HyDelta

WP3 Standards for hydrogen

D3.1 – Developing standards for hydrogen

Status: final

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Document summary

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Dissemination level		
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Executive Summary

Executive summary

A lot of research is currently carried out and knowledge is being gained on the use and distribution of hydrogen and natural gas/hydrogen blends. To safeguard this information, it needs to be incorporated into new or existing standards. At the same time, work is already underway on standardisation in the Netherlands and at a European level. It is for this reason that the association of electricity and gas network operators in the Netherlands, Netbeheer Nederland, requires an overview of all ongoing standardisation projects and the current progress of these projects.

This report aims to create an overview of the standardisation projects currently underway and their status. The target group who we envisage will read this document consists of people who have been delegated as members of standards committees on behalf of Netbeheer Nederland.

A great deal of research is currently being conducted and knowledge gained in the field of use and distribution of hydrogen and natural gas/hydrogen blends. To safeguard this information, it needs to be incorporated into new or existing standards. At the same time, work is already underway on standardisation, both within the Netherlands and at a European level. As a result, Netbeheer Nederland needs an overview of all current standardisation projects and their progress.

This report aims to create an overview of the standardisation projects currently underway and their status. This document is specifically addressed to experts who are involved in standardisation on behalf of Netbeheer Nederland and/or who are delegated to the relevant standards committees.

The overview created provides insight into the differences between the currently applied natural gas standards and the desired new situation in which natural gas standards have been expanded with standards for hydrogen. In this study, more than seventy topics from the literature were inventoried that relate to the gas infrastructure. Each subject is assigned a Hydelta identification number (HyID). For each subject, the current known status was examined and what action has been initiated. This analysis shows the gaps per subject. In consultation with the advisory group from Netbeheer Nederland, these gaps were assessed and a priority was given on the basis of the importance for the Dutch network operators and the influence that can be exercised by the Dutch network operators. The information has been processed into tables for each source in which the current status is discussed per subject, which standard is relevant and which standards committee is involved. The priority assigned by the supervisory committee is also indicated in the tables.

The following were the highest priorities that emerged and are shown with their HyDelta identification numbers:

- Pressure tests for pipelines (HyID 8).
- Gas volume measurements (HyID 36).
- Rapid measurement of gas composition (HyID 37).
- Safety, ATEX classification and requirements in the concerning tightness and testing (HyID 38).
- Requirements for permissible gas leaks (HyID 46)

In addition to these High priority topics, we have identified topics with an average priority level. These topics do not always relate to standardisation but they do play a role in the demonstration projects that the distribution network operators are currently preparing.

The extension of the respective standards to include hydrogen proceeds through the same organisational structure at the NEN, CEN and ISO levels as these are currently set up. To be successful, the most important instrument for Netbeheer Nederland is the delegation of experts to national and international standards committees to enable the development of standards for hydrogen to proceed favourably. It is recommended that the 5 topics with the highest priority are dealt with as soon as possible. It is also recommended that the 20 topics with average priority are monitored, and action is taken where necessary. This presents an important task for Netbeheer Nederland. Finally, for the sake of continuity and future understanding, it is advisable that the table is updated quarterly.

The prioritised subjects fall under standards committees. The international technical committees, the Dutch standards committees and the delegation in the network are listed below.

• Pressure tests for pipes: technical committee CEN/TC 234, Dutch standards committee 349008, Kiwa Technology on behalf of Netbeheer Nederland

• Gas quantity measurements: technical committee CEN/TC 237, Dutch standards committee 310066, Kiwa Technology on behalf of Netbeheer Nederland

• (Rapid) measurement of the gas composition: technical committee ISO/TC 193, Dutch standards committee 310193, Kiwa Technology on behalf of Netbeheer Nederland

• Safety, ATEX classification and tightness and testing requirements: technical committee CEN/TC 305, Dutch standard committee 341039, Dutch standard committee 341077

• Requirements for permissible gas leaks: Dutch standards committee 349008, Dutch standards committee 3490001, Kiwa Technology on behalf of Netbeheer Nederland

Contents

Chapter 1 Introduction

1.1. General

A lot of research is currently being done and knowledge is being gained on the introduction of hydrogen into existing infrastructure. In order to be able to use hydrogen in the existing gas grid, standardisation is an essential instrument. The approach taken by standards committees at the European level is to maintain the existing standards structure for natural gas and to extend the current standard to include hydrogen.

Current pilot studies in the Netherlands demonstrate that it is possible to use hydrogen in the grid. The knowledge gained from these pilot studies is being incorporated into existing or new standards. At the same time, work is in full swing in the Netherlands and at the European level on this addition to the standards.

Research on hydrogen and pilot studies that are currently being conducted or have been planned mainly concern technology, business operations or the properties of hydrogen. Many working groups and committees are working on the standardisation of the admixture of hydrogen to natural gas and full-scale hydrogen in the existing natural gas infrastructure. Standards are being developed in the context at the ISO (international), CEN (European) and NEN (nationally in the Netherlands) levels. It is not always clear how and where the knowledge gained from these research projects and pilot studies is documented in standards during the standardisation process. Furthermore, current standardisation projects may have some overlap.

1.2. Objective

This report aims to provide an insight into the relevant standardisation developments and the current status of these developments. Furthermore, a gap analysis is used to show which hydrogen-related knowledge concerning standardisation and normalisation is still lacking, and how this knowledge can be introduced or developed. In this way, the research contributes to safeguarding the interests of the prospective hydrogen sector in the Netherlands through the gas grid administrators and the TKI. The importance of the natural gas infrastructure for the transition to a sustainable energy supply with hydrogen as the energy carrier has recently been recognised internationally.

However, the standardisation of hydrogen in gas networks is still in its infancy. What we need to avoid is that the European standards are determined without the knowledge and specific focus areas of the Netherland gas grid administrators. This report aims to make a contribution by prioritising the topics that are important for the gas grid administrators. Therefore, this report envisages the need to situate standardisation within the strategic vision of Netbeheer Nederland.

In view of the objectives and the broad context of Work Package 3 within HyDelta, this report will not delve into technical details. The format used has been specifically developed for these research questions. In this report, the focus is on the future grid-bound distribution of hydrogen . For this reason, issues such as mobility (hydrogen as fuel for vehicles and steel tanks in CNG vehicles), generation and usage are not considered.

International parties have already described topics in the area of standardisation of hydrogen. One of those areas is the use of hydrogen in existing natural gas networks. The European Commission for Normalisation (CEN) has requested that the technical committees involved make a start on the standardisation of hydrogen in the natural gas network. The Energy Management Sector Forum (DFEM) has linked the topics

identified by the technical committees for natural gas to the other standardisation areas. At the international ISO level, standards are also being extended to include hydrogen or new standards are being drawn up.

Practical experience plays an important role in the development of renewed knowledge on hydrogen in grids. Over the coming years, distribution network administrators in the Netherlands will be implementing demonstration projects for hydrogen in which they will distribute hydrogen to customers. It is expected that the experience gained from these projects will simplify the development of standards.

1.3. Research questions

The following research questions have been included in the project proposal:

- What developments in standardisation regarding hydrogen have emerged recently at the European level?
- What knowledge is still lacking to be able to add the specific aspects for hydrogen to the standardisation and normalisation processes concerned?
- How can the new knowledge that needs to be developed be included in the standardisation and normalisation process so that the prospective hydrogen sector in the Netherlands makes a positive contribution to progress in this area?

Chapter 2 Method

2.1. General approach

In order to be able to systematically answer the research questions defined in section 1, the following approach has been adopted. The basic assumption of this report is that the reader is largely familiar with the current situation of the standardisation processes.

In the desired situation, all relevant existing standards for natural gas will also be applicable for natural gas/hydrogen blends and hydrogen. The CEN has already shown the direction in which the norms should be extended in its standardisation request. The intention is that this extension will occur though the same organisation structure as is currently in place. The delegates will join the standards committees on behalf of Netbeheer Nederland and will represent the grid administrators in the Netherlands. This may be implemented alongside already existing representation on behalf of the grid administrators.

In consultation with the guidance group, Kiwa Technology has embarked on the identification of the various sources and the analysis and discussion of the information available from these various sources. These sources are explained in paragraph 2.3. The discussions have resulted in tables containing a series of topics, priorities and comments for each source. The CEN TC234 Technical Report N1336 “H2NG” served as a starting point for this because this document was put together by all stakeholders involved with hydrogen in the gas infrastructure. [1] . Section 8 of the Technical Report deals with the amendments to the norms and the extra tasks for the standards committee that are necessary to get the gas infrastructure ready for hydrogen. A paragraph is dedicated to the requirements for standardisation for each standard that falls under the responsibility of TC 234. There are 14 paragraphs, and first paragraph contains an introduction. No priorities were indicated in this TC234 document.

The preparation of this table forms the basis for the current status in terms standardisation and determining the available knowledge. This table is also the starting point for the gap analysis. A gap analysis consists of describing a “current situation” and a “desired situation”. The “gap” is the difference between these two situations. The status column shows the current known status, and where this is known, which action has been put into motion. The “desired situation”, as described at the beginning of this section, is that these norms are extended to include hydrogen. The priority level at which this should occur is described using the prioritisation score given by the guidance group, see also paragraph 2.2. The lowest value here has the highest priority.

A recommendation and strategy to streamline the standardisation and enable grid administrators in the Netherlands to influence this follows from the current status of the standardisation processes and the gaps. Therefore, it is important to bring knowledge from the Netherlands and HyDelta into the formal standardisation programmes at the European level, with the ultimate aim of effectively representing the interest of the Netherlands with regard to hydrogen at the European level.

2.2. Allocation of priorities

An important part of this report is setting priorities for the topics identified. The priorities were set by the guidance group, which considered the following points:

- Does the topic have special importance for the Netherlands?
- Urgency: should the topic be completed when the large-scale hydrogen networks are rolled out?
- Should the topic be handled by the grid administrators or by suppliers/manufacturers? (for instance, for purchased parts)
- How much progress is expected on the standardisation of the topic when the grid administrators are not focusing on it?
- Is there a general consensus that the standardisation of the topic is currently progressing well?

2.3. Sources that are discussed

Various sources were consulted for this report. The sources are explained briefly below. Three of these sources have each been given their own section that starts with a part of the table followed by a few comments and an overview of the standardisation endeavours.

- TC 234. This is the technical committee within CEN that focuses specifically on the gas infrastructure. [1]

- H2IGO report “Analysis of hydrogen standardisation 2018-2020”. H2IGO is the Netherlands standardisation platform for hydrogen in industrial and build environment of the Royal Netherlands Standardization Institute (NEN). [2]

- SFEM report “Hydrogen for mobility and networks”. The Sector Forum Energy Management (SFEM) was founded in 2006 and acts as an advisory and coordination body for policy and strategic issues that involve standardisation in the areas of energy management and energy efficiency. [3] [4] [5]

Furthermore, there are two sources (exploratory study into hydrogen and standards survey by Marcogaz) that are of sufficient importance to be appended to this summary and the table, but these have not been given separate sections.

In the exploratory study into hydrogen, written by Kiwa Technology and DNV-GL for Netbeheer Nederland, Netbeheer Nederland conducted a study into gas quality. [6] It did not consider odorization. The results of this study have not been specifically incorporated in the table, but they will be included in accumulated knowledge.

Marcogaz conducted a*standards survey* in 2020. [7] Marcogaz represents the European gas industry in discussions with the European Commission. Research has been conducted into the permitted admixture percentage of hydrogen based on current gas network codes. It emerged that injection of pure hydrogen is not permitted in gas networks. Furthermore, it was concluded that an amendment of the standards has already been envisaged is only needed for the purposes of the TSO. In view of the fact that this report arrives at conclusions for a single topic (admixture percentages), this source has not been given its own section, but individual aspects have been included.

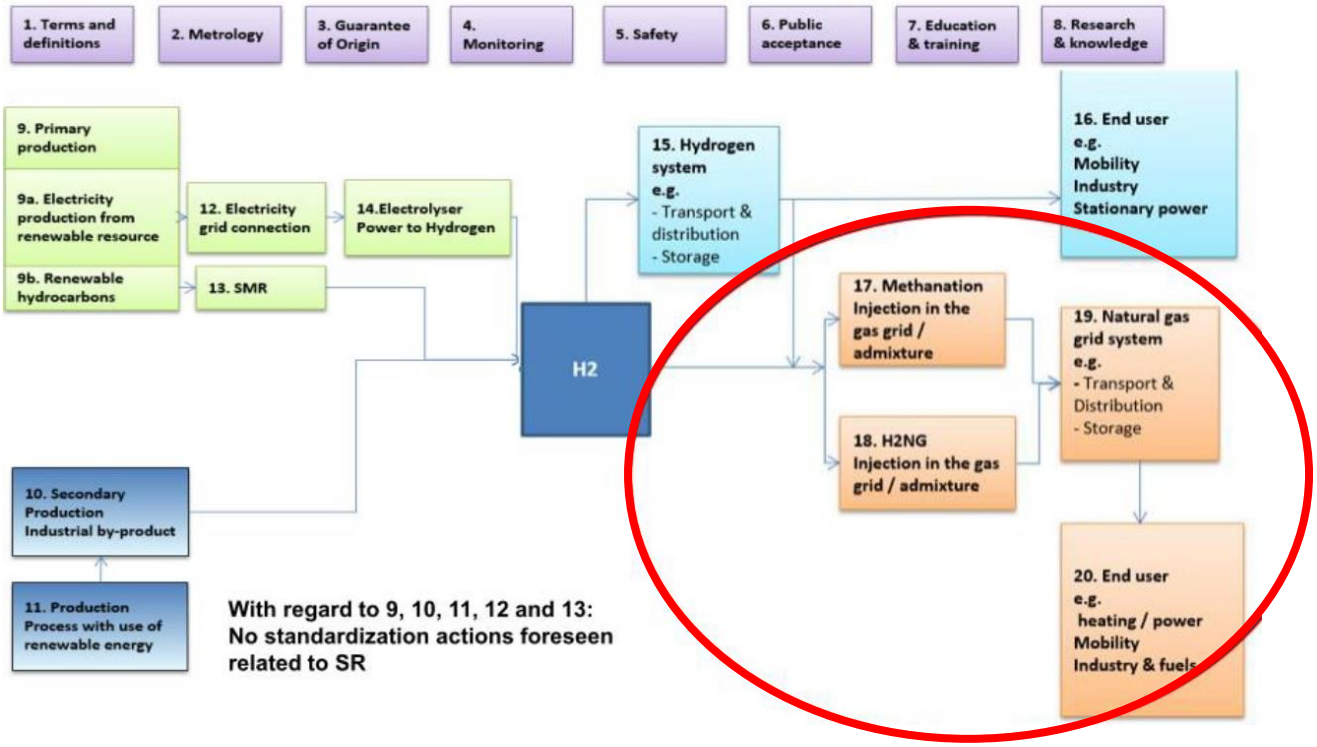
2.4. Description of the table

Table numbers are not used in this document because it has been built around one large table. In order to promote the traceability of the various topics, the decision was made to always discuss parts of the table. Therefore, the part of the table that is based on the source discussed is shown in the following sections. The layout of the tables has been made uniform for all sources and contains the following information fields:

A. Hy ID: The HyDelta number for the respective standardisation topic
B. Ref ID: This contains the source of the topic concerned. The numbers correspond to the position of the topic in the source.
C. Prio: Priority as indicated by the guidance group. Red indicates top priority and so this is the most important.
D. Topic: Description of the standard or standards concerned.
E. Status/action: Description of the current status of the standard, followed by a possible (desired) action.
F. Content: Extension of the description, status and action. In addition, other important information can also be included here.
G. CEN/NL: The number of the respective European and Netherlands standards committee. In the case of national legislation, there is no CEN committee, so a CEN number is not shown. If there is also no national standards committee for the topic, it will suffice to indicate that the topic is being handled within Netbeheer Nederland (“NBHL”).
H. Comments: Extra box for explanatory notes. There is also a space here for comments about the priority.

Chapter 3 TC234

TC 234 defined a roadmap for standard development in 2017. This roadmap is part of CEN's Standardisation Request for the development of standards for hydrogen and is shown in the figure below.



The focus area of TC 234 is circled in red.

The first source that is discussed is also used as a starting point for the tables. The TC 234 is a technical committee and its focus area is gas infrastructure. The priorities allocated to the designs within the context of this HyDelta study were established by the guidance group in the TC 234. In addition to the priorities in the TC 234 technical report N1336, there is also a TC 234 – 1188 document that contains a table with topics and priorities from the TC 234 report [1]. There are a number of topics in 1118 with a time schedule which were consequently elaborated technically in N1336. The priorities of the topics are also shown in 1188. Only the focus areas from this document are treated with "high" priority. The "Ref ID" column contains a number that refers to the relevant paragraph in the TC234 report. Where "1188" is shown, this refers to the 1188 document.

3.1. Table

Hy ID	Ref ID	Prio	Onderwerp	Norm	Status/ Actie	Inhoudelijk	CEN/NL normcom.	Opmerkingen
1	8.5	5	Regeling van de gasdruk	EN 12186	Revisie geplant voor 2022-2024. Uitbreiding van de scope met H2 >98%	Naast uibreiding van de scope geen aanpassingen vereist. In de meeste gevallen beschrijft de norm materialen die reeds geschikt zijn voor 50% waterstof.	CEN: TC234 NL: 349065	Het zijn inkoopdelen. NEN 7244 NL situatie afleiden van EU norm. NC opzoeken. Zijn deze materialen daadwerkelijk getest met 50% waterstof? Is bekend of ze tegen 100% waterstof kunnen?
2	8.5	5	Regeling van de gasdruk	EN 12279	Geen technische veranderingen vereist		CEN: TC234 NL: 349008	
3	8.6	4	Gasmeetsystemen	EN 1776	Revisie is gepland in 2021-2022	gasmeetsystemen moeten waterstof of waterstof in aardgas betrouwbaar kunnen meten	CEN: TC234 NL: 349065	
4	8.7	5	Pijpleidingen <= 16 bar	EN 12007-1	Alle clausules uitbreiden voor waterstof	Op nagenoeg alle thema's is uitbreiding voor waterstof nodig. Verbindings-technieken en onderhoudsstrategieën zijn twee elementen die weinig aanpassingen vergen.	CEN: TC234 NL: 349008	Dit betreft onderdelen die netbeheerders inkopen.
5	8.7	5	Pijpleidingen <= 16 bar	EN 12007-2	Alle clausules uitbreiden voor waterstof		CEN: TC234 NL: 349008	Dit betreft onderdelen die netbeheerders inkopen.
6	8.7	5	Pijpleidingen <= 16 bar	EN 12007-3	Alle clausules uitbreiden voor waterstof	Effect op toegepaste materialen in het netwerk is bekend, maar niet in de norm genoemd.	CEN: TC234 NL: 349008	Dit betreft onderdelen die netbeheerders inkopen.
7	8.7	3	Pijpleidingen <= 16 bar	EN 12007-4	Nog geen noodzaak tot revisie geidentificeerd	De norm behandelt renovatie van bestaande netwerken.	CEN: TC234 NL: 349008	
8	8.8	1	Druktesten voor leidingen	EN 12327	Alle clausules uitbreiden voor waterstof	De parameters voor de testprocedures moeten worden aangepast	CEN: TC234 NL: 349008	veilig werken. Definitie in NEN 7244-7. Reeks is op H2 gescand, moet nog aangepast worden.
9	8.10	5	Aansluitleidingen	EN7244 / EN 12007-5	Revisie van de norm door CEN is gepland	Bij kwaliteitscontrole en operationele zaken de soort gas (waterstof) noemen. Bij verbindingestechnieken en afdichtingen de norm opnieuw beoordelen.	CEN: TC234 WG 2&10 NL: 349008	
10	8.11	5	Leidingen voor gasinstallaties	EN 15001-1	De norm is recent in stemming gebracht, zonder waterstofaspecten. Een definitie van waterstof(houdend) gas in EN 437 is gewenst.	Mogelijk effect van hoge concentraties waterstof op metaalmoeheid en permeatie bij fitmateriaal. Zuivere vergelijking van EIGA en AIGA materialen nodig. Harmonisatie van aardgas-waterstofmengsels met PED noodzakelijk.	CEN: TC234 WG8 NL: 3490004	Dit is "achter de meter" en heeft voor netbeheer lage prioriteit
11	8.11	5	Leidingen voor gasinstallaties	EN 15001-2	Norm houdt geen rekening met waterstof(houdend) gas. PBM's voor waterstofhoudend gas mogelijk noodzakelijk.	Vermindering van de risico's is mogelijk met verhoogd inspectieregiem.	CEN: TC234 WG8 NL: 3490004	Objectgebonden maatregelen, zoals ventilatie en het voorkomen van onstekingsbronnen, vallen buiten de scope van dit project.
12	8.12	5	Gasleidingen In gebouwen	EN 1775	Aanpassing van de norm is verwacht.	De procedures voor lektesten beoordelen of ze ook voor waterstof(houdend) gas geschikt zijn	CEN: TC234 NL: 34910003	
13	8.14, SFEM	5	Veiligheid en integriteit	EN 15399 / EN 16348	Beide normen worden geïntegreerd, waarbij H2 wordt beschouwd (8.14). Tijdspad normalisatie 2021-2024 (SFEM).	Te transporteren medium typeren. Monitoren van drukcycli toevoegen (8.14). Corrosie in netwerken. Testprocedures voor materialen en integriteitsbewaking (SFEM). Conditiebewaking van pijpleidingen (SFEM).	CEN: NL: 349008	

Hy ID	Ref ID	Prio	Onderwerp	Norm	Status/ Actie	Inhoudelijk	CEN/NL normcom.	Opmerkingen
14	8.2, SFEM	n.v.t.	Gaskwaliteit H-gas	EN 16726+A1	Revisie voor waterstof in aardgas verwacht. Tijdspad normalisatie 2020-2023 (SFEM).	Relatieve dichteid, methaangetal, dauwpunt voor water en koolwaterstoffen	CEN: NL: 349008	Er is geen L-gas norm, dus geen normalisatie-onderwerp. Nederlandse MR gaskwaliteit aanpassen voor mengsels.
15	8.3	n.v.t.	Compressie	EN 12583	H2 is onderdeel van de lopende revisie	Normen van materialen waar naar wordt verwezen moeten worden aangepast naar 100% waterstof	CEN: TC234 NL: 349065	Verantwoordelijkheid leveranciers
16	8.4, SFEM	n.v.t.	Leidingen met P>16 bar	EN 1594	H2 is onderdeel van de lopende revisie	Verandering van de norm voor gassamenstelling. Toevoegen van een materiaalfactor in de berekening van de wanddikte (8.4) Conditiebewaking van pijpleidingen (SFEM).	CEN: TC238/234 NL: 310004	EN 437 is TC 238. Buiten de scope van netbeheer.
17	8.9	n.v.t.	Lassen van staal	EN 12732	Norm is op dit moment in revisie	Bij de volgende revisie waterstofaspecten meenemen	CEN: TC234 NL: 310004	De lasmethode hangt af van het staal, in mindere mate van het gas.
18	8.13	n.v.t.	Ondergrondse gasopslag	diversen				Valt buiten de verantwoordelijkheid van netbeheer.
19	1188	2	Gaskwaliteit (waterstof in aardgas)	nieuw	Substantiële bijmengpercentages waterstof zijn voor NL nog niet beschouwd.	Prioriteit voor NL komt voort uit toelaatbaar bijmengpercentage. Percentage is nu laag.	CEN: TC234/JTC 6 NL: 310197	Kan een rol gaan spelen als mengsels mogelijk vanuit het buitenland gaan binnenstromen.
20	1188	2	Gaskwaliteit (waterstof in waterstofnetwerk)	ISO 14687	samenstelling door NBNL verkend.	Verschillen tussen norm en NBNL waterstofkwaliteit zit voor een groot deel in de onzuiverheden.	CEN/TC 234, CEN/TC 268, JTC 6 NL: 310197	Samenstelling op nationaal niveau vaststellen.
21	1188	n.v.t.	Gaskwaliteit (CNG voertuigen)	EN 16723-2	Prenormatief onderzoek wordt gedaan, resultaten worden verwacht in 2022.	Resultaten laten compatibiliteit zien van CNG tanks met waterstof	CEN/TC 408 NL: 310408	Vooralsnog buiten de scope van het project . Wachten op resultaten.
22	1188	5	Vaststellen van gaskwaliteits parameters	EN 16723-2 /EN ISO 15971 / EN ISO 6974 / EN ISO 12213	tijdspad aanpassen van de normen 2020 / 2021	Eigenschappen van waterstof beschrijven	CEN/TC 238 NL: 310193; 310197	EN 16723-2 (biomethaan) niet relevant. Overige normen alleen relevant voor H2 -NG blends
23	1188, SFEM	5	Sensoren voor concentratie metingen H2 en H2NG	Nieuw	Tijdspad normalisatie 2021-2024 (SFEM).	Onderzoek en technologie ontwikkeling.	CEN: ntb NL: ntb	Dit zijn componenten voor bewaking van de gaskwaliteit. Is relevant voor blends.
24	1188, SFEM	2	Sensoren voor lekdetectie van H2 en H2NG.	ISO 26142	Planning hangt af van EC-CEN PNR (voor H2NG)	ATEX classificatie voor ruimtes met lek van blends (SFEM).	CEN: ISO/TC 197 , JTC 6 NL: 310197	Dit zijn persoonlijke beschermingsmiddelen. Komt overeen met de prioriteit van NL commissie
25	1188	5	Waterstof lek gerelateerde veiligheids risico's	EN 1839 / EN 15967 / EN ISO 15848 / ISO/TR 15916	Planning hangt af van EC-CEN PNR	Is voor leveranciers van componenten, o.a. industriële afsluiters. Zij leveren naar specificatie van de netbeheerder.	JTC 6 CEN: TC 305 NL: 341093; 341077	

Hy ID	Ref ID	Prio	Onderwerp	Norm	Status/ Actie	Inhoudelijk	CEN/NL normcom.	Opmerkingen
26	1188, SFEM	5	Pakkingen en verbindingen	EN 549:2019	Geen planning (1188) Tijdspad normalisatie 2021-2024 (SFEM).	Geen afhankelijkheid van ander TC werk, maar hangt wel af van onderzoek. Resultaten voor waterstof in aardgas beschikbaar in sommige landen (DE). Voor H2 is de situatie onbekend. Definitie van gewenste prestatie (SFEM).	CEN/TC 208 (WG 4) NL: 342045	Het is bekend dat EN 549 rubbers tegen H2 kunnen. Rubbers zitten in producten die netbeheerders aanschaffen. Normalisatie ligt dus bij de leverancier. Aandachtspunt voor ntebeheerders zijn de componenten die al in het net zitten.
27	1188	n.v.t.	Pakkingen en verbindingen	EN 13090:2001	Geen planning	Geen afhankelijkheid van ander TC werk, maar hangt wel af van onderzoek.	CEN/TC 208 (WG 4) NL: 349034	Schroefdraadverbindingen in leidingen in gebouwen. Gebouwen valt buiten het aandachtsgebied van de netbeheerder.
28	1188	5	Pakkingen en verbindingen	EN 377:1999-04	Geen planning	Geen afhankelijkheid van ander TC werk, maar hangt wel af van onderzoek.	CEN/TC 208 (WG 4) NL: 342070	Proefstukken van staalproducten voor mechanische beproeving. Relatie tussen het gas in de leiding en de vervaardiging van proefstukken onbekend.
29	1188	5	Pakkingen en verbindingen	EN 751-1, -2 en -3	Geen planning for H2 aspecten. (EN 751-3 wordt nu gereviseerd voor ENQ)	Geen afhankelijkheid van ander TC werk, maar hangt wel af van onderzoek.	CEN/TC 208 (WG 4) NL: 349034	Afdichtingsmaterialen voor metallieke schroefdraadverbindingen
30	1188, SFEM	5	Appendages in het gas systeem (regelaars, kranen, etc.)	nieuw	Drukregelaars: Tijdspad normalisatie 2022-2026 (SFEM). Excess flow valves: Tijdspad normalisatie 2020-2023 (SFEM).		CEN/TC 69 NL:	TC 69 is "industrial valves". Normalisatie ligt bij de leveranciers. Samenwerking met TC 69 is relevant.

3.2. Analysis of table and comments

The most important priorities from the TC234 are:

- Pressure tests for pipelines (HyID 8). All existing clauses must be adapted for hydrogen.
- The gas quality for hydrogen blends in natural gas (HyID 19). The guidance group holds the view that if hydrogen is admixed in the countries surrounding the Netherlands, then this gas will also be transported in networks in the Netherlands. At present, the permitted admixture percentage of hydrogen in natural gas is low in the Netherlands.
- The quality of hydrogen in hydrogen grids (HyID 20). This is very similar to the main components in ISO 16487. There is a difference between the trace components and the odorant has not yet been chosen. Definition of the composition is desirable.
- The development of sensors for leak detection of blends of hydrogen in natural gas (HyID 24). A pre-normative study is required before standardisation can begin.

A large number of the topics in the table have a lower priority or are not applicable, because:

- Work has already begun on revising the standard.
- The standard for technical network components, or technical components of network components describes what the grid administrators are purchasing. Therefore, the responsibility in the standards committees rests with the suppliers.
- Despite the fact that the topic in the source is classified as “grid administrator”, the topic is beyond the scope of Nederlands Netbeheer.

3.3. Tasks and durations

The adaptations for the TC234 standardization are scheduled between 2020 and 2025.

Chapter 4 H2IGO

H2IGO report “Hydrogen in the built environment”. H2IGO is a Dutch platform that was created in late 2018 because it had emerged from meetings with Dutch stakeholders that a Dutch platform for coordination, knowledge-sharing, identification and prioritisation was greatly needed in the standardisation landscape. The “Hydrogen in the built environment” report establishes priorities for alterations to the standards that are important for the Netherlands. A number of fundamental decisions have also been prepared on matters such as gas composition, odorization and energy measurement. [2]

Gas volume measurement
The actions recommended by the platform for gas volume measurement are as follows:

- Pre-standardization research into the calibration of meters for hydrogen and for natural gas/hydrogen blends.
- Make volume correction devices (EVS) suitable for variable gas composition.
- Include the presence of hydrogen in the standards for the measurement set-up and examine how the ATEX classification of this set-up changes.
- In the case of natural gas/hydrogen blends, study the geographic and time-dependent fluctuations of the gas composition.

Odorization of natural gas and natural gas/hydrogen blends
To date, there has not been much experience with the odorization of gases containing hydrogen. The platform does not anticipate the occurrence of any problems, but this still needs to be demonstrated. The aspects which play a role in the choice of a hydrogen odorant in the Netherlands are identified. These aspects are derived from the choice of an odorant for natural gas.

Research is currently being carried out within HyDelta into an odorant for hydrogen. Netbeheer Nederland expects for the time being that it will be possible to deploy the odorant used in natural gas (tetrahydrothiophene, THT) as an odorant for hydrogen without any problem.

4.1. Table

Hy ID	Ref ID	Prio	Onderwerp	Norm	Status/ Actie	Inhoudelijk	CEN/NL normcom.	Opmerkingen
31	H2IGO 2.2.1.1., SFEM	3	gashoeveelheidsmeting grootverbruik	EN 12480; 12405; 12261;	Toepasbaarheid voorlopige resultaten nagaan.	effecten nieuwe gassen in onderzoek in EURAMET verband	CEN: TC 237 (gasmeters) NL: 310066	effecten nog niet bekend. Resultaten onderzoek medio 2022
32	H2IGO 2.2.1.2., SFEM	3	gashoeveelheidsmeting; meetverantwoordelijken	Reglementen meetverantwoorfdelijken	Toepasbaarheid voorlopige resultaten nagaan.	Acties zijn afhankelijk van onderzoeksresultaten, o.a. van NEWGASMET	CEN: n.v.t. NL:VMNED en net-beheerders	nog niet bekend wat de geschikheid van de meters is
33	H2IGO 2.2.1.1, SFEM	3	gashoeveelheidsmeting; thermische hoeveelheidsmeting	EN 17526	Dialoog met meterleveranciers is gestart (Hydelta WP 1D). Extra aandacht geven aan kalibratieproces met lucht.	normen beschrijven nog geen waterstof, uitbreiding gestart.	CEN: TC 237 NL: 310066	MID-toegelaten meter verwacht vóór de start van de waterstofdemo's kleinverbruik
34	H2IGO 2.2.1.2., SFEM	3	gashoeveelheidsmeting; ultrasone hoeveelheidsmeting	EN 14236	Dialoog met meterleveranciers is gestart (Hydelta WP 1D). Extra aandacht geven aan kalibratieproces met lucht.	normen beschrijven nog geen waterstof, uitbreiding gestart.	CEN: TC 237 NL: 310066	MID-toegelaten meter verwacht vóór de start van de waterstofdemo's kleinverbruik
35	H2IGO 2.2.1.3, SFEM	3	gashoeveelheidsmeting turbinemeters	EN 12261	Bestaande meetinrichtingen	effect nieuwe gassen in onderzoek. NEWGASMET	CEN: TC 237 NL: 310066	effecten nog niet bekend. Resultaten onderzoek medio 2022
36	H2IGO 2.2.1, SFEM	1	gashoeveelheidsmeting; EVHI	EN 12405	EVHI's geschikt maken (H2 IGO 2.3.1.2). Goedkope gassensoren ontwikkelen. Aantal meetpunten vergroten?	bij variabele gassamenstelling H2 concentratie individueel meten	CEN: TC 237 NL: 310066	Meetinrichtingen kunnen H2 als dragergas toepassen, waardoor ze H2 niet detecteren
37	H2IGO 2.2.2.	1	wisselende gassamenstelling; met hoge frequentie de gassamenstelling bepalen	nieuw	Geografische aspecten en tijdsafhankelijke verschillen H2-aardgasmengsels (H2IGO 2.3.1.4)	H2 sensoren die in staat zijn om in een aardgasmatrix te meten zijn commercieel beschikbaar	CEN: n.v.t. NL: NBNL / H2IGO platform bijeenkomst 2021.	Nog geen start van dit onderwerp. Meterleveranciers en Meetverantwoordelijken hebben een voorkeur voor constant H2 gehalte.
38	H2IGO 2.2.3	1	Veiligheid en ATEX classificatie	ATEX richtlijnen	Waterstof is beschreven in ATEX regelgeving	Voor > 75% H2 in aardgas geldt MESG IIc	ATEX	Voor EVHI's is dit kritisch mits deze in de gasruimte ondergebracht zijn.
39	H2IGO 2.2.4	3	Wet- en regelgeving Verrekening	nieuw	Nagaan wat wettelijk mogelijk is. Huidige opvatting: je moet opgeven wat je levert, in dit geval kubieke meters.	Nog niet gestart. Is een belangrijk aspect van de waterstofdemo's.	CEN: n.v.t. NL: o.a. NBNL	verrekening van waterstof (nog) niet in de gascodes opgenomen.
40	H2IGO 2.2.4	3	Wet- en regelgeving Herleid controleren van de miswijzing van waterstofmeters	nieuw	Overleg met VSL over technische aspecten gestart (H2IGO 2.3.1.1 en 2.3.2.1)	Eerste specificatie van een meetsysteem geformuleerd	CEN: n.v.t. NL: NBNL	haalbaarheid nog onbekend. Het lijkt erop dat controle met lucht zal blijven. Wat is de relatie tussen waterstof en lucht?
41	H2 IGO 2.3.2.2	3	Meetcode gas	nationaal document	Nagaan wat er niet wordt afgedekt door de Meetcode gas	Toepasbaarheid voor H2/aardgasmengsels onbekend	CEN: n.v.t. NL: NBNL	
42	H2IGO 3.2	5	Keuze odorant voor H2	nationale richtlijnen	Totdat het odorant wordt toegepast, THT gebruiken in de waterstofdemo's.	Er is nog geen odorant gekozen. Alternatieven worden nu onderzocht.	CEN: n.v.t. NL: NBNL Hydelta WP 2.	Het odorant moet voldoen aan de Nederlandse eisen. Er zijn enkele kandidaten.
43	H2IGO 3.2	5	Odorant voor H2 in aardgas	nationale richtlijnen	Ruikbaarheidstesten voor mengsels definiëren.	THT kan gebruikt worden.	CEN: n.v.t. NL: NBNL	De ruikbaarheid van een mengsel is nog niet voldoende aangetoond.

Hy ID	Ref ID	Prio	Onderwerp	Norm	Status/ Actie	Inhoudelijk	CEN/NL normcom.	Opmerkingen
44	H2 IGO 4.1	5	Waterstof door een gasdistributienet Gassamenstelling	nationaal document	Samenstelling delen met leveranciers van componenten (bv. Van gasmeters)	Verkenning is uitgevoerd. Aansluiting met internationale consensus zoveel als mogelijk gerealiseerd.	CEN: n.v.t. NL: NBNL	entry- en exit specificatie van gas geformuleerd, exclusief odorant.
45	H2 IGO 4.2	3	Standaard voor 20% H2 in waterstof	nationale richtlijnen	Starten met verkenning naar de specificatie van het gas. Aansluiten bij internationale consensus?		CEN: NL: NBNL	Verantwoordelijkheid voor gastoestellen. Aandachtspunten voor specifieke gebruikers (generatoren en stalen tanks van CNG voertuigen). Snelheid van fluctuatie H2 percentage
46	H2 IGO 5	1	Veiligheid Dichtheidseisen en -beproeving	nationale richtlijnen	acceptabele waarden definiëren	Er ligt geen norm wat we acceptabel lekkage vinden.	CEN: NL: NBNL	
47	H2IGO	3	Ontstekingsbronnen	n.v.t.	aansluiten bij bestaande ATEX normen. Grensgebied netwerk en woningen aangeven daar die niet onder ATEX vallen	Onstekingsbronnen beoordelen op basis van heersende regelgeving.	CEN: n.v.t. NL: NBNL	
48	H2IGO	3	Lekzoeken	bedrijfsrichtlijnen netbeheerders	Detectiegrens bepalen en werkprocedures opstellen		CEN: n.v.t. NL: NBNL	
49	H2IGO	3	Training van personeel	bedrijfsrichtlijnen netbeheerders	Training van personeel starten		CEN:n.v.t. NL: NBNL	
50	H2IGO	3	Penetratie in afgesloten ruimten		concentraties definiëren	wat is acceptabel?	CEN: n.v.t. NL: NBNL	
51	H2IGO	5	Specifieke onderdelen van binneninstallaties	richtlijnen voor installateurs	Gedrag van waterstof in binnenleidingen is onderzocht door netbeheerders.	Binnenleidingen met H2 kunnen bij werkzaamheden langere tijd losgekoppeld zijn.	CEN: n.v.t. NL: NBNL	Menging van waterstof en lucht in openstaande binnenleidingen is beschreven.
52	H2IGO	3	Veiligheidsmaatregelen	bedrijfsrichtlijnen netbeheerders	procedures voor werken met waterstof opstellen	Waar is er verandering of uitbreiding in de procedures nodzakelijk?	CEN: NL: NBNL	Welke standaard procedures gaan we hanteren?
53	H2IGO	3	Onderhoud en Beheer	bedrijfsrichtlijnen netbeheerders	Gedrag van bestaande infrastructuur bij waterstof beschrijven.	Waterstof opnemen in standaard werkwijze door trainingen en voorzien van goede meetapparatuur	CEN: NL: NBNL	
54	H2IGO	3	Incidentbestrijding	Brandweer	Resultaten van onderzoeken IFV geven richting aan incidentbestrijding	Bepalen bestrijdingsplan en handleiding voor ontwerp voor waterstofinstallatie in huis.	CEN: n.v.t. NL: NBNL	

4.2. Analysis of table and comments

The highest priorities in this part of the table consist of standardization for gas volume measurements with an EVC, rapid measurement of gas composition, safety and ATEX classification and the requirements concerning tightness and testing.

For all measurement principles of the gas volume measurement, the standards must be extended to include hydrogen. (HyID 31 to 36). Meters and instruments come from foreign suppliers that manufacture products and sell them on the European market according to EU standards. The products must have MID approval. HyDelta has a hydrogen measurement work package that looks at the availability of hydrogen meters. Hydrogen meters are available for pilot studies over the short term, but these are not yet described in standards.

Safety is the guiding principle during the creation of the standards. In addition to safety, there are number of relevant focus areas because of the hydrogen demonstration projects that are being prepared. Although not part of the standardisation, these must be dealt with by grid administrators and have been included in the table. This concerns the following:

- Drawing up criteria for tightness testing of pipelines. (Hy ID 46)
- Measurements and calculations involving the hydrogen. (Hy ID 31 to 37, 39 to 41)
- Rapid measurement of changes in natural gas/hydrogen quality (Hy ID 37)
- Checking hydrogen meters. (Hy ID 40)
- Hydrogen distribution through the existing gas grid (Hy ID 44)
- Drawing up specifications for hydrogen and natural gas blends. (Hy ID 45)
- Training grid administrators' employees to work safely with hydrogen. (Hy ID 49)
- Checking the hydrogen resistance of grid components when changing over from natural gas to hydrogen. (Hy ID 46, 53)

4.3. Tasks and durations

There are still a number of tasks to be completed before the demonstration projects in the Netherlands are properly prepared to get started. For instance, it is important that licences and work procedures for hydrogen are in place. Furthermore, operational staff need to be adequately trained. In addition to the installation, the measurement and calculation process for the hydrogen used must be sufficiently trusted by the connected parties. To make this a success, it is desirable to have MID permitted measurement instruments available.

The time frame for standardisation is not clearly indicated in the H2IGO report.

Chapter 5 HyDelta, TC237 and SFEM Energy management

There is also a need for standardisation in various work packages in the HyDelta national consortium programme. These have been grouped together here (Hy ID 55 to 62). They mainly concern issues about accruing knowledge and fiscal metering of hydrogen.

In addition to the findings from HyDelta, this section also considers the final report from the Sector Forum Energy Management (SFEM) working group of CEN/CENELEC (final report 2019). [5] This source is older than the TC234 report but it contains a table with priorities. Furthermore, SFEM has largely based its reports for the gas infrastructure components on work from TC234. In addition to the report from 2006, we have included various other SFEM reports. These reports have some overlap which is why only the relevant topics have been selected from these reports for inclusion in the table. The SFEM working group focuses on the gas grid network and devices. The topics (from the ”Gas System” partial report) that were selected for the study are as follows: natural gas quality, installations that are linked to the gas grid, grid integrity and grid administration. This report does not cover topics involving gas applications.

The following table identifies the topics from HyDelta for which the authors believe that standardisation action must be initiated over the short term (these are topics Hy ID 63 to 72). Although a number of these topics lie outside of the area of expertise of the grid administrators, some of the topics, such as the production of hydrogen, will be of concern to them.

The SFEM report identifies a number of “Near term standardisation actions”. The authors have supplemented these with comments. A part of the topics overlaps with the other standardisation topics, as a result of which these have been merged. For these topics, the abbreviation “SFEM” has been noted under the “Ref ID”.

5.1. Table of HyDelta and SFEM work packages

Hy ID	Ref ID	Prio	Onderwerp	Norm	Status/ Actie	Inhoudelijk	CEN/NL normcom.	Opmerkingen
55	Hydelta WP 3	5	Waterstofproductie bij de waterstofdemo's	n.v.t.	Aan kennisopbouw beginnen.	er gaat lokaal waterstof geproduceerd worden, maar dit besteedt de netbeheerder uit.	CEN: NL: NBNL/ demo's / Hydelta WP 3	Weinig ervaring met de techniek en de regelgeving.
56	Hydelta WP 3	5	opslag van waterstof bij de waterstofdemo's.	n.v.t.	Aan kennisopbouw beginnen.	Er gaat lokaal waterstof worden opgeslagen, maar dit ligt buiten het domein van de nebeheerder.	CEN: NL: NBNL/ demo's / Hydelta WP 4	Weinig ervaring met de techniek en de regelgeving.
57	Hydelta WP 1D	3	toezichthouder op de Metrologiewet Agentschap Telecom (AT)	Metrologiewet	Dialoog met AT gestart in Hydelta WP 1D.	Alleen MID toegelaten meters voor waterstof zijn toegestaan.	CEN: TC 237 NL: 310066	Meters in het veld moeten gecontroleerd kunnen worden met lucht.
58	Hydelta WP 1D	3	MID toegelaten meters. Rol van de Notified Bodies	Measuring Instrument Directive (MID)	Er is nog geen toegelaten meter bekend. NMi is bezig eerste meters te beoordelen.	Meterleveranciers verwachten dat hun NoBo's waterstofmeters op korte termijn kunnen toelaten.	CEN: TC 237 NL: 310066	Dit vereist herleidbaar controleren. Het is nog niet gedemonstreerd.
59	Hydelta WP 1D	5	integratie van waterstofmeting in de Meterpool kleinverbruik	reglement meterpool KV	Formulering methode afronden binnen WP 1D	in onderzoek. voorstel wordt geformuleerd	CEN: n.v.t. NL: NBNL / AT / Hydelta WP 1D	Controleren van de meters met lucht beschrijven.
60	TC 237 WG9 (US meters)	3	Niet-conventionele gassen (CEN) Wisselende gassamenstelling	EN 437	NL gassamenstelling publiceren naar componentenleveranciers. Vergelijking van de sporencomponenten met NEWGASMET om impact op meters vast te stellen.	Niet-conventionele gassen zijn globaal in CEN aanpak gedefinieerd.	CEN: TC 237 WG 9; TC 234 liaison met TC 238 (EN 437) NL: 310066	Op werkgroepniveau is dit niet werkbaar, een duidelijkere defintie is noodzakelijk. (geldt met name voor mengsels H2 in aardgas). EN 437 (testgassen) ondergaat momenteel veranderingen.
61	Hydelta WP 3	3	Gebruik bestaande aardgasinstallaties		Verschillen inventariseren.	Gastec QA kent mogelijkheid voor waterstof-screening van gebruikte materialen	CEN: n.v.t. NL: Gastec QA	
62	Hydelta WP 3	3	Gastec QA voor enkele componenten RNB	nationale regelgeving	Verschil in risico-contouren tussen aardgas en waterstof vaststellen.		CEN: n.v.t. NL:	Veiligheids-regelgeving (ATEX, risico-contouren)

Hy ID	Ref ID	Prio	Onderwerp	Norm	Status/ Actie	Inhoudelijk	CEN/NL normcom.	Opmerkingen
63	SFEM	n.v.t.	Regelstrategieën voor elektrolysers	Geen normen genoemd.	Er zijn nog geen strategieën geformuleerd voor invoeding in een net.	98% H2: regelstrategieën elektrolyser Blends: eender		Een netbeheerder zal voor de demo's de waterstofproductie uitbesteden.
64	SFEM	n.v.t.	Compressorstations	EN ISO 10440 / EN ISO 10439	Tijdspad normalisatie 2022-2025	Onbekend of blends zijn inbegrepen.	CEN: n.v.t. NL: 310008	
65	SFEM	3	Ombouw van aardgas naar waterstof	Containerbegrip. Heeft betrekking op bestaande netten	Alle normen aanpassen. Tijdspad normalisatie 2021-2024.	Corrosie in netwerken is een punt van aandacht.	CEN: diversen NL: diversen	Normalisatie heeft alleen betrekking op componenten die vervangen worden.
66	SFEM	5	Stromingsgedrag in netten	Geen normen genoemd.	Tijdspad normalisatie 2022-2024.	Kennisopbouw zou moeten plaatvsinden bij netbeheerders.	CEN: ntb NL: ntb	
67	SFEM	5	Conditiebwaking van pijpleidingen	EN 12007 reeks	geen informatie	Conditiebewaking van pijpleidingen bij aanwezigheid van waterstof formuleren	CEN: TC234 NL: 349008	
68	SFEM	5	Odorisatie	ISO TR 16922 (2013)/ EN ISO 13734 (2013)	Tijdspad normalisatie 2022-2024.	Testen van nieuwe odoranten.	CEN: NL: 310193	Testprocedures van odorant zullen niet sterk wijzigen.
69	SFEM	5	Permeatie	Geen normen genoemd.	Tijdspad normalisatie: 2023 - 2027	Permeatie is een eigenschap van materialen. Een eis is niet bekend.		
70	SFEM	5	Eigenschappen van aardgas-waterstof mengsels	IEC 60079-0	geen informatie	ATEX classificatie voor ruimtes met lek van aardgas-waterstof mengsels.	CEN: n.v.t. NL: 363031	Speelt een rol in gebouwen met infrastructuur voor mengsels
71	SFEM	5	Eigenschappen van aardgas-waterstof mengsels	IEC 60079-10	geen informatie	ATEX classificatie voor ruimtes met lek van aardgas-waterstof mengsels.	CEN: n.v.t. NL: 363031	Speelt een rol in gebouwen met infrastructuur voor mengsels
72	SFEM	n.v.t.	Guarantees of origin	EN 16325	Herkomst van de waterstof is nog niet beschreven.	EU certifcatieschema's. Hernieuwbare energie richtlijn (RED) is er alleen voor elektriciteit, niet voor gas. Waterstof opnemen in EN 16325	CEN: JTC6 NL: 310030	aanvullend op bestaande norm

5.2. Analysis of table and comments

In this section, no topics have been identified with the top priority. However, a large number of topics have average priority. The topics focus on fiscal metering of the hydrogen, the Gastec QA quality mark, and the effect on existing grids of the conversion to hydrogen.

According to the SFEM/WG for hydrogen, the most significant standardisation activities for gas grid administrators are as follows:

- CEN/CLC/JTC 6 on Hydrogen in Energy Systems. The scope regarding hydrogen is cross-sector and involves topics such as terminology, guarantee of origin, operational management, relevant safety issues and training and therefore provides a lot of information. In view of the broad scope, grid administrators are not associated with this directly. Knowledge transfer takes place through the NEN.
- CEN/TC 234 on Gas Infrastructure. See section 3 of this report.
- ISO/TC 193 on Natural Gas. These are international agreements that are used. Covers the physical properties and methods of determining these properties for gases, in particular natural gases. Various standards already take into account the presence of a limited concentration of hydrogen.
- ISO/TC 158 on Analysis of Gases. These are international agreements that are used. Deals with standardisation in the area of gas analysis. The topics are terminology, preparation of calibration gas blends, sampling and analysis methods, including the performance evaluation of analysers.
- CEN/TC 238 on Test Gases. This is the definition of test gases for appliances. These are referred to here because the definition of the test gases is the only place where the European Member States say something about gas quality within CEN standardisation. These test gases are often used as the basis for the creation of standards.

5.3. Tasks and durations

The HyDelta programme runs until May 2022. Most of the work packages will have been concluded by the end of 2021. It is important that the standards committees are able to consider the various research results from the programme.

The SFEM has an extensive schedule in its report (P97 of [5]). It can be seen that most of the standardisation work for SFEM working groups 1 to 5 will start in early 2022 and will have to be completed in late 2024. Therefore it is extremely important for Netbeheer Nederland to become involved now.

Chapter 6 Conclusions and recommendations

6.1. Conclusions

Netbeheer Nederland is represented in standards committees for gas infrastructure by various experts from grid administrators and Kiwa Technology. It is expected that they will play a leading role in the extension of the European standards for natural gas, blends of natural gas/hydrogen and pure hydrogen. They will be tasked with ensuring that the timeline for standardisation runs in parallel to the priorities of grid administrators in the Netherlands wherever possible. The strategy we will follow is to delegate existing and new experts to standards committees with topics that must be accelerated in the Netherlands. For this reason, the extension of the standards to include hydrogen are scheduled for the period from 2021 to 2024 for the majority of the standardisation work.

National legislation calls for the use of hydrogen infrastructure that complies with technical requirements. It is commonly known which steps need to be taken to move from natural gas to hydrogen, but these still needs to be set out in the standards. Standardisation is often the only way to give regulators certainty about the safety of the grid and the quality of the gas volume measurement. That is why it is extremely important to focus on standardisation topics.

For Netbeheer Nederland, its most important instrument is the delegation of experts to national and international standards committees to contribute to the knowledge available in the Netherlands during the development of standards for hydrogen and in doing so do, to ensure that the standards are in line with the situation in the Netherlands. It is important to extend the current policy with a focus on prioritised hydrogen-related topics and, where necessary, additional relevant topics from this report.
A number of topics that are handled come from the national partnerships and are implemented at a national level. For this purpose, the tasks of the grid administrators will also include the following: grid codes, measurement codes and documenting the requirements placed on gas quality. Netbeheer Nederland has only taken several important steps for these topics, but it is certainly not finished yet.

European standards committees have outlined the extension of the scope of standards for natural gas to natural gas with hydrogen. It is important to continue to actively follow the standardisation of grid components for hydrogen, although it still needs to be established exactly how this will be achieved.

National topics need to be dealt with so that the various demonstration projects involving hydrogen that will be starting in the near future can be carried out in accordance with a safe and standardised method.

6.2. Recommendations

Place a high priority on participation in the development of standards for hydrogen by organising the delegation of experts to international, European and national standards committees.

It is recommended that the five topics with the highest priority are dealt with as soon as possible (see table 2). A Dutch standards committee has already been appointed for pressure tests for pipelines, EVC devices and varying gas compositions. The ATEX guidelines and the associated body that applies these (or may apply these in the future) in the area of hydrogen must be considered for the ATEX classification of natural gas/hydrogen blends. The final topic with high priority is “Safety of Tightness Requirements and Testing”. National guidelines should be drawn up for this in the near future. Research is currently ongoing in this area and the results from this can be included in the guidelines to be drawn up.

Attention should also be focused on topics with average levels of priority. Although these appear to be ranked as having lower importance, it is still important that the guiding principles of grid administrators in the Netherlands are properly considered. It is also recommended that these topics continue to be monitored closely.

If the table drawn up in this report is used in the near future as reference material, it is recommended that the table is kept live and coordinated with the progress of the standardisation between the standards committees. This can be done, for instance, by adding the current status every six months and modifying the priorities to the situation at that time.

Table 2: The 5 topics with the highest priority and the schedule in half years.

Hy ID	Ref ID	Onderwerp	Norm	Status/ Actie	Inhoudelijk	CEN/NL normco	Planning
8	8.8	Druktesten voor leidingen	EN 12327	Alle clausules uitbreiden voor waterstof	De parameters voor de testprocedures moeten worden aangepast	CEN: TC234 NL: 349008	22H1
36	H2IGO 2.2.1, SFEM	Gashoeveelheidsmeting; EVHI	EN 12405	IGO 2.3.1.2). Goedkope gassensoren ontwikkelen. Aantal meetpunten vergroten?	bij variabele gassamenstelling H2 concentratie individueel meten	CEN: TC 237 NL: 310066	22H1
37	H2IGO 2.2.2.	Wisselende gassamenstelling; met hoge frequentie de gassamenstelling bepalen	Nieuwe norm	Geografische aspecten en tijdsafhankelijke verschillen H2-aardgasmengsels (H2IGO 2.3.1.4)	H2 sensoren die in staat zijn om in een aardgasmatrix te meten zijn commercieel beschikbaar	CEN: n.v.t. NL: NBNL / H2IGO platform bijeenkomst 2021.	22H2
38	H2IGO 2.2.3	Veiligheid en ATEX classificatie	ATEX richtlijnen	Waterstof is beschreven in ATEX regelgeving	Voor > 75% H2 in aardgas geldt MESG llc	ATEX	22H1
46	H2 IGO 5	Veiligheid Dichtheidseisen en -beproeving	nationale richtlijnen	acceptabele waarden definiëren	Er ligt geen norm wat we acceptabel lekkage vinden.	CEN: NL: NBNL	22H1

References

[1] T. C. C. 234, “Gas infrastructure — Consequences of hydrogen in the gas infrastructure and identification of related standardisation need in the scope of CEN/TC 234, Technisch Rapport N1336 “H2NG”,” DIN, 2021.

[2] F. van den Brink, T. de Groot, W. Hazenberg, E. Huijzer, W. Koppenol, H. de Laat, C. van de Sande, R. Velthuizen and T. van Wingerden, “Analyse waterstofnormalisatie 2018-2020: Normalisatieplatform H2 Industrie en Gebouwde Omgeving,” NEN Energy (Stichting Koninklijk Nederlands Normalisatie Instituut), Delft, 2021.

[3] E. Weidner, M. Honselaar, R. Ortiz Cebolla, B. Gindroz and F. de Jong, “Sector Forum Energy Management / Working Group Hydrogen,” European Union, 2016.

[4] F. C. a. H. Observatory, “Chapter 4 Standards,” Fuel Cells and Hydrogen Observatory, 2020.

[5] A. Laurent , F. Barth, L. Briottet, A. Carayol, A. Chazottes, J. Cluytmans, T. Constantinescu, C. Copin, F. De Jong, H. De Laat, G. De Real, V. Di Noto, L. Docter, J. Dubost, A. Eriksson, J.-R. Filtz, A. Gago, A. Garcia Hombrados, B. Gindroz, A. Gome, F. Grohmann, F. Haloua, N. Hart, M. Honselaar, D. Hedley, R. Judd, M. Kaldonek, D. Klassek, J. Klimstra, N. Kraus, P. Lucchese, L. Millington, L. Mostert, G. Müller-Syring, J. Newton, R. Perotti, U. Schmidtchen, H. Schülken, M. Sekita, C. Thomson, M. Waidhas, E. Weidner, B. Weinberger, T. van Wingerden and M. Zarzuela, “Sector Forum Energy Management – Working Group Hydrogen: 2018 update report,” Publications Office of the European Union, Luxembourg, 2019.

[6] H. V. P. V. (. G. E.A. Polman (Kiwa), “Verkennende studie naar waterstof, geschreven door Kiwa Technology en DNV-GL, Entry- en exitpunten distributienet,” Kiwa Technology B.V., Apeldoorn, 2021.

[7] Marcogaz, “Guidance Note on Energy Determination when Non-Conventional Gases are injected into the Gas Network,” Marcogaz, 2020.

[8] D. R. H. de Laat, “Rapportage normalisatieplan 2020 - onderdeel normcomissies gasmeting,” Kiwa / NBNL, Apeldoorn, 2021.

Appendix I Overview of questions – HyDelta WP3

The following questions have been carried over from the project proposal.

- What developments in standardisation regarding hydrogen have emerged recently at the European level?
- What knowledge about hydrogen with regard to standardisation and normalisation is still lacking?
- How can the new knowledge required be developed and incorporated so that progress in the Netherlands' hydrogen gas distribution sector regarding hydrogen developments is not hampered?

The proposed approach according to the project proposal:

- After publication of the CEN TC234 report, Kiwa will summarise the status in the area of standardisation and determine the knowledge available.
- A gap analysis will be prepared using this inventory and that will be tested with various stakeholders in the Netherlands.
- The gaps will be presented in the Netherlands and Europe alongside the existing research and pilot studies (technical, operational and pilot studies) and the conclusions or research aims will be set out point by point.
- For this purpose, we will use all public knowledge from bodies of which Kiwa is a member or to which it contributes, including our network, in order to make contact with other experts and initiatives.
- The gaps will be used to formulate a proposal for follow-up action from HyDelta.

A recommendation and strategy to streamline the standardisation and influence this by grid operators in the Netherlands follows from the current status of the standardisation processes and the gaps, with the aim of maximising Dutch interests and the fit of the Dutch situation at the European level.

Appendix II Guidance group

Name	Network operator
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Peter van Wesenbeeck	Gasunie
Walter Koppenol	Enexis