried out before it can be adopted. Companies can then apply for a hydrogen storage permit. It should be noted that if hydrogen storage is planned in the sub-seabed, it must not conflict with the Danish Maritime Plan. At present (June 2021), no areas have been reported or reserved for hydrogen storage in the Maritime Plan. If hydrogen storage is to take place offshore, the Maritime Plan must first be notified before applications can be submitted and permits issued.

3.4. Estonia

In Estonia, there are no underground natural gas storages in the Estonian specific legislation because there are no underground natural gas storages in the country.

Currently, the Ministry of Economic Affairs and Communications is responsible for the financial support of national geological investigations, drilling programs and permits for industrial underground energy storage projects.

Directive 2012/18/EU (SEVESO III) is not considered to need to be adapted for underground hydrogen storage, and this is transposed in four normative acts and laws: ²⁷

- Minimum hazard threshold and threshold quantity of a chemical and procedure for determining the hazard category of an establishment with a major accident hazard and the procedure for identifying a hazardous establishment.

- Chemicals Act1



- Minimum hazard threshold of the chemical and procedure for determining the threshold quantity of the hazardous chemical and the hazard category of the establishment.

4) Requirements and collection of mandatory documents for establishments with a risk of hazardous or serious accident, information to the public and notification of accidents.

The country does not have any legislation in place for underground storage of hydrogen nor has any underground storage of hydrogen in your country gone through a legalisation process.

3.5. France

Natural gas underground storage projects in France must comply with 3 national regulations:

- The Mining Code: Livre II du Code minier.28
- Décret 2006-648 du 2 juin 2006 relative to mining rights and underground storage rights.²⁹
- The Environment Code, it derives from the SEVESO European Directive, and is relatively similar across the European Union.³⁰

Exploration, creation, tests, or operation of an underground natural storage require a mining concession. On February 17, 2021, a law *Ordonnance n° 2021-167 du 17 février 2021 relative à l'hydrogène*,³¹ dispensed the owner of a mining concession for natural gas storage to obtain a new one for hydrogen storage, should the project be within the same perimeter.

The national bodies who regulate underground gas storage permitting are Ministry of Mining, Oil and Gas and Ministry of Environment. Recently, in a specific way to respond to the demand to give a framework to underground storage for developments related to hydrogen the Energy Code with a new Book VIII has been created specifically for all provisions concerning hydrogen and with the Ordinance N°2021-167 of 17 February 2020 on hydrogen. This text lays the first legislative foundations for the construction of a hydrogen sector in France.³²

In terms of industrial safety, the *rubrique* 4715 *Hydrogène* of the *ICPE nomenclature* already exists, derived from the SEVESO Directive,²⁷ which already deals with hydrogen storage. For example, it defines the type of authorisation required for the storage project, it does not influence whether the storage is underground or above ground:

- Declaration below 100 kg of hydrogen stored.
- Authorisation below 1 tonne.
- SEVESO seuil bas (~low level): below 5 tonnes.
- SEVESO seuil haut (~high level): higher

Furthermore, the Law no. 2003-699 of 30 July 2003 on the prevention of technological and natural risks and on the repair of damages is applicable too.³²

The study carried out by Gombert et al., 2021³² discusses in detail the legislative process that underground hydrogen storage would have to go through in France. According to the Mining



Code, it is necessary to distinguish the use of the stored hydrogen. On the one hand, if the hydrogen is for industrial use, i.e. as a raw material for various industrial processes (chemical, refining), it is governed by the Mining Code (Book II, Article L211.2), "chemical product for industrial use". On the other hand, if the hydrogen is used for energy purposes, i.e. as an energy carrier for various end uses (mobility, injection into the gas grid, methanation, conversion into electricity), it is not currently covered by the mining code. However, a draft ordinance on hydrogen, under article 52 of the energy-climate law n° 2019-1147 of 8 November 2019, provides for subjecting underground storage of hydrogen for energy purposes, by amending article L. 211-2 of the mining code.

Secondly, according to the Environment Code, the application of the Seveso Directive regulations and the resulting ICPE nomenclature requires the identification of the ICPE headings according to the quantities of product stored in the installations or the nature of the activities with the analysis of their impacts (environmental and hazard study) make it possible to define the application process:

- Procedure for requesting the modification of an EIOPC installation subject to authorisation.
- Procedure for applying for a new ICPE heading
- Procedure for applying for a Single Environmental Authorisation (SAA)

In addition, depending on the nature of the application, the applicant may have to carry out various additional studies, e.g. environmental, impact assessment or impact study, hazard studies or financial guarantees.

In parallel, it is also necessary to carry out a study of the Urban Planning Code to check the compatibility of the location of the project with the specific regulations of the territory: Coastal Law, application for building permits, etc. Depending on the nature of the project (budget and nature of the activities), the project may also be submitted in advance to the CNDP, National Concertation of the Public Debate.

In any case, whatever the project, in France it is advisable, even essential, to submit the project in advance to the administration; in a second phase, it is also recommended to meet with the communities affected by the location of the project and the installations. The aim is above all to anticipate, as far as possible, the smooth running of administrative procedures without neglecting the aspect of project communication with a view to its acceptance by the local population and residents.

Other issues related to the regulation of natural gas or underground natural gas storage must be considered by the expert consulted is the adapting the existing benchmark with adapted tolerances for hydrogen (e.g., qualifying connections with more stringent thresholds) and



more monitoring of the lifetime of wells, to improve safety and ensure good acceptance despite the specific hazard profile.

Although underground hydrogen storage in France has not yet gone through a legalisation process, preparations are underway for the first pilot projects. Storengy has submitted this year 2021 the first application for a pilot project for underground hydrogen storage in a small salt cavern the EU-funded R&D project Hypster.³³ Also, Hydrogène de France (HDF) and Teréga have signed a Memorandum of Understanding (MoU) to develop and provide geological energy storage solutions in salt caverns, launching HyGéo, a pilot project for the deployment of a new underground hydrogen storage.³⁴

3.6. Germany

Germany already has specific legislation for underground gas storage:

- Federal Mining Act, Bundesberggesetz BbergG.³⁵
- -Federal Immission Control Act, Bundes-Immissionsschutzgesetz BImSchG.³⁶
- Water Resources Act, Wasserhaushaltsgesetz.³⁷

National bodies regulating underground natural gas storage permits are the Ministry of Mining, Oil and Gas and the Ministry of Environment.

The legislation that applies to underground storage of chemical product is the same as that which currently applies to the underground storage of natural gas. Therefore, Germany has been able to build an industrial helium storage facility in Eindhoven without legislative change. industrial helium storage in Epe (North Rhine-Westphalia). Completed in September 2016, this is the world's first commercial underground storage of pure helium in a salt cavern. This cavity is located at a depth of 1300 m. Thus, the above legislation for the underground storage of natural gas in Germany, which also applies to the future storage of hydrogen.³²

Opinions on whether Directive 2012/18/EU (SEVESO III) should be adapted to underground hydrogen storage are ambiguous. In Germany, the SEVESO II Directive was mainly implemented via the Hazardous Incident Regulation, *Störfall-Verordnung, StörfallV; full name: Zwölfte Verordnung zum Bundes-Immissionsschutzgesetz (12. BImSchV).*³⁶ It lays down regulations concerning the construction, quality, and operations for various types of plant elements. For example, the law requires plant operators to conform with the state of the art in safety engineering, to use a safety management system, and to elaborate and apply an accident prevention plan. Larger plant elements are subject to more stringent requirements such as submitting safety reports and elaborating alarm and hazard prevent plans. The SEVESO III Directive is slated to be transposed into German law by 31.²⁷



Germany does not have any underground hydrogen storage project undergone a legalisation process.

3.7. Greece

The underground storage of natural gas specific legislation is Greece is shown below:

- Directive 2012/18/EE³⁸
- Greek Joint Ministerial Decision KYA 172058/2016³⁹
- Gazzete 354/B/17-2-2016 39
- Directive 2014/34/EE⁴⁰
- Greek Joint Ministerial Decision KYA Gazzete 1426/B/20-5-2016⁴¹
- Directive 2014/52/EE42

The national body regulating permits for underground storage of natural gas is the central government, at ministerial level, administration decentralised by the regional government. On the other hand, the experts consulted do not believe that Directive 2012/18/EU (SEVESO III) should be adapted to underground hydrogen storage. Furthermore, it is considered that it should be considered the regulation related to mixtures of natural mixed with hydrogen or CO_2 mixed with hydrogen, in the framework of the legislative development of underground storage of natural gas.

Finally, in Greece there is no legislation in force on underground hydrogen storage, nor has any underground hydrogen storage project undergone a legalisation process.

3.8. Hungary

In Hungary, the legislation for the underground storage of natural gas is laid down by:

- Act XLVIII of 1993 The Mining Act $^{\rm 43}$
- Act XL of 2008 Act on the Supply of Natural Gas⁴⁴
- Act XXVI of 2006 The Strategic Natural Gas Storage⁴⁵

-Governmental Decree Law no. 265/2009. (XII. 1.) On the implementation of the provisions of Act XXVI of 2006 on the strategic storage of natural gas KHEM 46

- Decree No. 2/2010. (I. 14.) On safety standards for oil and natural gas mining Decree NFM no. 6/2010. (VII.30.) On the safety of deep drillings ⁴⁷



The national bodies regulating natural gas storage permits are the Ministries of Mining, Oil and Gas Environment and Mining and the Hungarian Geological Survey Hungarian Energy and Public Utility Regulatory Authority.

The expert considers that Directive 2012/18/EU (SEVESO III) needs to be adapted for underground hydrogen storage and is transposed by Government Decree Law No. 219/2011. (X.20.) On the control of major-accident hazards involving hazardous substances.²⁷

Finally, no underground hydrogen storage has gone through a regulatory process and there is no legislation in place for underground hydrogen storage.

3.9. Italy

In Italy, underground storage of natural gas is subject to the Law on Hydrocarbons and Mining Activities. $^{\rm 48}$

Thus, the national bodies regulating underground natural gas storage permits are the Ministries of Mining and Environment.

On the other hand, it is considered that Directive 2012/18/EU (SEVESO III) should be adapted for underground hydrogen storage, and it is noted that there are specific rules based on SEVESO III.

Italy does not have any legislation in place for underground hydrogen storage nor has any underground hydrogen storage gone through a legalisation process.

3.10. Latvia

In Latvia, the legislation regulating subway natural gas storage is the Energy Law.⁴⁹ The national bodies regulating underground natural gas storage permits is the Ministry of Economy.

It is not considered that Directive 2012/18/EU (SEVESO III) should be adapted to subway hydrogen storage, and the regulation transposing by six national regulations.²⁷

Latvia does not have any legislation in place for subway hydrogen storage nor has any subway hydrogen storage project gone through a legalization process.



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3.11. Lithuania

In Lithuania, there are no underground natural gas storage facilities, so there is no specific legislation for it, although Lithuania has currently launched a project for the construction of an underground gas storage facility, Syderiai Underground Gas Storage.⁵⁰ The national agency in charge of underground storage permitting is the mining regulatory body.

In terms of industrial safety, the expert consulted considers that Directive 2012/18/EU (SEVESO III) should not be adapted for underground hydrogen storage, and the regulation transposing by thirty-eight national regulations.²⁷

Lithuania does not have any legislation in place for underground hydrogen storage nor has any subway hydrogen storage gone through a legalization process.

3.12. Netherlands

The Netherlands has specific legislation for the subway storage of natural gas, since underground natural gas storage is included in the Dutch Mining Act and Regulations. The Ministry of Economic Affairs and Climate Policy is responsible for the defining policies and executing the regulations (licences, storage plans) etc. The State Supervision of Mines is responsible for the supervising and monitoring the activities, especially in the context of health, safety, and environment. Regional authorities are responsible for surface and shallow subsurface aspects regulated by the Environment Act.⁵¹⁻⁵³

The paper published by E. Winters et al. discusses in detail Legal and societal embeddedness of largescale energy storage⁵⁴ in Netherlands. Thus, the licensing of underground energy storage is regulated by the Mining Act and derived regulations and by environmental legislation. The Mining Act regulates activities in the deep underground, 100 metres or more. Activities in the shallow subsoil, less than 100 metres deep, and on the surface are regulated by environmental legislation. To store substances underground, a storage permit must be applied for and obtained in advance. In most cases, storage activities take place directly after mining activities. Therefore, there is usually a clear link between the mining permit on the one hand and the storage permit on the other hand. The party obtaining the storage permit essentially receives a concession for the area. The second step in the procedure is to obtain an approved storage plan. Only with an approved storage plan and the necessary environmental permits can the storage be developed and used. The decision on the storage plan is coordinated with the environmental permits. This means that all conditions of the different permits must be fulfilled, but that the decisions are coordinated under the so-called "National Coordination Regulation", i.e., projects of national importance. A new Environment Act is expected to enter into force in early 2022. This new law aims to bring together rules on spatial planning, housing, infrastructure, nature, and the environment and to make



environmental legislation more comprehensible. Many of the permits will remain unchanged in terms of content, but the new law will introduce a new type of procedure and the National Coordination Regulation, and the National Integration Plan will be replaced by the project procedure and the project decision.

Other issues related to natural gas or underground natural gas storage regulation should have been considered are the regulations related to spatial planning, licensing procedures, environmental impacts, link between prior activities (e.g., gas/salt production) and re-use of storage assets (e.g., transition of ownership and liabilities).

The legislation for underground hydrogen storage is under development and so far, no underground hydrogen storage has gone through the legal process yet. Of note is the HyStock project,⁵⁵ which aims to develop a hydrogen storage project in a salt cavern, with testing started in September, 2021.

The legislation for underground hydrogen storage is under development and so far, no underground hydrogen storage has gone through the legal process.

3.13. Poland

In Poland, Act of 9 June 2011, Geological and Mining Law is the specific regulation for underground storage of natural gas.⁵⁶ The geological licence for underground gas storage is granted by the Minister of Climate and Environment, while the licence for the provision of energy storage services is granted by the President of the Energy Regulatory Office.

The Directive 2012/18/EU, Seveso III, is transposed by eight national laws.²⁷ According to experts consulted, this legislation should be adapted to underground hydrogen storage. The SEVESO III Directive applies not only to exploitation, i.e., exploration, extraction and processing of minerals in mines and quarries, including by drilling, and to landfills, including underground storage of waste. However, below all exclusions, in the form of separate text, the following information is given: By way of derogation from the first paragraph of (a)(e) (mineral exploitation - author's footnote) and (h) (landfills - author's footnote), the scope of this Directive covers underground storage of gas in natural terrain, aquifers, salt caverns and idle mines, and the chemical and thermal treatment and storage processes associated with these operations involving dangerous substances, as well as installations for the disposal of residues from flotation processes, including ponds or dams, containing dangerous substances.

The identified barriers are related with the current form of the Polish Energy Act. This law does not define the concept electricity storage. The current regulation only provides for the



regulation of storage of gaseous fuels. The current legislation does not include the concept of storage facility applicable to the electricity industry.

Thus, Poland does not have any legislation in place for underground hydrogen storage, nor has any underground hydrogen storage gone through a legalisation process.

3.14. Portugal

In Portugal, Decree-Law No. 140/2006, of July 26,⁵⁷ which develops the foundations of the organization and functioning of the National Natural Gas System, establishes in paragraph 2 of the Article 63, that the underground storage regulation of natural gas is approved by ordinance of the minister responsible for the energy area, under proposal of the Directorate-General for Energy and Geology. Ordinance 181/2012, of 8 July,⁵⁸ establishes the provisions for the research, design, construction, and exploration of cavities in saline formations in the national territory for the underground storage of natural gas, being applicable to underground storage facilities in operation, under construction or to be built, as well as the respective surface installations.

The national body that regulates underground gas storage permitting is the Directorate-General for Energy and Geology (DGEG) which also regulates mining and oil and gas activities. DGEG is a public administration body of the Ministry of Environment and Climate Action.

According to experts consulted, Directive 2012/18/EU (SEVESO III) should be adapted for underground hydrogen storage, and it is transposed in Decree-law 150/2015 from 5 August and Decree-law 42/2014 from 4 July.²⁷ Safety of underground natural gas storage is addressed in chapter IV of Ordinance 181/2012.⁵⁸

Portugal does not have any legislation in place for underground hydrogen storage, nor has any underground hydrogen storage gone through a legalisation process.

3.15. Romania

In Romania, the underground gas storage is regulated by Electricity and Natural Gas Law no. 123/2012, with subsequent amendments and completions, Order no. 20 from 26 of February 2020 issued by Romanian Energy Regulatory Authority (ANRE), Petroleum law 238/2004 and its application procedure which was approved through Governmental Decision no 2075/2004. The national bodies who regulate underground natural gas storage permitting is the Ministry of Mining. ⁵⁹



According to the consulted experts, Directive 2012/18/EU (SEVESO III) should be adapted for underground hydrogen storage and the Transposition of Directive 2012/18/EU (SEVESO III) was made through Law 59/2016 and Government Decision no. 804/2007.²⁷

Romania does not have any legislation in place for underground hydrogen storage, nor has any underground hydrogen storage gone through a legalisation process.

3.16. Spain

In Spain, the specific underground natural gas legislation is the Law 34/1998 of 7 October 1998 on the hydrocarbons sector,⁶⁰ as general frame, and other more specific the Royal Decree *1184/2020*, refer to geological underground storage.⁶¹

The national body that regulates underground natural gas storage permits is the Directorate General for Energy Policy and Mines, part of the Ministry for Ecological Transition and Demographic Challenge, MITECO.

According to the consulted experts the Directive 2012/18/EU (SEVESO III) should be adapted for underground hydrogen storage, and it is transposed to Spanish regulation by the Royal Decree 840/2015, of 21 September.²⁷

Spain does not have any legislation in place for underground hydrogen storage, nor has any underground hydrogen storage gone through a legalisation process

3.17. United Kingdom

In United Kingdom there are no specific legislation, underground gas storage is covered by existing protocols including Health & Safety law, National and local planning processes, Control of Major Accident Hazards, Environmental and groundwater legislation. The national bodies regulate underground natural gas storage permitting is through mail co-ordination is via the National and local planning processes. Several articles have already addressed this process, such as Howard B. J. Stone, et al.⁶² This regulatory process is described below, based on information provided by the above-mentioned authors.

The planning system in the UK has three levels: national, regional, and local government. The national level is dictated by Government policy. In response to the national level, a regional planning body sets out a spatial strategy for a ten-to-fifteen-year period. Expected land development needs are identified in the Spatial Strategy and must be in line with national policies. At the local level, a development framework is prepared which includes a development plan, development documents and a statement of community involvement. These development



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documents are used to prepare Development Plan Documents (DPDs), which reflect the needs of the population.

Development Plan Documents (DPDs), which reflect national, regional, and local needs. DPDs are then the starting point for the consideration of any planning application (ODPM 2005a). In the UK, therefore, the planning process for the construction of a salt cavern is initially dealt with at the local level.

Once the application has been submitted to the local council, the council consults its DPD and decides on the next course of action. The ODPM (2005b) states that if more than 25 tonnes of flammable gas is stored, the Health and Safety Commission (HSC) must grant a 'risk authorisation'. In addition to the intervention of the HSC, an environmental impact assessment may be required depending on the change of land use. In parallel to these activities, it is usual for an open meeting to be held for the public to view the proposal.

This is followed by a 21-day public consultation period when comments are received. Once this statutory public consultation period is over, a second open meeting is held at which the issues are discussed. If the application is considered too complicated for the local council to assess or meets one of the five criteria set out in ODPM (2005a), the Secretary of State has the right to intervene and decide on the application.

A flow chart of the planning process is shown in Figure 5.



Figure 5. Flow chart of planning procedure with loops for public consultation. Source: Howard B. J. Stone, Ivo Veldhuis and R. Neil Richardson Underground hydrogen storage in the UK. Geological Society, London, Special Publications 2009, v.313, p217-226.⁶²

According to the consulted experts, Directive 2012/18/EU (SEVESO III) no should be adapted for underground hydrogen storage. United Kingdom have other national standards that are adopted- e.g., health and safety legislation, national and local planning procedures, environmental standards.

Other issues related to natural gas or underground natural gas storage regulation should have been considered is the use of existing infrastructure in hydrogen storage operations (boreholes, platforms, pipelines) or the re-purposed use of brine caverns for gas storage operations.



Already three solution mined caverns have been used for hydrogen storage that are permitted and regulated in United Kingdom.



4. Standards

In the development of Task 6.1, assessment of the regulatory framework, different standards have been identified in relation to underground storage of natural gas:

- EN 1819-1 Gas infrastructure. Underground gas storage. Part 1: Functional recommendations for storage in aquifers.⁶³

- EN 1819-2 Gas infrastructure. Underground gas storage. Part 2: Functional recommendations for storage in oil and gas fields.⁶⁴

- EN 1819-3 Gas infrastructure. Underground gas storage. Part 2: Functional recommendations for storage in solutions-mined salt caverns.⁶⁵

- EN 1819-4 Gas infrastructure. Underground gas storage. Part 2: Functional recommendations for storage in rock caverns.⁶⁶

- EN 1819-5 Gas infrastructure. Gas infrastructure. Functional recommendations for storage in aquifers. $^{\rm 67}$

- EN (ISO 16530-1:2017). Petroleum and natural gas industries - Well integrity - Part 1: Life cycle governance. 68

This list was distributed to HyStories project partners and HyStories SAB members, for completion of standards or comments not identified. Some of the recommendations given by the experts remark that, beyond the standards listed, each member state may have local standards that will be applied at member state level, so it is always recommended, for each specific case, to consult the local, regional, or national legislation to check the mandatory or recommended application of the standards.

Thus, standards only concern those who want to read them, unless they are mentioned/specified in a legislation, which is a priori not the case in the underground storage industry in France. Their use depends on the technical sector. Those most concerned by standards are the ones that have a large activity outside of underground storage, such as:

- Drilling, wells, and completion: wells of underground storage in salt caverns or porous media are the same as those of Oil & Gas industry. This industry has developed standards progressively over time, the most applied being API (American Petroleum Institute) ones that



are followed by nearly all contractors and projects (except maybe in Russia or China). In this field is highlighted the Material selection referential e.g., *NACE MR0175 for sour service API standards for wells*, and *API 5C5 (validation of connections)*.

- Surface pipping, process, etc. Standards from e.g. ASME are quite commonly used.

In salt caverns, we should mention the role of SMRI (Solution Mining Research Institute), that has been for more than 55 years the main technological exchange forum. It produces Research Reports, and some are widely referred to in the industry (e.g., the one on MIT to test the tightness of salt caverns), being de facto used as a standard.

Furthermore, summary of technical standards was developed by MARCOGAZ applicable to the gas industry activities to guide representatives and players in the sector and can be consulted.⁶⁹

On the other hand, in addition to European standards, there are national standards developed by the oil and gas industry dealing with well integrity that are widely recognised and applicable to gas storage. Again, a list of these standards was shared with industry experts for completion or addition of comments, which are listed below.

- Norsok Standard D-010 Well integrity in drilling and well operations (Norway).⁷⁰

- Oil & Gas UK. Well Life Cycle Integrity Guidelines (United Kingdom).⁷¹

- German Federal Association of Natural Gas, Oil and Geoenergy (BVEG), Technical Rule Bohrlochkontrolle. Bohren, Workover, Well Intervention (Well control. Drilling, Workover, Well Intervention), (Germany).

- German Federal Association of Natural Gas, Oil and Geoenergy (BVEG), Technical Rule Well Integrity, (Germany).

Austria added pressure equipment directive:

- API standards pressure equipment directive.

In Germany another act must be considered:

- DVGW Regelwerke

Greece added a Directive:

- "Directive 2014/68/EU Joint Ministerial Decision 74124/ Δ BTN 1431/2026 Gazette 2278/B/22-7-2016".

In Poland, no national standards developed, but a ordinance includes requirements:

- Ordinance 118/2012, Chapter II includes requirements for design and construction of salt cavities and equipment to utilise.⁵⁸

Two new national standards were recommended from United Kingdom:

- Borehole Sites and Operation Regulations, 1995.⁷²

- OFGEM: Guidance on the regulatory regime for gas storage facilities in Great Britain (version 2).⁷³



5. EU Permits

In order to collect in this deliverable, the current permits needed to develop underground gas storage, a questionnaire was prepared and completed and reviewed by experts from France (Geostock, Teréga), Germany (Uniper, Storengy Deutschland), Spain (FHa, Enagas) and Poland (MEERI-PAS, Gaz System). These four countries were selected as they are the ones where business models will be developed in the framework of WP8, so the information presented in this deliverable is intended to complement and support them. The questionnaire on permits can be found in Annex II. The experts answers and comments are shown below.

5.1. France

	1. Authorisation name	2. Entity responsible for granting authorisation permits	3. Reference document	4. Resolution time	5. Is such a licence necessary if the activity takes place on existing underground storage?	6. Control, duration, renewal obligations		
	Exploitation concession							
	Permis de recherches de stockage souterrain (Licence) - Code minier (Mining code) : research phase	Ministre de l'énergie (Minister of Energy)	Livre II du Code minier, articles L221-1 et suivants Décret n°2006- 648 du 2 juin 2006	2 years from the admissibility of the application	No, provided that the perimeter is included in the existing licence or concession, and the stored substances are identicals.	The duration of the licence is five years, renewable once		
	Concession de stockage souterrain - Code minier (Mining code) : operation phase	Ministre de l'énergie (Minister of Energy)	Livre II du Code minier, articles L211.2 et suivants Décret n°2006- 648 du 2 juin 2006	2 years from the admissibility of the application	No, provided that the perimeter is included in the existing concession, and the stored substances are identicals.	The duration of the concession is twenty- five years, renewable once		
Global Authoris	Facilities							
ations	Autorisation environnemental e (ICPE)	Préfet (instruction DREAL)	Livre I, titre VIII du Code de l'environnement, articles L181-1 et suivants et R181- 4 et suivants	10-12 months from the admissibility of the application	Yes, weather the identified risks and environmental impacts could be changed (ex : convertion to a new product) and when the operator changes.	No time limit of the authorisation once granted Regular inspections by the Administration (DREAL)		
		Enviromental Impact						
	Evaluation environnemental e (Environment assessment)	Préfet (instruction DREAL)	Livre I, Titre II du Code de l'environnement, articles L122-1 et suivants, R122-1 et suivants	Environment assessment is included is the authorisation procedure (Unique Environmental Authorisation -	Yes, weather the identified risks and environmental impacts could be changed (ex : convertion to a new product).	The environment assessment remains valid as long as the activity is not subject to substantial modification.		



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				overall 10-12 months)			
			Public	utility declaration			
	A priori non						
			Public domai	n concession applic	cation	Γ	
	Autorisation d'occupation temporaire (AOT) du domaine public en cas de travaux réalisés sur le domaine public (<i>rare</i>)	Gestionnaire du Domaine Public	Livre I, Titre II du Code général de la propriété des personnes publiques, articles L. 2122-1 à L. 2122-4, L. 2125-1 à L. 2125- 6, R. 2122-1 à R. 2122-8 et R. 2125-1 à R. 2125- 6	2 months from the request	Yes, if the occupant and the activity are differents.	The authorisation is precarious and revocable.	
				Facilities			
Well	Code minier (Mining code)	DREAL + Prefecture + Ministère	Livre II, article L211.2	2 years	No (but an application, taking less time, would still be needed)	Concession maximum duration are 25 years, It then has to be renewed	
Authoris ations	Code de l'Environnement (Environmental code)	DREAL + Prefecture	"Procedure Autorisation Environementale Unique" (Unique Environmental Authorization)	1 year	Yes. New risk analyses, environmental impact studies would be required for a convertion to a new product	Annual contral inspection. No time limit of the authorisation once granted	
	Integrated environmental authorisation						
Plant	Code de l'Environnement (Environmental code)	DREAL + Prefecture	"Procedure Autorisation Environementale Unique" (Unique Environmental Authorization)	1 year	Yes. New risk analyses, environmental impact studies would be required for a nconvertion to a new product	Annual contral inspection. No time limit of the authorisation once granted	
tions	Facilities						
	Code de l'Environnement (Environmental code)	DREAL + Prefecture	"Procedure Autorisation Environementale Unique" (Unique Environmental Authorization)	1 year	Yes. New risk analyses, environmental impact studies would be required for a convertion to a new product	Annual contral inspection. No time limit of the authorisation once granted	
			Deciara		Yes. New risk	Annual contral	
	Code de l'Environnement (Environmental code)	DREAL + Prefecture	"Procedure Autorisation Environementale Unique" (Unique	1 year	analyses, environmental impact studies would be required for a	inspection. No time limit of the authorisation once granted	


			Environmental Authorization)		convertion to a new product	
		•	Build	ling permit plant		
	Autorisation d'urbanisme: permis de construire / déclaration préalable (building permit / preliminary declaration)	Competent public authority (communes ou groupements, DDT)	Livre IV du Code de l'urbanisme, articles L421-1 et suivants, articles R*420-1 à R*427-6	Instruction time: 3 months	Yes. New buildings require new permits	The building permit or the preliminary declaration are valid for 3 years.
			А	ctivity licence		
	Autorisation environnemental e (ICPE), formalisée par un arrêté préfectoral	Préfet (instruction DREAL)	Livre I, titre VIII du Code de l'environnement, articles L181-1 et suivants et R181- 4 et suivants	10-12 months from the admissibility of the application	Yes, weather the identified risks and environmental impacts could be changed (ex : convertion to a new product) and when the operator changes.	No time limit of the authorisation once granted Regular inspections by the Administration (DREAL)
				Other		
Other	Plan de Prévention des Risques Naturels (PPRN) Plan de Prévention des Risques Technologiques (PPRT)	Préfet	Code de l'Environnement (Environmental code) : PPRT : art. L515- 15 et suivants PPRN : art. L562- 1 et suivants	Ces plans doivent être pris en compte dans le cadre de l'autorisation environnemental e		
Other commen ts	In France, esser	ntially 2 application	s files, as per mining Nearly all is in	g and environmenta ncluded in these 2 c	l codes, will be prepared	for a new H2 storage.





Figure 6. Administrative procedure applicable to an application for an underground hydrogen storage permit in France. Source: Gombert et al., 2021³²

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5.2. Germany

	1. Authorisation name	2. Entity responsible for granting authorisation permits	3. Reference document	4. Resolution time	5. Is such a licence necessary if the activity takes place on existing underground storage?	6. Control, duration, renewal obligations
	1. Genehmigungsname	2. Für die Erteilung von Zulassungsgen ehmigungen zuständige Stelle	3. Referenzdoku ment	4. Entschlusszeit (Verfahrensdauer)	5. Ist eine solche Genehmigung erforderlich, wenn die Tätigkeit auf bestehenden Untertagespeich ern stattfindet?	6. Kontrolle, Dauer (Gültigkeitsdauer), Erneuerungspflichten
		Ex	ploitation conces	sion / Erlaubnis zur A	ufsuchung	
	Licence for exploration ofsolid resources	Mining authority	Federal Minig Act	no experience	no	as per licensing notice (acc. to work program)
	Aufsuchung von Bodenschätzen	Bergbehörde	Bundesbergges etz (BBergG)	keine Erfahrungswerte	nein	gem. Bescheid (angelehnt an Arbeitsprogramm)
	Licence for mining of solid resources	Mining authority	Federal Minig Act	no experience	no	as per licensing notice (leand on production expection)
	Bewilligung zur Gewinnung von Bodenschätzen	Berahehörde	Bundesbergges	keine Erfahrungswerte	nein	gem. Bescheid (angelehnt an Fördererwartung)
	Douenschutzen	Dergbenorde	EIZ (DDEIGO)	Lijuniungswerte	nem	Toruerer wurtung)
Claba	bouenschutzen	Dergbenorde	Facilities / (im Sinne) Einrichtung	ien	Tordererwartung
Globa I Autho	Official approval of plan	Mining authority	Facilities / (Regional Planning Act	im Sinne) Einrichtung appr. 1 up to 1.5 years	yes	generally not
Globa I Autho risatio ns global e (übor	Official approval of plan Planfeststellungsbesch eid (PFB)	Mining authority Berabehörde	Facilities / (Regional Planning Act Raumordnungs gesetz (ROG) i.V.m. BBergG, UVPG, UVP-V Berabau	<i>im Sinne) Einrichtung</i> appr. 1 up to 1.5 years	yes	generally not
Globa I Autho risatio ns global e (über geord	Official approval of plan Planfeststellungsbesch eid (PFB) Permit of Overall	Mining authority Bergbehörde Mining	Facilities / (Regional Planning Act Raumordnungs gesetz (ROG) i.V.m. BBergG, UVPG, UVP-V Bergbau Federal Minig	<i>im Sinne) Einrichtung</i> appr. 1 up to 1.5 years <i>ca. 1 bis 1,5 Jahre</i> appr. 1 up to 1.5	yes Ja	generally not
Globa I Autho risatio ns global e (über geord nete)	Official approval of plan Planfeststellungsbesch eid (PFB) Permit of Overall Operation Plan	Mining authority Bergbehörde Mining authority	Facilities / (Regional Planning Act Raumordnungs gesetz (ROG) i.V.m. BBergG, UVPG, UVP-V Bergbau Federal Minig Act	<i>im Sinne) Einrichtung</i> appr. 1 up to 1.5 years <i>ca. 1 bis 1,5 Jahre</i> appr. 1 up to 1.5 years	yes Ja yes	generally not <i>i.d.R. keine</i> generally appr. 25 years
Globa I Autho risatio ns global e (über geord nete) Gene hmigu naen	Official approval of plan Planfeststellungsbesch eid (PFB) Permit of Overall Operation Plan Zulassung Rahmenbetriebsplan	Mining authority Bergbehörde Mining authority Bergbehörde	Facilities / (Regional Planning Act Raumordnungs gesetz (ROG) i.V.m. BBergG, UVPG, UVP-V Bergbau Federal Minig Act Bundesbergges etz (BBergG)	<i>im Sinne) Einrichtung</i> appr. 1 up to 1.5 years <i>ca. 1 bis 1,5 Jahre</i> appr. 1 up to 1.5 years <i>ca. 1 bis 1,5 Jahre</i>	yes Ja Ja	generally not <i>i.d.R. keine</i> generally appr. 25 years <i>i.d.R. ca. 25 Jahre</i>
Globa l Autho risatio ns global e (über geord nete) Gene hmigu ngen	Official approval of plan Planfeststellungsbesch eid (PFB) Permit of Overall Operation Plan Zulassung Rahmenbetriebsplan	Mining authority Bergbehörde Mining authority Bergbehörde	Facilities / (Regional Planning Act Raumordnungs gesetz (ROG) i.V.m. BBergG, UVPG, UVP-V Bergbau Federal Minig Act Bundesbergges etz (BBergG)	<i>im Sinne) Einrichtung</i> appr. 1 up to 1.5 years <i>ca. 1 bis 1,5 Jahre</i> appr. 1 up to 1.5 years <i>ca. 1 bis 1,5 Jahre</i> Impact / Umweltein	yes Ja Ja Ja Ja fluss	generally not <i>i.d.R. keine</i> generally appr. 25 years <i>i.d.R. ca. 25 Jahre</i>
Globa I Autho risatio ns global e (über geord nete) Gene hmigu ngen	Official approval of plan Planfeststellungsbesch eid (PFB) Permit of Overall Operation Plan Zulassung Rahmenbetriebsplan	Mining authority Bergbehörde Mining authority Bergbehörde Mining authority (in agreement with	Facilities / (Regional Planning Act Raumordnungs gesetz (ROG) i.V.m. BBergG, UVPG, UVP-V Bergbau Federal Minig Act Bundesbergges etz (BBergG) Environmental	<i>im Sinne) Einrichtung</i> appr. 1 up to 1.5 years <i>ca. 1 bis 1,5 Jahre</i> appr. 1 up to 1.5 years <i>ca. 1 bis 1,5 Jahre</i> Impact / Umweltein	yes Ja yes Ja fluss	generally not <i>i.d.R. keine</i> generally appr. 25 years <i>i.d.R. ca. 25 Jahre</i>
Globa I Autho risatio ns global e (über geord nete) Gene hmigu ngen	Official approval of plan Planfeststellungsbesch eid (PFB) Permit of Overall Operation Plan Zulassung Rahmenbetriebsplan Environmental Impact Assessment	Mining authority Bergbehörde Mining authority Bergbehörde Mining authority (in agreement with specialised authorities)	Facilities / (Regional Planning Act Raumordnungs gesetz (ROG) i.V.m. BBergG, UVPG, UVP-V Bergbau Federal Minig Act Bundesbergges etz (BBergG) Environmental Impact Assessment Act	<i>im Sinne) Einrichtung</i> appr. 1 up to 1.5 years <i>ca. 1 bis 1,5 Jahre</i> appr. 1 up to 1.5 years <i>ca. 1 bis 1,5 Jahre</i> Impact / Umweltein	yes Ja Ja fluss	generally not <i>i.d.R. keine</i> generally appr. 25 years <i>i.d.R. ca. 25 Jahre</i>
Globa I Autho risatio ns global e (über geord nete) Gene hmigu ngen	Dotenschutzen Official approval of plan Planfeststellungsbesch eid (PFB) Permit of Overall Operation Plan Zulassung Rahmenbetriebsplan Environmental Impact Assessment Umweltverträglichkeit sprüfung (gehört zum PFB)	Mining authority Bergbehörde Mining authority Bergbehörde Mining authority (in agreement with specialised authorities) Bergbehörde (in Einvernehmen mit Fachbehörden)	Facilities / (Regional Planning Act Raumordnungs gesetz (ROG) i.V.m. BBergG, UVPG, UVP-V Bergbau Federal Minig Act Bundesbergges etz (BBergG) Environmental Impact Assessment Act Umweltverträgl ichkeitsprüfung sgesetz (UVPG)	<i>im Sinne) Einrichtung</i> appr. 1 up to 1.5 years <i>ca. 1 bis 1,5 Jahre</i> appr. 1 up to 1.5 years <i>ca. 1 bis 1,5 Jahre</i> Impact / Umweltein	yes Ja Ja Ja fluss yes	generally not <i>i.d.R. keine</i> generally appr. 25 years <i>i.d.R. ca. 25 Jahre</i>



		agreement	with Federal			
		with	Nature			
		specialised	Conversation			
		authorities)	Act			
		Bergbehörde	FFH-Richtlinie			
		(in	i.V.m.			
	FFH-	Einvernehmen	Bundesnatursc			
	Verträglichkeitsprüfun	mit	hutzgesetz			
	g (gehört zum PFB)	Fachbehörden)	(BNatSchG)		Ja	
		Public utility dec	laration / Erkläru	ng zum öffentlichen	Versorgungsuntern	ehmen
	Pu	blic domain conc	ession applicatior	n / Konzessionsantra	g für den öffentliche	en Bereich
			Ot	her / Sonstiges		
		Mining				
		authority (in				
		agreement				
		with		4		
	Water Permit for aquifer	specialised authorities)	Federal Water	appr. 1 up to 2 vears	ves	as per Approval Notification (20-40 years)
		Bergbehörde		700.0	700	
		(in				
	Wasserrechtliche	Einvernehmen				
	Erlaubnis Aquifer	mit	Wasserhaushal			
	(wenn vorhanden)	Fachbehörden)	tsgesetz (WHG)	ca. 1 bis 2 Jahre	Ja	gem. Bescheid (20-40 Jahre)
			Facilit	ies / Einrichtungen		•
	Permit of Special	Mining	Federal Minig			
	Operating Plan wells	authority	Act	appr. 2 months	no	generally unlimited
	Zulassung					
	Sonderbetriebspläne		Bundesbergges			
	Bohrungen	Bergbehörde	etz (BBergG)	ca. 2 Monate	Nein	i.d.R. unbefristet
Well						
Autho	Pul	blic domain conc	ession application	/ Konzessionsantrag	g für den öffentliche	en Bereich
ns						
Zulass						
ung Bohru						
ngen			Ot	her / Sonstiges		
		Mining				
		authority (in				
		agreement				
	Water Law Permit to	with				
	inject substances into	specialised	Federal Water	appr. 0.5 up to 1		
	the subsoil	authorities)	Act	year	no	as per Approval Notification



	Wasserrechtliche Erlaubnis Einbringen	Bergbehörde (in Einvernehmen				
	von Stoffen in den Untergrund	mit Fachbehörden)	Wasserhaushal tsgesetz (WHG)	ca. 0,5 bis 1 Jahr	Nein	gem. Bescheid
	Int	tegrated environ	mental authorisat	tion / integrierte um	veltrechtliche Gene	hmigung
	Permit acc. to Federal	Mining	Federal Imission			
	Immission Control Act	authority	Control Act	Appr. 1 year	yes	
			Bundesimmissi onsschutzgeset z (BImSchG)			
	Genehmiauna nach		I.V.M. 12. BImSchV			
	BlmSchG	Bergbehörde	Anhang 1 Nr. 9	Ca. 1 Jahr	Ja	
			Federal			
			Control Act in			
	Fulfilment of		conjunktion			
	obligations acc. to		with Hazardous			
	Hazardous Incident	Mining	Incident	before		
	Ordinance	authority	Ordinance	comissioning	yes	
			onsschutzaeset			
			z (BImSchG)			
			i.V.m.			
Plant	Erfüllung Pflichten	Devekskände	Störfallverordn		1	
autho	nach Storfallv	Bergbenorde	Endoral Water	DISTBIN	Ja	
risatio			Act in			
ns			conjuction with			
Anlag			Ordinance on			
ehmia			Installations for			
ung	Notifikation of		Handling			
	handling substances	Mining	Hazardous to	6 weeks before		
	hazardous to water	authority	Water	start installation	yes	
			Wasserhaushal			
	Anzeige von LAU- und	Doughobäudo	tsgesetz i.V.m.	6 Wochen im	10	
	HBV-Aniugen	Bergbenorde	AWSV	voruus	Ja	
	Main Onemating Diag	Data in a	Facilit	ies / Einrichtungen	T	[
	"installation phase"	authority	Act	appr. 3 months	no	generally 2 years
	Hauptbetriebspläne		Bundesbergges			
	Errichtungsphase	Bergbehörde	etz (BBergG)	ca. 3 Monate	Nein	i.d.R. 2 Jahre
	Special Operating Plan					
	for installation of	Mining	Federal Minig			
	components	authority	Act	appr. 2 months	no	
	Sonderbetriebspläne					
	Errichtung einzelner		Bundesbergges			
	Komponenten	Bergbehörde	etz (BBergG)	ca. 2 Monate	Nein	
	Special Operating Plan					
		Mining	Federal Minia			
	Individual	IVIINING	Federal Willing			



	1	1	1	1	
Sonderbetriebspläne					
Änderung einzelner		Bundesbergges			
(omponenten	Bergbehörde	etz (BBergG)	ca. 2 Monate	Ja	
Notification acc. to	Energy	High Pressure			
High Pressure Gas	Regulatory	Gas Pipeline	8 weeks before		
Pipeline Ordinance	Authority	Ordinance	start	yes	
		Gashochdruckle			
Anzeige nach		itungsverordnu			
GasHDrLtgV für ggf.	Energieaufsich	ng	8 Wochen im		
Anbindungsleitung	tsbehörde	(GasHDrLtgV)	Voraus	Ja	
C	eclaration of put	l olic utility / Erklär	una zum öffentlicher	n Versoraunasunter	rnehmen
		, <u></u>			
	Bu	ilding permit plan	nt / Baugenehmigung	g der Anlage	•
	Building	German			
	authorities	Statutory Code			
	managed by	on			
	mining	Construction			
Building permit	authority	and Building	appr. 8 weeks	no	
	Bauämter				
		Paugasatzhuch			
	(über	Buugesetzbuch			-
3augenehmigung(en)	(über Bergbehörde)	(BauGB)	ca. 8 Wochen	Nein	
Baugenehmigung(en)	(über Bergbehörde)	(BauGB)	ca. 8 Wochen	Nein	
Baugenehmigung(en)	(über Bergbehörde)	(BauGB)	ca. 8 Wochen	Nein	
Baugenehmigung(en) Main Operating Plan	(über Bergbehörde) Mining	(BauGB) Activity licent	ca. 8 Wochen c e / Betriebsgenehm	Nein igung	
Baugenehmigung(en) Vain Operating Plan	(über Bergbehörde) Mining authority	(BauGB) Activity licent Federal Minig	ca. 8 Wochen	Nein igung	generally 2 years
Baugenehmigung(en) Main Operating Plan 'operating phase"	(über Bergbehörde) Mining authority	Activity licent Federal Minig Act	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months	Nein igung yes	generally 2 years
Baugenehmigung(en) Main Operating Plan Operating phase" Hauptbetriebsplan Betriebsphase	(über Bergbehörde) Mining authority Berghehörde	Activity licent Federal Minig Act Bundesbergges etz (BBeraG)	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months	Nein igung yes	generally 2 years
Baugenehmigung(en) Main Operating Plan 'operating phase'' Hauptbetriebsplan Betriebsphase	(über Bergbehörde) Mining authority Bergbehörde	Activity licent Federal Minig Act Bundesbergges etz (BBergG)	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months ca. 3 Monate	Nein igung yes Ja	generally 2 years i.d.R. 2 Jahre
Baugenehmigung(en) Main Operating Plan "operating phase" Hauptbetriebsplan Betriebsphase	(über Bergbehörde) Mining authority Bergbehörde	Activity licence Federal Minig Act Bundesbergges etz (BBergG)	ca. 8 Wochen	Nein igung yes Ja	generally 2 years <i>i.d.R. 2 Jahre</i>
Baugenehmigung(en) Main Operating Plan 'operating phase'' Hauptbetriebsplan Betriebsphase	(über Bergbehörde) Mining authority Bergbehörde	Activity licent (BauGB) Federal Minig Act Bundesbergges etz (BBergG) Ot	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months ca. 3 Monate her / Sonstiges	Nein igung yes Ja	generally 2 years i.d.R. 2 Jahre
Baugenehmigung(en) Main Operating Plan 'operating phase'' Hauptbetriebsplan Betriebsphase	(über Bergbehörde) Mining authority Bergbehörde Mining	Activity licend Federal Minig Act Bundesbergges etz (BBergG) Ot	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months ca. 3 Monate her / Sonstiges	Nein igung yes Ja	generally 2 years i.d.R. 2 Jahre
Baugenehmigung(en) Main Operating Plan operating phase" Hauptbetriebsplan Betriebsphase	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in	Activity licend Federal Minig Act Bundesbergges etz (BBergG) Ot	ca. 8 Wochen	Nein igung yes Ja	generally 2 years <i>i.d.R. 2 Jahre</i>
Baugenehmigung(en) Main Operating Plan Operating phase" Hauptbetriebsplan Betriebsphase	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in agreement with	Activity licend Federal Minig Act Bundesbergges etz (BBergG) Ot Federal Water	ca. 8 Wochen	Nein igung yes Ja depending on changes	generally 2 years <i>i.d.R. 2 Jahre</i> as per Approval Notification
Baugenehmigung(en) Main Operating Plan 'operating phase" Hauptbetriebsplan Betriebsphase Water Law Permit surface water discharge	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in agreement with specialised	Activity licent (BauGB) Federal Minig Act Bundesbergges etz (BBergG) Ot Federal Water Act	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months ca. 3 Monate her / Sonstiges appr. 3 up to 12 months	Nein igung yes Ja depending on changes	generally 2 years <i>i.d.R. 2 Jahre</i> as per Approval Notification (appr. 15 - 20 years)
Baugenehmigung(en) Main Operating Plan Operating phase" Hauptbetriebsplan Betriebsphase Nater Law Permit urface water lischarge	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in agreement with specialised authoritics)	Activity licent (BauGB) Federal Minig Act Bundesbergges etz (BBergG) Ot Federal Water Act	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months ca. 3 Monate her / Sonstiges appr. 3 up to 12 months	Nein igung yes Ja depending on changes	generally 2 years <i>i.d.R. 2 Jahre</i> as per Approval Notification (appr. 15 - 20 years)
Baugenehmigung(en) Vain Operating Plan 'operating phase" Hauptbetriebsplan Betriebsphase Nater Law Permit surface water discharge	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in agreement with specialised authorities)	Activity licent (BauGB) Activity licent Federal Minig Act Bundesbergges etz (BBergG) Ot Federal Water Act	ca. 8 Wochen	Nein igung yes Ja depending on changes	generally 2 years <i>i.d.R. 2 Jahre</i> as per Approval Notification (appr. 15 - 20 years)
Baugenehmigung(en) Main Operating Plan "operating phase" Hauptbetriebsplan Betriebsphase Water Law Permit surface water discharge	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in agreement with specialised authorities) Bergbehörde	Activity licent (BauGB) Federal Minig Act Bundesbergges etz (BBergG) Ot Federal Water Act	ca. 8 Wochen	Nein igung yes Ja depending on changes	generally 2 years <i>i.d.R. 2 Jahre</i> as per Approval Notification (appr. 15 - 20 years)
Baugenehmigung(en) Main Operating Plan "operating phase" Hauptbetriebsplan Betriebsphase Water Law Permit surface water discharge	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in agreement with specialised authorities) Bergbehörde (in	Activity licent (BauGB) Federal Minig Act Bundesbergges etz (BBergG) Ot Federal Water Act Wasserhaushal	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months ca. 3 Monate her / Sonstiges appr. 3 up to 12 months ca. 3 bis 12	Nein igung yes Ja depending on changes abhänging von	generally 2 years <i>i.d.R. 2 Jahre</i> as per Approval Notification (appr. 15 - 20 years) gem. Bescheid (ca. 15-20
Baugenehmigung(en) Main Operating Plan 'operating phase" Hauptbetriebsplan Betriebsphase Water Law Permit surface water discharge Wasserrechtliche Erlaubnis Einleitung	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in agreement with specialised authorities) Bergbehörde (in Einvernehmen	Activity licent (BauGB) Federal Minig Act Bundesbergges etz (BBergG) Ot Federal Water Act Wasserhaushal tsgesetz (WHG)	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months ca. 3 Monate her / Sonstiges appr. 3 up to 12 months ca. 3 bis 12 Monate	Nein igung yes Ja depending on changes abhänging von Änderungen	generally 2 years <i>i.d.R. 2 Jahre</i> as per Approval Notification (appr. 15 - 20 years) <i>gem. Bescheid (ca. 15-20</i> <i>Jahre</i>)
Baugenehmigung(en) Main Operating Plan 'operating phase" Hauptbetriebsplan Betriebsphase Water Law Permit Surface water discharge Wasserrechtliche Erlaubnis Einleitung Oberflächenwasser	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in agreement with specialised authorities) Bergbehörde (in Einvernehmen mit	Budgesetzbuch (BauGB) Activity licend Federal Minig Act Bundesbergges etz (BBergG) Ot Federal Water Act Wasserhaushal tsgesetz (WHG)	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months ca. 3 Monate her / Sonstiges appr. 3 up to 12 months ca. 3 bis 12 Monate	Nein igung yes Ja depending on changes abhänging von Änderungen	generally 2 years <i>i.d.R. 2 Jahre</i> as per Approval Notification (appr. 15 - 20 years) <i>gem. Bescheid (ca. 15-20 Jahre)</i>
Baugenehmigung(en) Vain Operating Plan 'operating phase" Hauptbetriebsplan Betriebsphase Water Law Permit surface water discharge Wasserrechtliche Erlaubnis Einleitung Dberflächenwasser	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in agreement with specialised authorities) Bergbehörde (in Einvernehmen mit Fachbehörden)	Budgesetzbuch (BauGB) Activity licend Federal Minig Act Bundesbergges etz (BBergG) Ot Federal Water Act Wasserhaushal tsgesetz (WHG)	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months ca. 3 Monate her / Sonstiges appr. 3 up to 12 months ca. 3 bis 12 Monate	Nein igung yes Ja depending on changes abhänging von Änderungen	generally 2 years <i>i.d.R. 2 Jahre</i> as per Approval Notification (appr. 15 - 20 years) gem. Bescheid (ca. 15-20 Jahre)
Baugenehmigung(en) Main Operating Plan operating phase" Auptbetriebsplan Betriebsphase Nater Law Permit urface water discharge Vasserrechtliche Frlaubnis Einleitung Dberflächenwasser	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in agreement with specialised authorities) Bergbehörde (in Einvernehmen mit Fachbehörden) Mining	Budgesetzbuch (BauGB) Activity licend Federal Minig Act Bundesbergges etz (BBergG) Ot Federal Water Act Wasserhaushal tsgesetz (WHG)	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months ca. 3 Monate her / Sonstiges appr. 3 up to 12 months ca. 3 bis 12 Monate	Nein igung yes Ja depending on changes abhänging von Änderungen	generally 2 years <i>i.d.R. 2 Jahre</i> as per Approval Notification (appr. 15 - 20 years) <i>gem. Bescheid (ca. 15-20 Jahre)</i>
Baugenehmigung(en) Main Operating Plan operating phase" Hauptbetriebsplan Betriebsphase Nater Law Permit urface water lischarge Vasserrechtliche Frlaubnis Einleitung Dberflächenwasser	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in agreement with specialised authorities) Bergbehörde (in Einvernehmen mit Fachbehörden) Mining authority (in	Budgesetzbuch (BauGB) Activity licend Federal Minig Act Bundesbergges etz (BBergG) Ot Federal Water Act Wasserhaushal tsgesetz (WHG)	ca. 8 Wochen	Nein igung yes Ja depending on changes abhänging von Änderungen	generally 2 years <i>i.d.R. 2 Jahre</i> as per Approval Notification (appr. 15 - 20 years) <i>gem. Bescheid (ca. 15-20 Jahre)</i>
Baugenehmigung(en) Main Operating Plan operating phase" Hauptbetriebsplan Betriebsphase Vater Law Permit urface water discharge Wasserrechtliche Erlaubnis Einleitung Oberflächenwasser	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in agreement with specialised authorities) Bergbehörde (in Einvernehmen mit Fachbehörden) Mining authority (in agreement	Budgesetzbuch (BauGB) Activity licend Federal Minig Act Bundesbergges etz (BBergG) Ot Federal Water Act Wasserhaushal tsgesetz (WHG) Federal Water	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months ca. 3 Monate her / Sonstiges appr. 3 up to 12 months ca. 3 bis 12 Monate appr. 3 up to 12	Nein igung yes Ja depending on changes abhänging von Änderungen depending on	generally 2 years <i>i.d.R. 2 Jahre</i> as per Approval Notification (appr. 15 - 20 years) <i>gem. Bescheid (ca. 15-20 Jahre)</i> as per Approval Notification
Baugenehmigung(en) Main Operating Plan operating phase" Hauptbetriebsplan Betriebsphase Water Law Permit turface water discharge Wasserrechtliche Erlaubnis Einleitung Oberflächenwasser	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in agreement with specialised authorities) Bergbehörde (in Einvernehmen mit Fachbehörden) Mining authority (in agreement with	Budgesetzbuch (BauGB) Activity licend Federal Minig Act Bundesbergges etz (BBergG) Ot Federal Water Act Wasserhaushal tsgesetz (WHG) Federal Water Act	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months ca. 3 Monate her / Sonstiges appr. 3 up to 12 months ca. 3 bis 12 Monate appr. 3 up to 12 months	Nein igung yes Ja depending on changes abhänging von Änderungen depending on changes	generally 2 years <i>i.d.R. 2 Jahre</i> as per Approval Notification (appr. 15 - 20 years) <i>gem. Bescheid (ca. 15-20 Jahre)</i> as per Approval Notification (appr. 15 - 20 years)
Baugenehmigung(en) Main Operating Plan 'operating phase" Hauptbetriebsplan Betriebsphase Nater Law Permit surface water discharge Nasserrechtliche Frlaubnis Einleitung Oberflächenwasser Nater Law Permit vaste water discharge	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in agreement with specialised authorities) Bergbehörde (in Einvernehmen mit Fachbehörden) Mining authority (in agreement with specialised	Budgesetzbuch (BauGB) Activity licend Federal Minig Act Bundesbergges etz (BBergG) Ot Federal Water Act Wasserhaushal tsgesetz (WHG) Federal Water Act	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months ca. 3 Monate her / Sonstiges appr. 3 up to 12 months ca. 3 bis 12 Monate appr. 3 up to 12 months	Nein igung yes Ja depending on changes abhänging von Änderungen depending on changes	generally 2 years <i>i.d.R. 2 Jahre</i> as per Approval Notification (appr. 15 - 20 years) <i>gem. Bescheid (ca. 15-20 Jahre)</i> as per Approval Notification (appr. 15 - 20 years)
Baugenehmigung(en) Main Operating Plan operating phase" Auptbetriebsplan Betriebsphase Vater Law Permit urface water lischarge Wasserrechtliche Erlaubnis Einleitung Oberflächenwasser Vater Law Permit vaste water discharge	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in agreement with specialised authorities) Bergbehörde (in Einvernehmen mit Fachbehörden) Mining authority (in agreement with specialised authority (in agreement with	Budgesetzbuch (BauGB) Activity licend Federal Minig Act Bundesbergges etz (BBergG) Ot Federal Water Act Wasserhaushal tsgesetz (WHG) Federal Water Act	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months ca. 3 Monate her / Sonstiges appr. 3 up to 12 months ca. 3 bis 12 Monate appr. 3 up to 12 months	Nein igung yes Ja depending on changes abhänging von Änderungen depending on changes	generally 2 years <i>i.d.R. 2 Jahre</i> as per Approval Notification (appr. 15 - 20 years) <i>gem. Bescheid (ca. 15-20 Jahre)</i> as per Approval Notification (appr. 15 - 20 years)
Baugenehmigung(en) Main Operating Plan operating phase" Auptbetriebsplan Betriebsphase Vater Law Permit urface water lischarge Wasserrechtliche Erlaubnis Einleitung Oberflächenwasser Vater Law Permit vaste water discharge	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in agreement with specialised authorities) Bergbehörde (in Einvernehmen mit Fachbehörden) Mining authority (in agreement with specialised authority (in agreement with specialised authorities) Bergbehörde	Budgesetzbuch (BauGB) Activity licend Federal Minig Act Bundesbergges etz (BBergG) Ot Federal Water Act Wasserhaushal tsgesetz (WHG) Federal Water Act	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months ca. 3 Monate her / Sonstiges appr. 3 up to 12 months ca. 3 bis 12 Monate appr. 3 up to 12 months	Nein igung yes Ja depending on changes abhänging von Änderungen depending on changes	generally 2 years <i>i.d.R. 2 Jahre</i> as per Approval Notification (appr. 15 - 20 years) <i>gem. Bescheid (ca. 15-20 Jahre)</i> as per Approval Notification (appr. 15 - 20 years)
Baugenehmigung(en) Main Operating Plan 'operating phase" Hauptbetriebsplan Betriebsphase Nater Law Permit surface water discharge Nasserrechtliche Erlaubnis Einleitung Oberflächenwasser Nater Law Permit vaste water discharge Nasserrechtliche	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in agreement with specialised authorities) Bergbehörde (in Einvernehmen mit Fachbehörden) Mining authority (in agreement with specialised authority (in agreement with specialised authorities) Bergbehörde (in	Budgesetzbuch (BauGB) Activity licend Federal Minig Act Bundesbergges etz (BBergG) Ot Federal Water Act Wasserhaushal tsgesetz (WHG) Federal Water Act Wasserhaushal tsgesetz (WHG) Federal Water Act	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months ca. 3 Monate her / Sonstiges appr. 3 up to 12 months ca. 3 bis 12 Monate appr. 3 up to 12 months ca. 4 bis 12	Nein igung igung yes Ja depending on changes abhänging von Änderungen depending on changes depending on changes	generally 2 years <i>i.d.R. 2 Jahre</i> as per Approval Notification (appr. 15 - 20 years) <i>gem. Bescheid (ca. 15-20 Jahre)</i> as per Approval Notification (appr. 15 - 20 years)
Baugenehmigung(en) Main Operating Plan 'operating phase" Hauptbetriebsplan Betriebsphase Nater Law Permit surface water discharge Wasserrechtliche Erlaubnis Einleitung Oberflächenwasser Nater Law Permit vaste water discharge	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in agreement with specialised authorities) Bergbehörde (in Einvernehmen mit Fachbehörden) Mining authority (in agreement with specialised authority (in agreement with specialised authorities) Bergbehörde (in Einvernehmen	Budgesetzbuch (BauGB) Activity licend Federal Minig Act Bundesbergges etz (BBergG) Ot Federal Water Act Wasserhaushal tsgesetz (WHG) Federal Water Act Wasserhaushal tsgesetz (WHG) Federal Water Act Wasserhaushal tsgesetz (MHG)	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months ca. 3 Monate her / Sonstiges appr. 3 up to 12 months ca. 3 bis 12 Monate appr. 3 up to 12 months	Nein igung igung yes Ja depending on changes abhänging von Änderungen depending on changes abhänging von änderungen	generally 2 years <i>i.d.R. 2 Jahre</i> as per Approval Notification (appr. 15 - 20 years) <i>gem. Bescheid (ca. 15-20 Jahre)</i> as per Approval Notification (appr. 15 - 20 years) <i>gem. Bescheid (ca. 15-20 Jahre)</i>
Baugenehmigung(en) Vain Operating Plan 'operating phase" Vauptbetriebsplan Betriebsphase Water Law Permit surface water discharge Vasserrechtliche Erlaubnis Einleitung Oberflächenwasser Nater Law Permit waste water discharge Vasserrechtliche Erlaubnis Einleitung Abwasser	(über Bergbehörde) Mining authority Bergbehörde Mining authority (in agreement with specialised authorities) Bergbehörde (in Einvernehmen mit Fachbehörden) Mining authority (in agreement with specialised authorities) Bergbehörde (in Einvernehmen mit	Budgesetzbuch (BauGB) Activity licend Federal Minig Act Bundesbergges etz (BBergG) Ot Federal Water Act Wasserhaushal tsgesetz (WHG) Federal Water Act Wasserhaushal tsgesetz (WHG)	ca. 8 Wochen ce / Betriebsgenehm appr. 3 months ca. 3 Monate her / Sonstiges appr. 3 up to 12 months ca. 3 bis 12 Monate appr. 3 up to 12 months ca. 3 bis 12 Monate	Nein igung igung yes Ja Ja depending on changes abhänging von Änderungen depending on changes abhänging von Änderungen abhänging von Änderungen	generally 2 years <i>i.d.R. 2 Jahre</i> as per Approval Notification (appr. 15 - 20 years) <i>gem. Bescheid (ca. 15-20 Jahre)</i> as per Approval Notification (appr. 15 - 20 years) <i>gem. Bescheid (ca. 15-20 Jahre)</i>



General comments on permitting for natural gas storage purpose in Germany are shown below.

- Licenses

Authorisation to operate a cavern or an aquifer storage doesn't explicitly require a mining license. However, in the former GDR mining properties ("Bergwerkseigentum") are extensively existing, covering also usage for storage purposes.

Authorisation to operate a depleted reservoir as storage, even if not explicitly required only for storage purpose, requires mining rights ("Bergbauberechtigung").

Co-production of mineral resource(s) is indissociable from storage operation in depleted fields

Co-production requires mining rights ("Bergbauberechtigung") / field related to concrete area and mineral resource(s).

In the area of former Federal Republic Germany (FRG) old mining rights and contracts (prior to effective date of Federal Mining Act 1982) still can be valid, in the area of former German Democratic Republic (GDR) it can be a mining property ("Bergwerkseigentum").

Authorisation to build a cavern storage requires a mining license by the respective owner based on civil law, if a respective maintained salt mining right or another maintained (old) mining right or contract referring to a certain salt dome exists. Otherwise, a (public) mining license is needed ("Bewilligung").

- Permits

Additionally, storage conversion, construction and/or operation (subsurface and above ground facilities) requires operation plan(s) (framework, main and/or special; "Rahmen, Haupt- und/oder Sonderbetriebspläne") including concrete description of (planned) operation and granted by the relevant mining authorities (depending on respective federal state). Beginning with a generic permit (framework operation plan: Rahmenbetriebsplan") required level of detail for the description of the (planned) operation increases in the next steps with the main and/or special operation plans which scope is generally limited to a project step and/or part of the facility (e.g., well drilling, surface facilities construction ...). The generic framework operation plan (Rahmenbetriebsplan") is valid for a long period of time (e.g., 10-15 years, can also be unlimited). The validity of special operation plan(s) is formally unlimited but ends in practice upon completion of the works covered by the application. Main operation plans are generally valid for 2 years (can also be longer) and must be renewed accordingly to operate an UGS.

In each federal state there is a unique administration in charge (mining office, "Bergamt", of the respective federal state) which has the case being to consult respectively to reach an agreement with all (local) authorities concerned. This includes among others environmental authorizations and building permits. It is worth noticing that regarding environmental impact assessment the special regulation for mining activities, which applies for natural gas storage (Verordnung über die Umweltverträglichkeitsprüfung bergbaulicher Vorhaben, UVP-V



Bergbau), formally doesn't apply for construction of a new hydrogen storage but the general regulation in terms of the "Gesetz über die Umweltverträglichkeitsprüfung". Additionally, stricter regulations under Federal Immission Control Act may apply for hydrogen.

- Validity for existing UGS

It must be assumed that for all activities taking place on existing underground storage all the above authorisations/licenses will be necessary. However, for existing storages planned to be reused for hydrogen, it is not possible to give a generic answer on the question which ones may still be valid and which ones will have to be renewed/updated or even be completely filed again. Licences may still be valid for hydrogen storage to the extent the scope of the current ones is not explicitly limited to natural gas storage. Whether a framework operation plan still can be valid would have to be investigated on a case-by-case basis, it is however probable that they would lose their validity in most cases. To the extent additional significant adverse or other significant environmental effects may be caused by the change of the stored medium, a new environmental impact assessment would have to be performed as part of a (new) framework operation plan (considering the specificities mentioned above). New permits for conversion/extension would at least have to be apply for. At least an amendment, most probably a new application will be needed for the main operation plan for operating the storage.

To sum up, an automatic extension of the validity of authorisations/licenses from natural gas to hydrogen is not given by law as of today. Additionally, specific regulations for storage of natural gas wouldn't apply for the storage of hydrogen. An adaption of the regulative framework for hydrogen storage to secure existing authorisations/licenses and extend the validity of specific regulations to hydrogen would favor the rapid development of dedicated infrastructures for hydrogen.



5.3. Spain

	1. Authorisati on name	2. Entity responsible for granting authorisation permits	3. Reference document	4. Resolution time	5. Is such a licence necessary if the activity takes place on existing underground storage?	6. Control, duration, renewal obligations
			Exploitati	on concession		
	Administra tive authorisati ons and Concession Exploitatio n	MINETAD (Ministry for Ecological Transition and the Demographic Challenge)	Law 34/1998 of 7 October 1998 on the hydrocarbons sector.	It really depends on the project. Experiences of waiting more than two years	Yes	30 years, extendable for two successive periods of 10 years if the obligations are fulfilled. There are obligations relating to collection rights and reporting to the administration.
	Facilities					
Global Authorisatio ns	Administra tive authorisati on, approval of the implement ation project and recognition of public interest	MINETAD (Ministry for Ecological Transition and the Demographic Challenge)	Law 34/1998 of 7 October 1998 on the hydrocarbons sector. Royal Decree 1434/2002, of 27 December, which regulates the activities of transport, distribution, commercialisation, supply and authorisation procedures for natural gas installations.	4 months	Yes	
	Enviromenta	al Impact				
	Environme ntal Impact Assessmen t	MINETAD (Ministry for Ecological Transition and the Demographic Challenge). Envioremental issues now belongs to Minetad	Law 21/2013, of 9 December, on environmental assessment.	4 months is the minimum, prior to that the project needs to be under public information	Yes	
	Public utility	declaration				



	Declaration of Public Utility Autrizacion	MINCOTUR (Ministry of Industry, Tourism and Trade)	Law 34/1998 of 7 October 1998 on the hydrocarbons sector.	4 months	Yes	30 years, extendable for two successive periods of 10 years if the obligations are fulfilled. There are obligations relating to collection rights and reporting to the administration.
	Other			I	<u> </u>	
	other					
	Act of Commissio ning	Regional industry and energy unit			Yes	
	Facilities				<u></u>	
Well Authorisatio ns	Administra tive authorisati ons for constructio n, alteration, operation, transfer and closure	Industry Regional Bodies, in Aragon case: (https://www.arago n.es/tramitador/- /tramite/instalacione s-almacenamiento- transporte- secundario- distribucion-gas- natural-glp)	Law 34/1998 of 7 October 1998 on the hydrocarbons sector. Royal Decree 1434/2002, of 27 December, which regulates the activities of transport, distribution, commercialisation, supply and authorisation procedures for natural gas installations. Futhermore, it should be added the regional regulation, for example in Aragon: Law 11/2014, of 4 December, on the Prevention and Environmental Protection of Aragon Law 39/2015, of 1 October, on the Common Administrative Procedure of Public Administrations	3 months	Yes	
	Public doma	in concession application	on			



	Declaration of public utility of the installation s for the storage, transport and distributio n of gas.	Industry Regional Bodies, in Aragon case: (https://www.arago n.es/tramitador/- /tramite/instalacione s-almacenamiento- transporte- secundario- distribucion-gas- natural-glp)	Law 34/1998 of 7 October 1998 on the hydrocarbons sector. Royal Decree 1434/2002, of 27 December, which regulates the activities of transport, distribution, commercialisation, supply and authorisation procedures for natural gas installations. Futhermore, it should be added the regional regulation, for example in Aragon: Law 11/2014, of 4 December, on the Prevention and Environmental Protection of Aragon Law 39/2015, of 1 October, on the Common Administrative Procedure of Public Administrations	3 months	Yes	
	Integrated e	nvironmental authorisa	ation			
Plant authorisatio ns	Integrated Environme ntal Authorisati on	Enviromental Regional Bodies (INAGA) in Aragon case	Royal Legislative Decree 1/2016, of 16 December, approving the revised text of the Law on integrated pollution prevention and control. Law 5/2013, of 11 June, amending Law 16/2002, of 1 July, on integrated pollution prevention and control and Law 22/2011, of 28 July, on waste and contaminated soils Royal Decree 815/2013, of 18 October, approving the Regulation on industrial emissions and implementing Law 16/2002, of 1 July, on integrated pollution prevention and control.	10-8 months In Aragon Case; The application must be submitted to the Aragonese Institute of Environment al Management (INAGA) at least 9 months before the date on which the activity is intended to start.	Yes	Permits shall be reviewed and, where necessary, updated within 4 years of the adoption of Best Available Techniques (BAT) conclusions for the main activity of an installation. However, the competent authority may review permits ex officio where it considers it appropriate to do so.



		Law 22/2011, of 28 July, on waste and contaminated soils Law 11/2014, of 4 December, on Environmental Prevention and Protection of Aragón (In Aragon Case)			
Facilities	<u>+</u>	-	ł	ł	
Administra tive authorisati ons for constructio n, alteration, operation, transfer and closure	Industry Regional Bodies, in Aragon case: (https://www.arago n.es/tramitador/- /tramite/instalacione s-almacenamiento- transporte- secundario- distribucion-gas- natural-glp)	Law 34/1998 of 7 October 1998 on the hydrocarbons sector. Royal Decree 1434/2002, of 27 December, which regulates the activities of transport, distribution, commercialisation, supply and authorisation procedures for natural gas installations. Futhermore, it should be added the regional regulation, for example in Aragon: Law 11/2014, of 4 December, on the Prevention and Environmental Protection of Aragon Law 39/2015, of 1 October, on the Common Administrative Procedure of Public Administrations	3 months	Yes	
Deciaration	or public utility				



Declaration of public utility of the installation s for the storage, transport and distributio n of gas.	Industry Regional Bodies, in Aragon case: (https://www.arago n.es/tramitador/- /tramite/instalacione s-almacenamiento- transporte- secundario- distribucion-gas- natural-glp)	Law 34/1998 of 7 October 1998 on the hydrocarbons sector. Royal Decree 1434/2002, of 27 December, which regulates the activities of transport, distribution, commercialisation, supply and authorisation procedures for natural gas installations. Futhermore, it should be added the regional regulation, for example in Aragon: Law 11/2014, of 4 December, on the Prevention and Environmental Protection of Aragon Law 39/2015, of 1 October, on the Common Administrative Procedure of Public Administrations	3 months	Yes	
Building per	mit plant				
Building permit	Municipal body	Royal Decree 314/2006 of 17 March 2006, approving the Technical Building Code.	Variable according to municipality	No	
Activity licer	nce				
Environme ntal Licence for Classified Activity	Municipal body	Law 7/2011, of 5 April, on classified activities and public shows and other complementary administrative measures.	Variable according to municipality	No	



5.4. Poland

	1. Authorisatio n name	2. Entity responsible for granting authorisation permits	3. Reference document	4. Resolution time	5. Is such a licence necessary if the activity takes place on existing underground storage?	6. Control, duration, renewal obligations
	Exploitation co	oncession				
	Concession for underground tankless storage of substances (Expoiltation concession) (in Polish: Koncesja na podziemne bezzbiorniko we magazynowa nie substancji)	The minister of Environment (in Polish: Minister Środowiska)	1) Act of June 9, 2011, Geological and Mining Law (in Polish: Ustawa z dnia 9 czerwca 2011 r. Prawo geologiczne i górnicze) Other in the box below	30 days	Usually yes	Regional Mining Authorities (in Polish: Okręgowe Urzędy Górnicze OUG), 3-50 years
al Authorisations	 2) Regulation of underground of sprawie rejestri 3) Regulation of in the scope of sprawie wzoró 4) Notice of th Mining (in Poli przepisów Pravistic 5) Cabinet Reg Polish: Rozporzio oddziaływać na 6) Act of Deceristic 7) Act of Octob protection of t o udostępnian oddziaływania 8) Act of 14 Jun postępowania 9) Act of 30 Au Prawo o postę 10) Regulation Rozporządzenia 	of the Minister of the marbon dioxide storage ru obszarów górniczyc of the Minister of the the Geological and N w druków informacji e Minister of the Envi sh: Obwieszczenie Mi wa geologicznego i gó ulation of September ządzenie Rady Ministr a środowisko), mber 14, 2012 on was ber 3, 2008 on the pro he environment and o iu informacji o środow na środowisko), ne 1960 Code of Adm administracyjnego), gust 2002 Law on pro powaniu przed sądam of the Minister of the e Ministra Środowiska	Environment of Octobe e sites (in Polish: Rozpor ch i zamkniętych podzie Environment of Februa Aining Law (in Polish: Ro dotyczących opłat z zak ronment of July 16, 201 nistra Środowiska z dnia rniczego), 10, 2019 on projects th rów z dnia 10 września 2 ste (in Polish: Ustawa z d ovision of information o on environmental impa- visku i jego ochronie, ud inistrative Procedure (ir pceedings before admin ni administracyjnymi), e Environment of 28 De a z dnia 28 grudnia 2012	rr 16, 2014 on the rządzenie Minise mnych składow ry 25, 2015 on te ozporządzenie No resu przepisów 8 on the rates of a 16 lipca 2018 of nat may have a se 2019 r. w spraw dnia 14 grudnia n the environme of assessments of dziale społeczeń n Polish: Ustawa istrative courts cember 2011 or 1 r. w sprawie p	ne register of mini tra Środowiska z o isk dwutlenku wę emplates of infor Ministra Środowisk Prawa geologiczn of fees for 2019 in r. w sprawie staw Significant impact ie przedsięwzięć r 2012 r. o odpada ent and its protec (in Polish: Ustawa istwa w ochronie a z dnia 14 czerwc (in Polish: Ustawa odziemnych skład	ng areas and closed dnia 16 października 2014 r. w gla) mation forms regarding fees ka z dnia 25 lutego 2015 r. w ego i górniczego), the field of Geological and ek opłat na rok 2019 z zakresu on the environment (in mogących znacząco ch), tion, public participation in z dnia 3 października 2008 r. środowiska oraz o ocenach a 1960 r. Kodeks a z dnia 30 sierpnia 2002 r. este landfills (in Polish: lowisk odpadów),
Glob	Facilities	arcii 2018 - Entrepren	ieurs Law (in Polisn: Us	tawa z dhia 6 m	arca 2018 r Prav	wo przedsiębiorCOW)



Voivode (in Polish: wojewoda) of the Minister of Ecor ządzenie Ministra Gos ieci gazowe i ich usytu 20, 2017 - Water Law (27, 2001, Environmen	1) Act of July 7, 1994 Construction Law (in Polish: Ustawa z dnia 7 lipca 1994 r. Prawo budowlane), nomy of April 26, 2013 spodarki z dnia 26 kwiet owanie), in Polish: Ustawa z dnia	on technical cor tnia 2013 r. w sp a 20 lipca 2017 r	nditions for gas ne prawie warunków	tworks and their location (ir technicznych, jakim powinn
of the Minister of Ecor ządzenie Ministra Gos ieci gazowe i ich usytu 20, 2017 - Water Law (27, 2001, Environmen	budowlane), nomy of April 26, 2013 spodarki z dnia 26 kwieł owanie), 'in Polish: Ustawa z dnia stal Protection Law /in 5	on technical cor tnia 2013 r. w sp 3 20 lipca 2017 r	l nditions for gas ne prawie warunków	tworks and their location (ir technicznych, jakim powinn
leci gazowe i ich usytu 20, 2017 - Water Law (27, 2001, Environmen	iowanie), in Polish: Ustawa z dnia ital Protection Law (in F	a 20 lipca 2017 r		
20, 2017 - Water Law (27, 2001, Environmen	in Polish: Ustawa z dhia	a 20 lipca 2017 r		
27, 2001, Environmen	ITAL PROTOCTION LAW UN L		Prawo wodne),	, 2001 - During a share an
		'olish: Ustawa z	dhia 27 kwietnia .	2001 r. Prawo ochrony
arch 2003 on spatial p a z dnia 27 marca 2003 niami wykonawczymi)	Janning and developme 3 r. o planowaniu i zago	ent and many of spodarowaniu p	ther acts, including przestrzennym ora	g executive regulations (in az wiele innych ustaw, łączn
lards: guidelines and in Idards of the Gas Chan olskie Normy i Normy	nstructions of gas pipel nber of Commerce, etc. Branżowe, Standardy T	ine operators, P . (in Polish: Pozo Techniczne Izby	'olish Industry Sta ostałe normy: wyt Gospodarczej Gaz	ndards and Standards, yczne i instrukcje operatoró ownictwa itp.)
management Act, from	m 21st August 1997 (Us	tawa o gospoda	arce nieruchomoś	ciami)
compliance Act, from	30 August 2002 (Ustaw	va o systemie od	ceny zgodności)	
ction products Act fro	m 16th April 2004 (usta	iwa o wyrobach	budowlanych)	
y Law Act from 10th A	pril 1997 (ustawa Praw	o energetyczne)	
Impact				
Commune head (in Polish: wójt), major (in Polish: burmistrz) or city president	1) Act of October 3, 2008 on the provision of information on the environment and its protection, public participation in environmental protection and on environmental impact assessments, (in Polish: Ustawa z dnia 3 października 2008 r. o udostępnianiu informacji o	30 days		Regional Directorate for Environmental Protection Polish: Regionalna Dyrekcj Ochrony Środowiska), 6 years
	lards: guidelines and in idards of the Gas Char olskie Normy i Normy management Act, from compliance Act, from ction products Act fro y Law Act from 10th A 2014/68/EU OF THE F 4 on the harmonisatic pment (DYREKTYWA w ha rynku urządzeń ciśr Impact Commune head (in Polish: wójt), major (in Polish: burmistrz) or city president	Iards: guidelines and instructions of gas pipel idards of the Gas Chamber of Commerce, etc. olskie Normy i Normy Branżowe, Standardy T management Act, from 21st August 1997 (Us compliance Act, from 30 August 2002 (Ustaw ction products Act from 16th April 2004 (ustay y Law Act from 10th April 1997 (ustawa Praw2014/68/EU OF THE EUROPEAN PARLIAMEN 4 on the harmonisation of the laws of the Me pment (DYREKTYWA w sprawie harmonizacji in a rynku urządzeń ciśnieniowych)Impact1) Act of October 3, 2008 on the provision of information on the environment and its protection, public participation in environmental protection and on environmental impact assessments, (in Polish: wójt), major (in Polish: burmistrz) or city president1) Act of October 3, 2008 r. o udostępnianiu	lards: guidelines and instructions of gas pipeline operators, P idards of the Gas Chamber of Commerce, etc. (in Polish: Pozo olskie Normy i Normy Branżowe, Standardy Techniczne Izby management Act, from 21st August 1997 (Ustawa o gospoda compliance Act, from 30 August 2002 (Ustawa o systemie oc ction products Act from 16th April 2004 (ustawa o wyrobach y Law Act from 10th April 1997 (ustawa Prawo energetyczne) 2014/68/EU OF THE EUROPEAN PARLIAMENT AND OF THE C 4 on the harmonisation of the laws of the Member States repment (DYREKTYWA w sprawie harmonizacji ustawodawstw na rynku urządzeń ciśnieniowych) Impact 1) Act of October 3, 2008 on the provision of information on the environment and its protection, public participation in environmental protection and on environmental impact assessments, (in Polish: wójt), major (in Polish: burmistrz) or city 2008 r. o udostępnianiu 30 days	Iards: guidelines and instructions of gas pipeline operators, Polish Industry Statidards of the Gas Chamber of Commerce, etc. (in Polish: Pozostałe normy: wytolskie Normy i Normy Branżowe, Standardy Techniczne Izby Gospodarczej Gaz management Act, from 21st August 1997 (Ustawa o gospodarce nieruchomość compliance Act, from 30 August 2002 (Ustawa o systemie oceny zgodności) ction products Act from 16th April 2004 (ustawa o wyrobach budowlanych) y Law Act from 10th April 1997 (ustawa Prawo energetyczne) 2014/68/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL 4 on the harmonisation of the laws of the Member States relating to the makipment (DYREKTYWA w sprawie harmonizacji ustawodawstw państw członkow: na rynku urządzeń ciśnieniowych) Impact 1) Act of October 3, 2008 on the provision of information on the environment and its protection, public participation in environmental protection and on environmental protection and on environmental impact assessments, (in Polish: wójt), major (in Polish: Ustawa z U08 r. o udostępnianiu 30 days

2) Regulation of the Council of Ministers of September 10, 2019 on projects that may significantly affect the environment (in Polish: Rozporządzenie Rady Ministrów z dnia 10 września 2019 r. w sprawie przedsięwzięć mogących znacząco oddziaływać na środowisko),

3) Act of June 14, 1960, Code of Administrative Procedure (in Polish: Ustawa z dnia 14 czerwca 1960 r. Kodeks postępowania administracyjnego),



4) Act of November 16, 2006 on stamp duty (in Polish: Ustawa z dnia 16 listopada 2006 r. o opłacie skarbowej),

5) Regulation of the Minister of Finance of September 28, 2007 on the payment of stamp duty (in Polish: Rozporządzenie Ministra Finansów z dnia 28 września 2007 r. w sprawie zapłaty opłaty skarbowej)

Public domain	ain concession application			
		1) Act of 27 March		
		2003 on spatial		
Decision on	Commune head (in	planning and		
the location	Polish: wójt),	development (in		
of a public	major (in Polish:	Polish: Ustawa z dnia	30 days	
purpose	burmistrz) or city	27 marca 2003 r. o		
investment	president	planowaniu i		
		zagospodarowaniu		
		przestrzennym),		

2) Act of August 21, 1997 on real estate management (in Polish: Ustawa z dnia 21 sierpnia 1997 r. o gospodarce nieruchomościami),

3) Act of November 16, 2006 on stamp duty (in Polish: Ustawa z dnia 16 listopada 2006 r. o opłacie skarbowej),

4) Act of 7 July 1994 Construction Law (in Polish: Ustawa z dnia 7 lipca 1994 r. Prawo budowlane),

5) Regulation of the Minister of Infrastructure of August 26, 2003 on signs and nomenclature used in the decision to determine the location of a public purpose investment and in the decision on development conditions (in Polish: Rozporządzenie Ministra Infrastruktury z dnia 26 sierpnia 2003 r. w sprawie oznaczeń i nazewnictwa stosowanych w decyzji o ustaleniu lokalizacji inwestycji celu publicznego oraz w decyzji o warunkach zabudowy),

6) Regulation of the Minister of Finance of September 28, 2007 on the payment of stamp duty (in Polish: Rozporządzenie Ministra Finansów z dnia 28 września 2007 r. w sprawie zapłaty opłaty skarbowej)

Other

other				
Water law permit (in Polish: Pozwolenie wodnoprawn e)	Director of the regional water management board (in Polish: Dyrektor regionalnego zarządu gospodarki wodnej)	1) Act of July 20, 2017 - Water Law (in Polish: Ustawa z dnia 20 lipca 2017 r Prawo wodne),		

2) Act of April 27, 2001, Environmental Protection Law (in Polish: Ustawa z dnia 27 kwietnia 2001 r. Prawo ochrony środowiska),

3) Regulation of the Council of Ministers of September 10, 2019 on projects that may significantly affect the environment (in Polish: Rozporządzenie Rady Ministrów z dnia 10 września 2019 r. w sprawie przedsięwzięć mogących znacząco oddziaływać na środowisko),

4) Regulation of the Minister of Maritime Economy and Inland Navigation of 21 August 2019 on the scope of water management instructions (in Polish: Rozporządzenie Ministra Gospodarki Morskiej i Żeglugi Śródlądowej z dnia 21 sierpnia 2019 r. w sprawie zakresu instrukcji gospodarowania wodą),

5) Regulation of the Minister of Maritime Economy and Inland Navigation of 28 June 2019 on substances particularly harmful to the aquatic environment, the introduction of which in industrial sewage into sewage devices requires a water permit (in Polish: Rozporządzenie Ministra Gospodarki Morskiej i Żeglugi Śródlądowej z dnia 28 czerwca 2019 r. w sprawie substancji szczególnie szkodliwych dla środowiska wodnego, których wprowadzenie w ściekach przemysłowych do urządzeń kanalizacyjnych wymaga uzyskania pozwolenia wodnoprawnego)

Facilities



_							
Well Authorisatio ns	Project of geological works	Ministry of the Environment	1) Geological and Mining Law of June 9, 2011 (in Polish: Prawo geologiczne i górnicze z dnia 9 czerwca 2011 r.),			District Mining Offices (in Polish: Okręgowe Urzędy Górnicze OUG)	
	2) Regulation of projects, includ grudnia 2011 r wykonywanie 3) Act of June 2 postepowania	 2) Regulation of the Minister of the Environment of 20 December 2011 on detailed requirements for geological works projects, including works whose performance requires a license (in Polish: Rozporządzenie Ministra Środowiska z dnia 20 grudnia 2011 r. w sprawie szczegółowych wymagań dotyczących projektów robót geologicznych, w tym robót, których wykonywanie wymaga uzyskania koncesji), 3) Act of June 14, 1960 - Code of Administrative Procedure (in Polish: Ustawa z dnia 14 czerwca 1960 r Kodeks 					
	Integrated env	vironmental authorisa	ation				
	Integrated permit	voivodship marshal (in Polish: marszałek województwa)	1) Act of April 27, 2001, Environmental Protection Law (in Polish: Ustawa z dnia 27 kwietnia 2001 r. Prawo ochrony środowiska).	6 months			
	 2) Regulation of the Minister of the Environment of 27 August 2014 on types of installations that may cause spollution of individual natural elements or the environment as a whole (in Polish: Rozporządzenie Ministra Śridnia 27 sierpnia 2014 r. w sprawie rodzajów instalacji mogących powodować znaczne zanieczyszczenie poszce elementów przyrodniczych albo środowiska jako całości), 3) Regulation of the Council of Ministers of September 10, 2019 on projects that may significantly affect the of (in Polish: Rozporządzenie Rady Ministrów z dnia 10 września 2019 r. w sprawie przedsięwzięć mogących zna oddziaływać na środowisko), 4) Regulation of the Minister of the Environment of 27 August 2014 on the amount of registration fees (in Po Rozporządzenie Ministra Środowiska z dnia 27 sierpnia 2014 r. w sprawie wysokości opłat rejestracyjnych), 5) Act of 17 July 2009 on the system for managing the emissions of greenhouse gases and other substances (Ustawa z dnia 17 lipca 2009 r. o systemie zarządzania emisjami gazów cieplarnianych i innych substancji), 6) Act of November 16, 2006 on stamp duty (in Polish: Ustawa z dnia 16 listopada 2006 r. o opłacie skarbowe 7) Act of 3 October 2008 on the provision of information on the environment and its protection, public partic environmental protection and on environmental impact assessments (in Polish: Ustawa z dnia 3 października udostępnianiu informacji o środowisku i jego ochronie, udziale społeczeństwa w ochronie środowiska oraz o oddziaływania na środowisko), 						
,							
	 8) Regulation of the Minister of Finance of September 28, 2007 on the payment of stamp duty (in Polish: Rozporządzenie Ministra Finansów z dnia 28 września 2007 r. w sprawie zapłaty opłaty skarbowej) 9) Ministry of the Economy regulation on detailed conditions for the operation of the gas system from 2nd july 2010 (Boznarzadzenie Ministra Conservation of stamp duty in anticipation of the gas system from 2nd july 2010 						
	Building permit plant						
	Building	County Office of district (in Polish:	1) Act of July 7, 1994 Construction Law (in Polish: Ustawa z dnia 7 lipca 1994 r. Prawo budowlane),	65 days			
	permit	starostwo powiatowe)	2) Act of February 13, acts (in Polish: Ustawa oraz niektórych innych 3) Act of June 14, 1960 14 czerwca 1960 r. Ko	2020 amending z dnia 13 luteg n ustaw),), Code of Admi deks postępowa	the Act - Constru o 2020 r. o zmiani nistrative Procedu ania administracyj	ction Law and certain other ie ustawy - Prawo budowlane ure (in Polish: Ustawa z dnia nego),	



		 Act of 3 October 200 protection, public parti impact assessments (in informacji o środowisk środowiska oraz o ocer 	D8 on the provis icipation in env n Polish: Ustawa u i jego ochroni nach oddziaływa	ion of informatio ironmental protec a z dnia 3 paździer ie, udziale społecz ania na środowisk	n on the environment and its ction and on environmental mika 2008 r. o udostępnianiu reństwa w ochronie ro),
		5) Act of March 21, 199 maritime administratio morskich Rzeczypospol	91 on the marit on (in Polish: Us litej Polskiej i ad	ime areas of the F tawa z dnia 21 ma dministracji morsł	Republic of Poland and arca 1991 r. o obszarach kiej),
		6) Act of November 16	, 2006 on stam	o duty (in Polish: I	Jstawa z dnia 16 listopada
		2006 r. o opfacie skarb	owej), Geological and N	Aining Law (in Pol	ish: Ustawa z dnia 9 czerwca
		2011 r. Prawo geologic	zne i górnicze),		
		 8) Regulation of the Mi on the following design of construction and rec of the right to use the p demolition (in Polish: R 24 sierpnia 2016 r. w sp rozbiórkę, zgłoszenia b oświadczenia o posiada budowlane, oraz decyz 9) Regulation of the Mi April 2012 on the detai Rozporządzenie Minist kwietnia 2012 r. w spra 	inister of Infrast ns: application f construction of property for con cozporządzenie prawie wzorów udowy i przebu anym prawie do cji o pozwoleniu inister of Transp iled scope and f ra Transportu, l awie szczegółow	tructure and Cons or a building or d a single-family re nstruction purpos Ministra Infrastru : wniosku o pozw dowy budynku m o dysponowania n na budowę lub r port, Construction form of a construct Budownictwa i Go vego zakresu i for	struction of August 24, 2016 emolition permit, notification sidential building, declaration es, and construction or aktury i Budownictwa z dnia olenie na budowę lub ieszkalnego jednorodzinnego, ieruchomością na cele ozbiórkę), n and Maritime Economy of 25 stion design (in Polish: ospodarki Morskiej z dnia 25 my projektu budowlanego),
		10) Regulation of the N	Ainister of Infra	structure of June	26, 2002 on the construction,
		data on occupational s	afety and healt	h protection (in P	olish: Rozporządzenie
		Ministra Infrastruktury	z dnia 26 czerv	vca 2002 r. w spra	awie dziennika budowy,
		dotyczące bezpieczeńs	twa pracy i och	jnej oraz ogłoszer rony zdrowia),	na zawierającego dane
		11) Regulation of the C	Council of Minist	ters of 25 Novem	ber 2010 on structures and
		construction works, in Polish: Rozporzadzenie	matters of whice Rady Ministróv	ch the volvode is f w z dnia 25 listopa	the first instance authority (in a adda 2010 r. w sprawie
		obiektów i robót budov wojewoda),	wlanych, w spra	awach których org	ganem pierwszej instancji jest
		12) Regulation of the N stamp duty (in Polish: F	Ainister of Finar Rozporządzenie	nce of September Ministra Finansó	28, 2007 on the payment of w z dnia 28 września 2007 r.
		w sprawie zapłaty opła	ity skarbowej),	loomont Lobor o	nd Tashnalogy of Fabruary
		12, 2021 on specifying of the provisions of Art	the application t. 45a paragraph	form for a decision. 1 of the Constru	no recriticity of February on to exclude the application uction Law Act (in Polish:
		Rozporządzenie Minist sprawie określenia wzo	ra Rozwoju, Pra oru formularza	icy i Technologii z wniosku o wydani	dnia 12 lutego 2021 r. w e decyzji o wyłączeniu
		stosowania przepisow	art. 45a ust. 1 u	istawy - Prawo bi	idowlane)
Use permit	voivodeship building supervision inspector (in Polish: wojewódzki inspektor nadzoru	1) Act of July 7, 1994 Construction Law (in Polish: Ustawa z dnia 7 lipca 1994 r. Prawo budowlane),	About 3 months		
	budowlanego)	2) Act of November 16 2006 r. o opłacie skarb	, 2006 on stamı owej),	o duty (in Polish: I	Jstawa z dnia 16 listopada



			3) Act of March 2, 2020 on special solutions related to the prevention, prevention and combating of COVID-19, other infectious diseases and crisis situations caused by them (in Polish: Ustawa z dnia 2 marca 2020 r. o szczególnych rozwiązaniach związanych z zapobieganiem, przeciwdziałaniem i zwalczaniem COVID-19, innych chorób zakaźnych oraz wywołanych nimi sytuacji kryzysowych),			
			4) Regulation of the Minister of Infrastructure of June 23, 2003 on the model and method of keeping records of construction works commenced and commissioned (in Polish: Rozporządzenie Ministra Infrastruktury z dnia 23 czerwca 2003 r. w sprawie wzoru i sposobu prowadzenia ewidencji rozpoczynanych i oddawanych do użytkowania obiektów budowlanych),			
			5) Regulation of the Minister of Infrastructure of 23 June 2003 on the template of the mandatory inspection protocol (in Polish: Rozporządzenie Ministra Infrastruktury z dnia 23 czerwca 2003 r. w sprawie wzoru protokołu obowiązkowej kontroli),			
			6) Regulation of the Council of Ministers of 25 November 2010 on structures and construction works, in matters of which the voivode is the first instance authority (in Polish: Rozporządzenie Rady Ministrów z dnia 25 listopada 2010 r. w sprawie obiektów i robót budowlanych, w sprawach których organem pierwszej instancji jest wojewoda),			
			7) Regulation of the Prime Minister of October 16, 2002 on granting employees of construction supervision authorities the power to impose fines by way of a criminal mandate (in Polish: Rozporządzenie Prezesa Rady Ministrów z dnia 16 października 2002 r. w sprawie nadania pracownikom organów nadzoru budowlanego uprawnień do nakładania grzywien w drodze mandatu karnego),			
			8) Regulation of the Minister of Transport, Construction and Maritime Economy of 25 April 2012 on the detailed scope and form of a construction design (in Polish: Rozporządzenie Ministra Transportu, Budownictwa i Gospodarki Morskiej z dnia 25 kwietnia 2012 r. w sprawie szczegółowego zakresu i formy projektu budowlanego)			
			9) The Minitry of Infrastructure Regulation on the types of construction objects at the execution of which it is required to appoint an investor supervision inspector z dnia 19 listopada 2001 r. (Rozporządzenie Ministra Infrastruktury w sprawie rodzajów obiektów budowlanych, przy których realizacji jest wymagane ustanowienie inspektora nadzoru inwestorskiego z dnia 19 listopada 2001 r.)			
			10) ACT on technical supervision from 21th December 2000 (Ustawa o dozorze technicznym)			
	Other					
	1) ACT on stocks of crude oil, petroleum products and natural gas and the principles of proceeding in situations of threat					
	to the national	security of supply an	d disturbances on the petroleum market from 16th February 2007 (Ustawa o			
	bezpieczeństwa	a paliwowego państw	i narrtowých i gazu ziemnego oraz zasadách postępowania w sytuacjách zagrozenia /a i zakłoceń na rynku naftowym)			
Other	2) Ministry of the gas fuels trait	he Energy regulation ade from 15th march f oraz rozliczeń w obr	on the detailed rules for the development and calculation of tariffs and settlements in 2018 (Rozporządzenie Ministra Energii w sprawie szczegółowych zasad kształtowania rocie paliwami gazowymi)			
	3) DIRECTIVE 2	009/73/EC OF THE EL	JROPEAN PARLIAMENT AND OF THE COUNCIL			
	of 13 July 2009	concerning common	rules for the internal market in natural gas and repealing Directive 2003/55/EC			
	(Dyrektywa dotycząca wspólnych zasad rynku wewnętrznego gazu zimnego)					



	4) REGULATION (EU) NO 1227/2011 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 October 2011 on wholesale energy market integrity and transparency (rozporządzenie w sprawie integralnościi przejrzystości hurtowego rynku energii)
Other comments	



6. Legal barriers

The main obstacle to the development of underground hydrogen storage is that hydrogen is currently defined in most European regulations as a chemical product and not as an energy carrier. This issue hinders the deployment of electrolytic hydrogen production plants, which are often subject to the same regulatory requirements as hydrogen production from fossil fuels, i.e. a chemical industry. This obstacle is common to all applications of renewable hydrogen technologies.

In this respect, discrepancies at European level on the approach and allowable concentration of hydrogen in natural gas are an inherent barrier to the development of underground hydrogen storage. Harmonised regulation at European level is needed to ensure a reliable investment climate for the parallel development of the grid, pure or blended with natural gas, and hydrogen storage.

Harmonised regulation is the first step to promote market and demand-side incentives and financial support to build hydrogen storage. These could be implemented in a second step with the emerging market but should ensure a balanced and continuous investment climate that allows refinancing and operation of both storage facilities and the grid in a harmonised and non-discriminatory market-based approach.

Furthermore, the need for efforts in the technical developments of these underground energy storage solutions is a concern of the sector, both in terms of the need to develop knowledge on the business model for the production of green hydrogen and e-fuels, the review of technical aspects and in a common effort to develop norms, standards and regulation to provide underground hydrogen storage operators with specific official guidelines for their management. Hydrogen can affect infrastructures (e.g., well completions, connectors, and pipelines) differently from methane storage, so the adaptation and definition of safety standards and regulations is essential.

On the other hand, a regulatory barrier for underground hydrogen storage can be regional or national regulations that aim to curb any activity in the subsoil, not only exploitation, but also exploration or characterisation of the subsoil: permits for geophysical campaigns, well permits or environmental assessment of each activity independently. It is necessary to review the approach to environmental regulations and the recognition of hydrogen as an energy vector, so that these storage facilities allow hydrogen safety, with safety and protection for health and the environment.

In addition, it has been identified that in some Member States, in its current form, the current legislation only covers the regulation of the storage of gaseous fuels. The current legislation



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does not include the concept of a storage facility applicable to the electricity industry and its energy storage function.

On the other hand, the storage of natural gas in certain Member States can be decided independently of the claims of landowners. This is currently not possible for any other type of storage (e.g. hydrogen, CO₂, heat) and represents a major barrier for underground hydrogen storage, so natural gas permits need to be reviewed and adapted for hydrogen.

Finally, hydrogen storage requires long-term commitments from both the regulatory framework and customers to make it a secure and win-win future.



7. Conclusions

The heterogeneity of legislation on underground storage in Europe is evident and leads to a ranking of countries according to how advanced their legislation is in adapting to underground hydrogen storage.

First, the United Kingdom is the only European country with a safety and environmental framework that has been applied for hydrogen storage for approximately 50 years. United Kingdom has developed its own health and safety guidelines, which can serve as an example for the rest of the countries. This experience in hydrogen storage can provide lessons learnt and good practices to be exported.

Secondly, other countries, where underground hydrogen storage could be legally implemented today, but which do not yet have such experience. This is the case of Denmark and Germany, which have a favourable scenario to start implementing their projects.

Other countries such as France or Netherlands, with relatively recent changes in their regulations, will allow pilot projects to be carried out. The importance of these pilot projects is crucial for the development of a regulatory framework and safety recommendations for underground hydrogen storage.

Finally, countries such as Spain and Portugal do not yet have underground hydrogen storage pilot projects or a favourable legal framework for them, although they consider the storage option in their national strategies for the year 2050 and can therefore be expected to act as observers of the regulations that will be established in the member countries.

Table 2 shows the classification concluded as of the date of this study, September 2021.



Table 2. Conclusions of the current legal framework of Underground Hydrogen Storage, UHS, by countries analyzed in D6.1as of September 2021. Source: FHa.

COUNTRY	CURRENT LEGAL FRAMEWORK
UK	Legislation UHS in force and long operation experience
DENMARK	Legislation in force to UHS
GERMANY	Legislation in force to underground storage of chemical product, not specific UHS
AUSTRIA	Existing regulation to UHS only for scientific research
FRANCE	Legislation for UHS is under development
NETHERLANDS	Legislation for UHS is under development
PORTUGAL	No UHS legislation under development but named in national strategy
SPAIN	No UHS legislation under development but named in national strategy
CZECH REPUBLIC	No UHS legislation under development
ESTONIA	No UHS legislation under development
GREECE	No UHS legislation under development
HUNGARY	No UHS legislation under development
ITALY	No UHS legislation under development
LATVIA	No UHS legislation under development
LITHUANIA	No UHS legislation under development
POLONIA	No UHS legislation under development
ROMANIA	No UHS legislation under development

It is noteworthy that this classification of countries is framed within the member states that have underground storage facilities for natural gas, or other compounds, and that it will therefore be these that can first begin to adapt their regulatory framework to hydrogen.

In this analysis, the technical development of underground pure hydrogen storage projects to provide a secure basis for regulatory development in all EU member states was identified as a current need, led by the experience of the UK. This path can be started with the implementation of pilot projects, as is already being done in France, Denmark, and the Netherlands. These results may be the only ones that can put an end to the disparity of opinions on the application or need for adaptation of industrial safety regulations and create a single technical opinion that can be translated into legislation.

On the other hand, the European Commission has already taken the first step to include hydrogen in the European Gas Directives, which address market regulation. This fact, together with the development of projects as well as business models that enable a sustainable economy are the necessary way to establish a legislative framework for hydrogen in Europe.



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Annex I

This section presents the questions asked in the legal framework survey.

These questions are grouped into four different parts.

The first section simply collects information about the surveyed country as well as information about the expert, as shown in Figure A.I.

Hystories T6.1. EU-27 natural gas regulatory framework survey		
1. Survey data		
1. Please, select your country:		
\$		
Company and professional activity:		
	11	

Figure AI.I. First section survey: survey data.

The second section gathers information on legislation specific to underground natural gas storage, regulatory bodies, expert opinion on guidance for legislation on underground hydrogen storage, possible barriers, as well as opinion on the possible need for adaptation of the SEVESO (III) directive on industrial safety.

Hystories T6.1. EU-27 natural gas regulatory framework survey
2. EU regulatory framework
2. Are there underground storage natural gas specific legislation in your country?
Yes
□ No
No, there are not underground storages natural gas in my country
If yes indicate the specific national legislation for underground storage facilities for natural gas.
3. If yes to the question 4, which national bodies regulate underground natural gas storage permitting?
Mining
Oil and gas
Enviroment
Other (please, explain in the box below)



4. Do you think that regulation of underground hydrogen storage would be necessary?
Yes, to the same degree as for methane storage (leaving Member States the choice of negotiated or regulated third party access).
Yes, but it should not be directly available to the market itself and should only be used by the operators for network operation purposes.
No, hydrogen storage facilities can be left unregulated.
In your opinion, what is the biggest regulatory barrier to underground hydrogen storage?
5. Do you think that Directive 2012/18/EU (SEVESO III) should be adapted for underground hydrogen storage?
Yes
No No
Which regulations transpose the Directive 2012/18/EU (SEVESO III) in your country? Are there other national safety standards in your country that apply to underground natural gas storage?
Figure AI.2. Second section: EU regulatory framework.

The third section deals with standards related to the integrity of underground storage and wells. The aim of this section is for the respondent to add a known standard to the list if it does not find one listed.



Hystories T6.1. EU-27 natural gas regulatory framework survey

3. Standards related to the integrity of underground storages and wells

6. Different standards have been identified in relation to underground natural gas storage, such as:

- EN 1819-1 Gas infrastructure. Underground gas storage. Part 1: Funtional recommendations for storage in aquifers.

- EN 1819-2 Gas infrastructure. Underground gas storage. Part 2: Funtional recommendations for storage in oil and gas fields.

- EN 1819-3 Gas infrastructure. Underground gas storage. Part 2: Funtional recommendations for storage in solutions-mined salt caverns.

- EN 1819-4 Gas infrastructure. Underground gas storage. Part 2: Funtional recommendations for storage in rock caverns.

- EN 1819-5 Gas infrastructure. Gas infraestructure. Funtional recommendations for storage in aquifers.
 - EN (ISO 16530-1:2017). Petroleum and natural gas industries - Well integrity - Part 1: Life cycle governance.

Do you consider that any further standards should be mentioned?

Yes
No

If yes, please specify the standards.

7. Different European standards there are also national standards developed by the oil and gas industry which deal with the well integrity which are widely acknowledged and applicable to gas storage, such as:

- Norsok Standard D-010 Well integrity in drilling and well operations.

- Oil & Gas UK. Well Life Cycle Integrity Guidelines.

- German Federal Association of Natural Gas, Oil and Geoenergy (BVEG), Technical Rule Bohrlochkontrolle. Bohren, Workover, Well Intervention (Well control. Drilling, Workover, Well Intervention).

- German Federal Association of Natural Gas, Oil and Geoenergy (BVEG), Technical Rule Well Integrity.

Does your country have any other national standards?

Yes

No No

If yes, please specify the nacional standards.



The fourth section, other relevant aspects, asks whether the expert considers that other aspects should have been considered in the survey, as well as whether his or her country currently has legislation for underground hydrogen storage.



D6.1-1 - Assessment of the Regulatory Framework

Hystories T6.1. EU-27 natural gas regulatory framework survey

4. Other relevant issues

8. Do you think that any other issues related to natural gas or underground natural gas storage regulation should have been considered in this survey?

Yes

No No

If yes, please specify any other issue.

9. Does your country have any current legislation for underground hydrogen storage?

Yes

No No

Has any underground hydrogen storage in your country passed through a legalisation process?

Figure AI.4. Fourth section: other relevant issues.



Annex II. Questionnaire on permits

This section collects the questionnaire that was completed and reviewed by expert entities from France (Geostock, Teréega), Germany (Uniper, Storengy Deutschland), Spain (FHa, Enagas) and Poland (MEERI-PAS, Gaz System), from which the answers presented in point 5. EU Permits.

	1. Authorisation name	2. Entity responsi ble for granting authorisa tion permits	3. Reference document	4. Resolution time	5. Is such a licence necessary if the activity takes place on existing underground storage?	6. Control, duration, renewal obligations
Global Authorisations	Exploitation concession					
	Facilities					
	Enviromental Impact					
	Public utility declaration					
			Public utility	yuecialation		
	Public domain concession application					
	Other					
Well	Facilities					
Authorisations						


	Public domain concession application					
	Other					
	Integrated environmental authorisation					
Plant						
authorisations	Facilities					
	Declaration of public utility					
	Duilding normit plant					
	Activity licence					
	Other					
Other	Other					
Other comments						
L	1					

Table A.I. Permitting Underground Gas Storage Questionnair.Source: FHA.





Hystories project consortium





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MicroPro GmbH

Microbiological Laboratories

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