



Hydrogen regulation/standard in European countries for injecting hydrogen into natural gas grid

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Contact

MARCOGAZ AISBL

Rue Belliard, 40

1040 Brussels – Belgium

marcogaz@marcogaz.org

www.marcogaz.org

ABOUT MARCOGAZ

Founded in 1968, MARCOGAZ represents 28 member organisations from 20 countries. Its mission encompasses monitoring and policy advisory activities related to the European technical regulation, standardisation and certification with respect to safety and integrity of gas systems and equipment, rational use of energy as well as environment, health and safety issues. It is registered in Brussels under number BE0877 785 464.

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1. Background

Hydrogen will be one of the main actors in the transition to a decarbonised energy system.

As a first step, one of the options is to inject limited amounts of hydrogen into the natural gas networks, blending.

Up to now, this is not a generalised practice and there are only some minor demonstration projects in operation.

To inject hydrogen in natural gas has an impact in the parameters defining the quality of this. On the other hand, to set natural gas quality parameters is a right of each European country and each one has a different approach:

- National regulation
- Standards
- Gas company requirements with specific contracts with the gas producer
- Other

MARCOGAZ started some years ago to collect information about the requirements for injecting hydrogen into natural gas networks in different European countries, in order to monitor how this practice is carried out in Europe,

This document is the third update of the initial document published in 2016 and updated in 2020, both available on MARCOGAZ website¹. Main changes are:

- Collect information for 12 European countries, 2 more than in the previous version.
- Changes in the quality parameter requirements in some countries.

¹ 2016 version: <https://www.marcogaz.org/wp-content/uploads/2021/04/UTIL-GQ-15-18.pdf>

2020 version: https://www.marcogaz.org/wp-content/uploads/2021/02/WG_GQ-405-H2RegulationSurvey.pdf

Questions		Spain	Germany	France	The Netherlands	Czech Republic	Italy	Belgium	Denmark	Slovakia	Sweden	Portugal	Ireland
Q1. - Is it allowed to inject pure hydrogen into:													
Distribution natural gas network?	Yes / No	NO	YES	NO	NO	YES	NO	Not excluded but not foreseen	YES [7]	NO	NO	NO	NO, Gas Quality specification in Code limits H2 < 0.1% mol
Transmission natural gas network?	Yes / No	NO	YES	NO	NO [1]	YES	NO	YES	YES [7]	NO	NO	NO	NO, Gas Quality specification in Code limits H2 < 0.1% mol
If the answer to Q1. is YES :													
Name of regulation / standard / rule / specification (including publication date) for:													
Distribution			DVGW G262 (technical rule on gas quality G260 refers to "renewable gas technical rule" G262)			The new definition of type of gases based on Energy act No.458/2000Sb since December 2024. Enabling H2 in content to 100% for TSO, DSO and SSO			[5], §27-29				
Transmission								According to Standard Transmission Contract Fluxys Belgium Authorized under Gas Law	[8], Does not specify H ₂ limits specifically, but refers to Gasloven for additional restrictions (see [5])				
Final hydrogen concentration the natural gas network after injection:													
Distribution	%mol / %vol / other					This is not specified yet in any technical or general standards		-					
Transmission	%mol / %vol / other							2 %mol					
If the answer to Q1. is NO :													

Questions		Spain	Germany	France	The Netherlands	Czech Republic	Italy	Belgium	Denmark	Slovakia	Sweden	Portugal	Ireland
Is it forecast to review the current regulation to consider hydrogen injection into natural gas network?	Yes / No / Not known	Yes Possibly in 2024		NO	YES, via a so called "Order in council" (Algemene Maatregel van Bestuur) the injection of pure hydrogen in the TSO network for blending purposes		NOT KNOWN.	-		NOT KNOWN.	NO	YES. Umbrella law was already published. Several subsidiary regulation documents have now to be adjusted. The government drive to H ₂ and renewables injection is large, so the adjustment process should start soon.	UNKNOWN: No planned changes yet, but EU Gas Regulation and revision of EN 16726 may prompt change to the Code to allow upto to 2% H ₂
	Comments/remarks to the injection of pure hydrogen into natural gas network:												
		There exits the possibility of an interpretation of current regulation that could allow to inject pure hydrogen if the resulting blend in the pipeline does not exceed the % for an injected mixture (see below).	DVGW G 262 to be included into DVGW G 260 in 2021		[1] In legislation (gas law) the definition of gas contains a requirement that the main constituent is methane and therefore the injection of pure hydrogen is excluded	It is not currently incorporated into the standards. We are still waiting for regulation process too. For now, by the end of 2024, we are implementing selected projects with the aim of examining the possibilities of both blends (up to 20% of H ₂) and pure hydrogen in the future into existing grids.	The actual regulation would allow the possibility to inject pure hydrogen if the final mixture is maximum 2% of hydrogen.	On Transmission network, injection of 100% H ₂ requires the subscription of a blending service in association with the entry service. The blending service is not offered everywhere on the network (not when there is not sufficient gas available for blending, not when gas can reach an interconnection point).		[6] The regulation [5] stipulates that "the % Volume of H ₂ in the distribution grid shall be approved by the safety authorities". There is no value mentioned in the regulation.		In Sweden, there is no current legislation or regulation for handling hydrogen.	See note [9] below

Questions		Spain	Germany	France	The Netherlands	Czech Republic	Italy	Belgium	Denmark	Slovakia	Sweden	Portugal	Ireland
Q2. - Is it allowed to inject hydrogen/natural gas mixtures into:													
Distribution natural gas network?	Yes / No	YES	YES	YES	YES	YES, the new definition of type of Gases make this possible (with out any further regulation/description)	YES	YES	YES [7]	NO	NO	Not defined [10]	NO, Gas Quality specification in Code limits H2 < 0.1% mol
Transmission natural gas network?	Yes / No	YES	YES	YES	YES		YES	YES	YES [7]	NO	NO	Not defined	NO, Gas Quality specification in Code limits H2 < 0.1% mol
If the answer to Q2. is YES:													
Name of regulation / standard / rule / specification (including date) for:													
Distribution		Norma de Gestión Técnica del Sistema. Protocolo de Detalle 1, NGTS PD-01 (Technical Management of the Gas System Regulations. Detail Protocol 1). 8 th October 2018	DVGW G262 (technical rule on gas quality G260 refers to "renewable gas technical rule" G262)	French gas operators technical prescriptions	Regeling van de Minister van Economische Zaken van 11 juli 2014, nr. WJZ/131966 84, tot vaststelling van regels voor de gaskwaliteit (Regeling gaskwaliteit)	See above/Q.2		Technical requirement Synergrid G8/01	[5], §27-29				
Transmission								Technical requirement Synergrid G8/01 + Standard Transmission Agreement Fluxys Belgium	[8], Does not specify H ₂ limits specifically, but refers to Gasloven for additional restrictions (see [5])				
Maximum hydrogen concentration in the mixture for injection into the natural gas network:													
Distribution	%mol / %vol / other	5 %mol	See below	Currently 6 %mol An evolution of the "Prescriptions Techniques" towards 2% H ₂ max is foreseen	0.5 %mol	See above/Q.2	≤ 2 %mol	2 %mol	The regulation referred below stipulates that "the % Volume of H ₂ in the distribution grid shall be approved by the safety authorities". There is no value mentioned in the regulation.				
Transmission	%mol / %vol / other			Currently 6% mol (probable evolution to 2%mol)	0.02 %mol [2]	See above/Q.2		100 %mol					
Final hydrogen concentration in the natural gas network after injection:													

Questions		Spain	Germany	France	The Netherlands	Czech Republic	Italy	Belgium	Denmark	Slovakia	Sweden	Portugal	Ireland
Distribution	%mol / %vol / other	5 %mol		Currently 6 %mol An evolution of the "Prescriptions Techniques" towards 2% H2 max is foreseen	0.5 %mol	See above/Q.2	≤ 2 %mol	2 %mol				Not defined [11]	
Transmission	%mol / %vol / other			Currently 6% mol (probable evolution to 2%mol)	0.02 %mol (High pressure L_HRL) 0.5 %mol (Regional L_HRL [3])	See above/Q.2	≤ 2 %mol	2 %mol					
Is it compulsory/required to monitor hydrogen concentration mixture prior to injection point?													
Yes / No		YES	NO, but for billing purposes it is required that hydrogen is either measured or less than 0.2% (technical PTB G14)	YES, to verify that the H ₂ concentration is below the authorized maximum value (6%) and to determine the GCV of the mixture.	Although not legally required, it will be part of the grid connection agreement between producer and TSO/DSO	NO		YES				YES	NO [12]
If the answer to Q2. is NO :													
Is it forecast to review the current regulation to consider hydrogen/natural gas mixture injection?													

Questions	Spain	Germany	France	The Netherlands	Czech Republic	Italy	Belgium	Denmark	Slovakia	Sweden	Portugal	Ireland
Yes / No / Not known	-	YES. New draft DVGW-G 260 published in September 2020.	Access to the grid is granted for all renewable & low-carbon gases (including gases containing some hydrogen) through the "Loi d'accélération des énergies renouvelables" published March 10th 2023; a support mechanism "contrat d'expérimentation" is to be launched in September 2023 to support biomethane produced by pyrogasification of biomass or hydrothermal gasification (and later synthetic methane produced through "power-to-methane" process if it is low-carbon gas).	YES [4], there is an initiative to extend the maximum hydrogen content for both transmission as well as distribution grid to 2 mol-% hydrogen.	Additional regulations addressing injection of Hydrogen into the distribution and transmission systems must be developed			This is a possibility that is under consideration within the gas industry and several investigations are presently on-going	NOT KNOWN	NO	YES [11]	UNKNOWN: No planned changes yet, but EU Gas Regulation and revision of EN 16726 may prompt change to the Code to allow upto to 2% H2
Comments/remarks to the hydrogen/natural gas mixture injection into natural gas network:												

Questions	Spain	Germany	France	The Netherlands	Czech Republic	Italy	Belgium	Denmark	Slovakia	Sweden	Portugal	Ireland
	<p>Hydrogen mixtures are considered as non-conventional gases in the regulation. It is foreseen an early updated of the regulation where H₂ concentration allowed will be linked to European regulation or standards</p>	<p>There is not a clear limit value as such. 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</p>	<p>In France there are some working groups dedicated to H₂ injection: stakeholders work on the definition and the framing of H₂ injection from a technical and contractual point of view and share a common vision on H₂ roadmaps.</p>	<p>See notes below</p>	<p>We observe European projects outputs focused on Hydrogen injection. We believe the regulation for Hydrogen blending, based on DVGW H2-20 project will be issued soon.</p> <p>We assume that a mixture of up to 20% hydrogen will not have a negative effect on the safety of all gas grids system, including end consumers appliances</p>	-	<p>On Transmission network, injection of any blend between 2 and 100% H₂ requires the subscription of a blending service in association with the entry service. The blending service is not offered everywhere on the network (not when there is not sufficient gas available for blending, not when gas can reach an interconnection point).</p>	<p>[6] The regulation stipulates that “the % Volume of H₂ in the distribution grid shall be approved by the safety authorities”. There is no value mentioned in the regulation</p>		<p>In Sweden, there is no current legislation or regulation for handling hydrogen.</p>	<p>See Notes below</p>	

NOTES

Germany	<p>Up to now the maximum H₂ content is limited by DVGW-code of practice G 262 to below 10 %. However, the new draft DVGW G 260 (which incorporates G 262) will allow up to 20 % hydrogen in the gas, given that the respective grid and all its downstream infrastructure and application are checked and deemed suitable. However, the following limitations remain:</p> <ul style="list-style-type: none"> • The hydrogen content needs to be considered in the Calorific Value measurement; otherwise, its addition is limited to 0,2 % (see PtB code G 14) • In the infrastructure, in particular gas turbines and underground storages are regarded as limiting factors • As CNG stations will dispense the fuel to any vehicle, including those with steel tanks coming under the 2 % limit of UN ECE R 110, CNG stations are a limiting factor.
The Netherlands	<p>[1]: In legislation (gas law) the definition of gas contains a requirement that the main constituent is methane and therefore the injection of pure hydrogen is excluded. [2]: 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 ≤ 0,02 mol-% needs to be accepted by the TSO [3]: In a closed transmission network conveying refinery gas a hydrogen content of 40 mol-% is allowed [4]: Seems to be relevant information although strictly the answer should be No since injection of hydrogen is already allowed</p>
Denmark	<p>[5]: BEK nr 230 - Bekendtgørelse om gaskvalitet (21st March 2018): https://www.retsinformation.dk/eli/ta/2018/230 [6]: Requirements on H₂ for injection in the natural gas net: H₂ > 98 %vol; C_nH_m < 0,5 %vol (CH₄ equivalent); DP -50 °C at P_{atm}; O₂ < 0,1 %vol; CO₂ < 0,2 %vol; [7]: Subject to individual authority approval on case-by-case evaluation (max 2 %vol expected). CH₄ shall be minimum 80 %vol. [8]: Rules for Gas Transport, Version 19.0, 1st Oct. 2019: https://en.energinet.dk/-/media/4FD6C9840E694FC9A9BD9251F75A9C01.pdf?la=en&hash=CB49CB8B0D3A0183C583B59BE0D48CC74CE583DD</p>
Portugal	<p>[9]: New legislation came out last August (Decreto-Lei n.º 62/2020 of August the 28th) concerning the organization of the gas system (distribution, transport, storage, LNG terminal and renewable, or low carbon content gas producers). It introduces the concept of gas production and gas producer (not existing in previous legislation) and defines general conditions under which DSO/TSO has to accept/receive, inject and distribute/transport produced gas. The document does not focus on technical aspects such as H₂ percentage, effects on the user's appliances, or billing issues. Percentage of H₂ in the distributed/transported gas is to be defined in subsequent regulations. Rising percentage targets are forecasted in the Portuguese Plan for Hydrogen published by the Government at about the same time. [10]: Portuguese legislation and subsidiary regulations have no reference to H₂ content. It is up to the TSO to guarantee the quality of the gas, since up to now no gas injection was allowed in the DSO side. The new legislation will change this situation. As far as we know, discussion about technical regulations has not yet stated. Historically no H₂ was ever reported by the TSO as part of Natural Gas composition. More than 80% of the consumption comes from LNG, which will not have any H₂ anyway. [11]: The new legislation, Plan for Hydrogen and other documents or positions from the Portuguese Government points to establishing objectives of H₂ percentage in the distributed gas. Objectives will increase along time. No technical details or concerns are discussed in these documents, or positions, but DSOs are aware of the issues the injection of H₂ will bring along. DSO are ready to participate in the preparation of the regulations that will support operations and practices in the future.</p>
Ireland	<p>[12]: Most installed gas chromatographs use TCD technology and cannot measure H₂, is monitored through monthly sample taken at system Entry Points.</p>