



European Standardisation of hydrogen and H2NG

Françoise DE JONG Secretary CEN-CLC/TC 6 and SFEM/WG Hydrogen 4th HIPS-NET Workshop Brussels, 14th June 2017

European Standardisation of hydrogen and H2NG



Overview Where did we start? SFEM WG Hydrogen TF 3 Natural Gas system and usage Where are we now? CEN-CLC/TC 6 Hydrogen in energy systems CEN/TC 234 Gasinfrastructure Next step EC Standardisation Request on hydrogen



Hydrogen and H2NG



Global climate goals with COP 21 + Policy of EU Commission to provide Secure, sustainable, competitive, affordable energy for every European = Framework for gas in the future

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Large scale energy storage

Large scale RES integration

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- Complement Strategic energy reserves and diversification of supply
- Decarbonisation of the energy system
 - » Synergies between RES and the natural gas grids
 - » Indigenous energy sources more important in future
 - » Link to other economic sectors (transport and industry)



SFEM/WG Hydrogen





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SFEM WG Hydrogen



Mission

- First objective: Analysis of the state of the art of technology and standardisation and a gap analysis on the main barriers including challenges and needs.
- Second objective (exchange role): to establish contact with key stakeholders from gas sector, grids, electric supply, mobility, funding organisations, to perform the work in the most effective way and to have broad support from the stakeholders for identifying the key challenges.

80+ experts from more than 60 European companies, organisations, institutes



SFEM/WG Hydrogen









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Results: Roadmap of near term action items

Connection to electricity grid Electrolysers

Gas system and usage

Hydrogen Technologies

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ID	Торіс	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6				
TF1	Interconnection	SoA Analysis									
	Key Performance Indicators	Standardisation									
FZ	Durability	Nev	v materials valida	ion							
	Performance	Pe	erformance mappi	ng							
	Degradation	Development of new materials									
	Gas quality harmonisation Establishing a European understanding of acceptable hydrogen concentrations										
	Gas Turbines (TSO/DSO)	Operating characteristics Recommendations to operators									
	CNG vehicle on-board storage (DSO)	SoA Analysis	Testing H ₂ limit	for steel tanks	Standar	disation	% H2				
	Porous rock underground storage (TSO)) SoA Analysis Microbial activity Standardisation/Certification									
TF3	Use for industrial processes (TSO/DSO)	Identify sensitive processes Develop mitigation methods Adaptation of infrastructure									
	Industrial burners (TSO/DSO)	SoA Analysis	Performa	nce tests	Standardisatio	n/Certification	.H2				
	Residential appliances (DSO)	SoA Analysis	Performa	nce tests	Standardisatio	n/Certification	>5%				
	Odorisation (DSO)	۲ ۱	est new odorants		Standar	disation					
	Compressor stations (TSO/DSO)			– – ► SoA ana	lysis Evalu	ation tests	10% H2				
	Refuelling infrastructure:	Risk assessment	methodology	Standar	N	_	^				
	General	Refuelling protocols									
	- Metering	SoA Analysis Accuracy improvement Standardisation									
TF4	-Connectors	SoA Analysis	Wear/Fat	igue tests	Standar	disation					
	-Hydrogen quality	Risk assessment Hydrogen imp	t - out of spec	Standard	disation						
	-H2 quality assurance	Measurement	techniques	Standard							

Task Force 3: Gas system and usage (1)

Roadmap of near term priorities

10		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
	Gas system													
7	Equipment and devices:					and the second second								
	- Adaptation of gas analysis methods	SoA analysis	Testing-Esa	tustion 1	Standardisation	Cartification	>							
	New gas analysis devices for H2>5%		Ф /	Cent	ication	\$								
8	Gas analysis: sensors	Define required	nents	Tecting/Validation		Standardisatios/C	enification							
150/0	- Pressure regulators and valves			• SoA an	alysis Spor	trits / inve	stigation of materi	<u>n</u>)	Standarditation	\Rightarrow				
	- Seals and connections	SeA analysin	Testing of	f connections	Stand	lardisation)							
	- Excess flow valves	Clesed volume flo	nw testing	Standardisation/	Certification) '								
1	installations and other components:		-			٨		8						
2	 underground storage (Porous rocks) 	304-An #951	RAG	7: Werobiological I	ACU HELY	V Stands	V							
8	- Compressor stations			+ SoA at	natyan X R	valuation tests	Guidelines for a	perators)						
150/	- Pre-mixing stations	18	Ð	D PAR A	Adeling	Requirement	i mixing	Standerdisati	<u>~ </u>					
- 09	Grid Integrity: - Grid Corrosion H2<10%	Degradation eval		Effects an materia	as N	Standartituation	->							
TSO/0	- Grid Corrosion H2>10%	Materials map			Standardisatio	$ \rightarrow $	~							
- 050	Grid Operation: - Flow behaviour	Test available Sof		Software develo	pment	Software	wildefion	ē.						
150/1	Pipeline monitoring	SoA analysis	F Evaluate main	tenance procedure		P Recommendation	N N	Ś.						
	/ Odorisation	SeA analysis	Testing of	performance	Stand	larditation)							
50	- Permeation	·····		5 0A.o	nalysis V Invest	igation of materials V	Acceptable per	restion	Standardisatio	$ \rightarrow $				
DSO -	Separation			Bendy	nerking)	Field Texts	Requirements d	rintion	Standardiuatio					
120/					~~~	,	A STORE			- V.				

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European Commission

Task Force 3: Gas system and usage (2)

Roadmap of near term priorities

Γ.	n Hand and many	2016 2017	2018 2019	2020 2021	2022 2023	2024 202	5 2026	2027	2028
1	M2NG End-users								
1	CNG Vehicles: - On-board storage	SoA-Analysis Testing CNG ste	rel tanks V Standardisation	sation of ISO R 110					
DSD	- Combustion system		Effect on combustion	= >					
	- Refuelling station		Proof of performance	*					
2	Residential appliances				~				
090	- Certification of appliances - Adaptive combustion control - New gas categories	- Certification of appliances SaA.Asalysis Testing of performance Standardisation/Certification - Adaptive combustion control R&D: Healthe devices Standardisation Definition gas parameters Definition of EU-gas categories							
	- Gas pipework in buildings	Gas pipework in buildings SoA-Analysis Testing							
TSO/DSO	Gas turbines:	CS: Investigation of material Operating characteristics							
100	Industrial use: - H2 effect on industrial processes	OCESSES Mentify sensitive processes Develop mitigation methods Adaptation of infrastructure							
	- Burners	SoA-Analysis Testing of	performance	Certification	⇒				



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Task Force 4: Hydrogen system and usage

Roadmap of near term priorities



Task Force 5: Cross-cutting (1)

Gas Detection systems and metering

- Application specific standards (process sensors, leak detection,...)
- Metering for ranges of H2 concentrations and pressure (link to TF4?) Legal basis 2009/137/EC Measuring Instruments Directive

ATEX – determination of hazardous zones for H2NG

Hydrogen Compatibility of Materials

•List of materials compatible with H2NG systems (based on ISO/TR 15916)

Thorough review of the existing testing methods

Education, Training

•Training in safety aspects of hydrogen/H2NG



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Task Force 5: Cross-cutting (2)

Legal aspects (Workshop May 2016) Issues discussed

- Regulatory framework for energy storage (including appropriate standards)
- Industrial Emissions Directive should it be applied for the production of hydrogen by electrolysis?
- Are DSO/TSO allowed to produce gas in the current legislative framework? Currently hydrogen is not defined as gaseous fuel but as technical gas which curtails this option.
- The gas market needs further reforms, in particular for linking gas and power sectors.
- Clarification of unbundling rules, as to who can own and operate energy storage? Grid operators are only exceptionally allowed to store energy.



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SFEM/WG Hydrogen

Continuation with aim: to provide a platform with exchange and coordination tasks

- exchange and communicate on hydrogen energy related development,
- to coordinate the work between different TCs in this field and
- **comprehensive approach** combining research, prenormative research and standardisation.

Last meeting 20 April 2017 (Delft, NEN)





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Background CEN-CLC/TC 6



Rationale behind the establishment

There was no European TC on hydrogen covering the wide range of topics identified by the SFEM WG Hydrogen. standardisation is the most appropriate way to tackle many of the critical issues identified.

Topics already covered by the scope of an existing TC will not be elaborated in the new TC



CEN-CLC/TC 6 Hydrogen in energy systems



Scope

Standardization in the field of systems, devices and connections for the production, storage, transport and distribution, measurement and use of hydrogen **from renewable energy sources and other sources**, in the context of the European strategy for the development and acceptance of the hydrogen market.

The scope includes cross cutting items such as: terminology, Guarantee of Origin, interfaces, operational management, relevant hydrogen safety issues, training and education.



CEN-CLC/TC 6 Hydrogen in energy systems



Excluded are:

- Storage and transport of liquid hydrogen which is covered in the scope of CEN/TC 268.
- Storage and transport of compressed hydrogen which is covered in the scope of CEN/TC 23.
- Vehicle refuelling stations and associated equipment and procedures as related to the Standardization Request M/533.
- The injection of hydrogen and the mixture of hydrogen with natural gas (H2NG) in the gas infrastructure, which is covered in the scope of CEN/TC 234.
- The use of mixtures of natural gas with hydrogen (H2NG).



CEN-CLC/TC 6 Hydrogen in energy systems





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CEN-CLC/TC 6 Structure



NEW CEN-CLC/TC 6 "Hydrogen in energy systems"

Chair Dr Bernard Gindroz

Secretary: Françoise de Jong

Secretariat:

WG 1: Terms and definitions Convener: Dominka Klassek (Poland)

WG 2: Guarantee of Origin Convener: Guy de Reals / Jacques Dubost (France)

WG 3: Hydrogen safety Convener:

Secretariat: France

Secretariat:

Adhoc group 1: safety - use of hydrogen in the public domain Convener: Kristian Vik (Norway)

Secretariat: Norway

Adhoc group 2: interface electrolyser to the e-grid	
Convener:	Secretariat:



CEN-CLC/TC 6 meeting 19th of May



Decision

Ad Hoc Group 3 (with CEN/TC 234) Interface to the gas grid

Respecting the aiming of the H2/H2NG standardisation (and EC SR) to include all parts of the gas chain from production to end use:

- CEN/TC 234 proposal to extend the interface exchange to all interested related TCs and stakeholders
- Decides to initiate with CEN/TC 234 an appropriate and continuous exchange and co-ordination under the umbrella of the Sector Fora Energy Management, Gas Infrastructure and Gas Utilisation, unifying all relevant TCs and other stakeholders.
- An informal meeting will be organized by the secretariat CEN/TC 234



CEN/TC 234



Approach 2016 Hydrogen into natural gas (H2NG)

- Definition of the appropriate requirements for H2NG related to gas quality, consequences on gas infrastructure and applications within the scope of CEN/TC 234
- Analysis of SFEM H2NG findings in CEN/TC 234 WGs, starting with a common workshop
- Clarification of the WGs' task
- Creation of prWI 00234080 for CEN Technical Report 'Consequences of H2on the gas infrastructure'



CEN/TC 234 WS H2NG March 2017 Conclusions (1)



Conclusion 1: General support to start the standardisation process (1)

- Although H2NG is still at an early stage, the WS H2NG participants support the start of the standardisation process now
- The first set of deliverables shall:
 - respect especially the restrictions for sensible parts of the gas systems, but shall – at the same time –
 - give freedom to given abilities of regional and/or local systems, without effecting safety
 - In parallel to the standardisation process perspectives to accept higher H2 concentrations in NG have to be developed



CEN/TC 234 WS H2NG March 2017 Conclusions (2)



Conclusion 1: General support to start standardisation process (2)

- Outcome of the informal enquiry about national limits of H2NG and related legislation/technical rules/standards,
 - many countries seem not to have a legal and/or technical framework for H2NG yet
 - Those having a framework follow different approaches with definition of very diverging H2 concentration limits all over Europe (0.1 % up to 10 % with restrictions)



CEN/TC 234 WS H2NG March 2017 Conclusions (3)



Conclusion 1: General support to start standardisation process (3)

- Early standardisation on European level (on the basis of a EU Standardisation Request) can support countries in the definition of a national framework in line with a European approach and to learn from each other across Europe at an early stage.
- The findings on H2NG summarized in the SFEM report are considered as a valuable and good starting point for the standardisation of H2NG.



CEN/TC 234 WS H2NG March 2017 Conclusions (4)



Conclusion 2: Realization of scoping/standardisation work in CEN/TC 234

Conclusion 3: Interfaces



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CEN/TC 234 WS H2NG March 207 Conclusions (4)



Conclusion 4: EC Standardisation Request

- The participants of the CEN/TC 234 WS H2NG welcomes the EC's support to the standardisation process by allocating a Standardisation Request to CEN and CENELEC and is ready to contribute expertise in the drafting, where considered appropriate
- As for H2NG, clear definition of responsibilities and liabilities is significant, the participants see the need of clarification on policy level. Therefore, EC support for clarification will be appreciated



CEN/TC 234 plenary May 2017 Decisions (1)



Realization of scoping/standardisation work in CEN/TC 234

- Intents to extend the existing standards for hydrogen in gas infrastructure, where necessary
- The need of new standards, e.g for blending facilities, injection facilities and pressure control, have still to be identified
- allocate the scoping and the standardisation work to the existing CEN/TC 234 WGs as they dispose of the necessary expertise/experts
- CEN/TC 234 WGs are requested to examine concentrations and determine the standardisation aspects from 0% to 100% H2 concentration in the existing gas infrastructure, extending the table

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CEN/TC 234 plenary May 2017 Decisions (2)



(SFEM WG H2 TF 3) and using available SFEM WG H2 TF 3 findings.

Summary of identified actions H ₂ in the gas grid								
2 vol% H2	5 vol% H2	10 vol% H2						
Gas turbines (e.g. performance/durability/legal iss.)	Same as for 2 vol% H2 plus:	Same as for 2 and 5vol% H2 plus:						
Underground storages (porous) (e.g. bacteria growth)	CNG on board tanks Fatigue induced failure /vehicle regulation and standardisation	Compressors (e.g. performance)						
Gas as feedstock (e.g. effect on processes regarding performance, efficiency)		Underground storages (caverns) Installations and bacteria growth in underground cavern storages						
		Safety and grid integrity						
		Industrial/residential burners and engines (e.g. performance)						



CEN/TC 234 plenary May 2017 Decisions (3)



- Results of the WGs will be compiled in preliminary TR 'Consequences of hydrogen in the natural gas infrastructure' within 12 to 18 month
 - Aim: reliable basis for the related CEN/TC 234 work planning and give reasons for pre-normative research
- Ensure coherent approach and procedures and support the identification of the adaptation need of the existing and new standards to enable H2 concentrations
- H2 concentrations; CEN/TC 234 Convenors/Secretaries (CAG 1) are requested to agree on the H2 concentration steps, to give guideline to the WGs (using the findings SFEM WG H2 TF 3, where useful)



CEN/TC 234 plenary May 2017 Decisions (4)



Interface with CEN-CLC/TC 6 request

To enable H2NG standardisation approach (and EC Standardisation Request on hydrogen) shall include all parts of the gas chain from production to end use.

Recommendations:

- involve all relevant CEN/CENELEC groups in the interface exchange e.g. in form of a co-ordination group.
- Active liaison work between the acting TCs is needed.
- Direct exchange between the relevant experts groups e.g. Underground gas storage (EN 1918 series) for H2 storage > liaison CEN -CLC/TC 6 and CEN/TC 234 WG 4
- Sectorial approach



Annual Union work programme for European Standardisation for 2017 (1)



Strategic priority of the EC:

Resilient Energy Union with a Forward-Looking Climate Change Policy

- aims at combining the infrastructures
- diversifying the energy resources
- reducing energy consumption and
- promoting climate-friendly technologies the following was indicated:
 - assuring interoperability between grids for increase of renewable energies in the power mix, in order to enhance the capacity of the existing infrastructures to absorb green energy resources while not increasing the cost for users.



Annual Union work programme for European Standardisation for 2017 (2)



5	COM(2011)885 on Energy Roadmap 2050 COM(2013) 169 on A 2030 framework for climate and energy policies. DIRECTIVE 2009/73/EC concerning common reles for the internal market in natural gas DIRECTIVE 2009/142/EC relating to appliances burning gaseous fuels Regulation (EC) No 71V/2009 on conditions for access to natural gas transmission networks Commission Implementing Decision EU 2015/1960 on the establishment of the annual priority lists for 2016 for the development of network codes and guidelines	Increase of renewable energies in the power mix contributes to energy security and reduction of greenhouse gas emissions. Injection of renewable electrolytic hydrogen into the NG grid allows to exploit the huge storage capacity of the NG grid and to link the gas and power grids, enhancing energy security, and to decarbonise thi transport, heat and industrial sectors. To enable this, new and/or updated European standards on interoperability between grids, on safe admixture of hydrogen to the NG grid, on gas quality and on compatibility with end-use appliances are needed. standardisation aspects of electrolysers for grid balancing standardisation aspects of hydrogen admixture to natural gas grid: safety, gas quality, standardisation aspects related to gas-fuelled appliances	Development o standards	f	3. A Resilient Energy Union with with a forward- looking climate change policy	Q1 2017	End of 2020



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Annual Union work programme for European Standardisation for 2017 (3)





Renewable hydrogen value chain

Not included in the scope of the SR: 9, 10, 11, 13, 16



Progress in the development of the Standardization request

- Initial informal meeting with DG ENER on 2017-01-23
- Call for Standardization Request Ad-hoc group (SRAHG) Hydrogen members
 - Role SRAHG: Coordination of CEN-CLC (and partners/liaisons) inputs to EC during the drafting and approval of SRs
- Second informal meeting with DG ENER on 2017-04-20
- Ad-hoc group meeting 19th of June to discuss and agree on:
 - Topics and content of Standardization Request from CEN-CENELEC perspective
 - Priorities and timeframe





THANK YOU

ANY QUESTIONS?

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