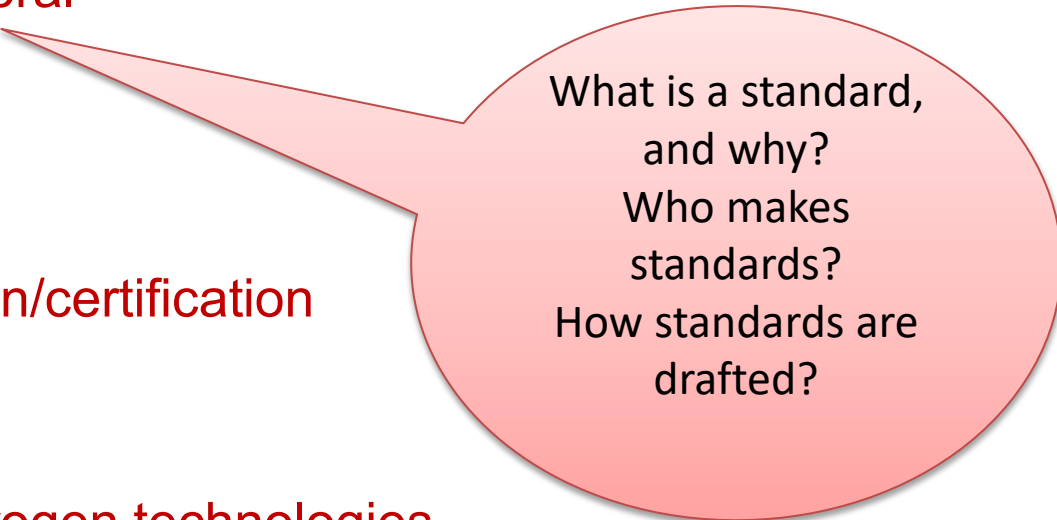


Standardization & Material challenges in hydrogen transportation & storage

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- Standardization in general
- Standards vs. regulation/certification
 - EU regulation
- Standardization in hydrogen technologies
 - CEN-CLC/JTC 6 Hydrogen in energy systems
 - ISO/TC 197 Hydrogen technologies



What is a standard,
and why?
Who makes
standards?
How standards are
drafted?

What is a standard?

“The standard is a uniform solution intended for a recurring case.”

*“A standard is a solid basis for achieving **compliance, safety, development and efficiency.**”*

A document, that is available for everyone

Standards are not free of charge: financing the operation

Approved by authority, a standardization organization or other recognized body

In principal, voluntary to use

Why use standards and participate in standardization

- The use of standards increases work productivity (Nordic research)
 - The most important reason for companies to use standards is **to improve market access, improve product/service quality** as well as **reduce risk**
 - On average, standardization is linked to an annual increase in labor productivity by 0.7 percent
- The European Commission recognizes standardization as **a key instrument for promoting innovation**
 - Standardization not only facilitates innovation but also serves as a crucial element in market placement strategies.
 - Standardization is also a tool for disseminating innovation, helping to guide the market by sharing knowledge and creating confidence in new solutions.

→ **Strategic standardization**

Standardization organizations

	Electrotechnical industry	Other industries	Telecommunications industry
Global level 	IEC International Electrotechnical Commission	ISO International Organization for Standardization	ITU International Telecommunication Union
European level 	CENELEC European Committee for Electrotechnical Standardization	CEN European Committee for Standardization	ETSI European Telecommunications Standards Institute
National level 	SESKO Electrotechnical Industry	SFS Finnish Standards Association SFS with its standards writing bodies	Traficom Finnish Transport and Communications Agency

© SFS

- Decentralized standardization
- SFS (CEN ja ISO) ja SESKO (CENELEC ja IEC) are acting central organizations i.e. National Standards Bodies (NSBs) – coordination, international memberships
- Standardization work is carried out in standardization groups comprising of SFS and various organizations representing their respective industries, i.e. standards writing bodies.
- SFS sells standards

Standards writing bodies in Finland

Private:

- Kemesta ry
- Metalliteollisuuden Standardisointiyhdistys ry
METSTA
- Muoviteollisuus ry FIPIF
- Rakennustuoteteollisuus ry
RTT ry
- SESKO ry
- Palvelualojen työnantajat
PALTA ry

Governmental:

- Finnish Environment Institute
- Finnish Transport Infrastructure Agency
- Finnish Transport and Communications Agency Traficom



KEMESTA 

SESKO

METSTA

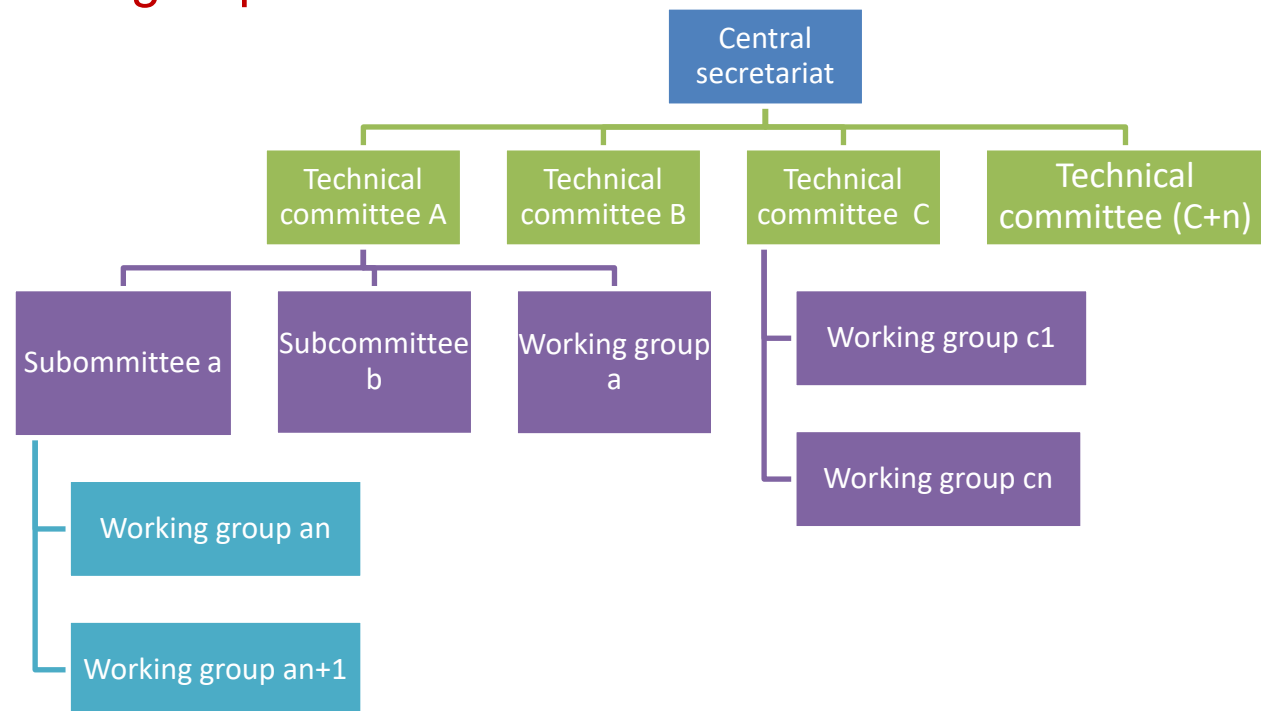


MUOVITEOLLISUUS RY
Finnish Plastics Industries Federation

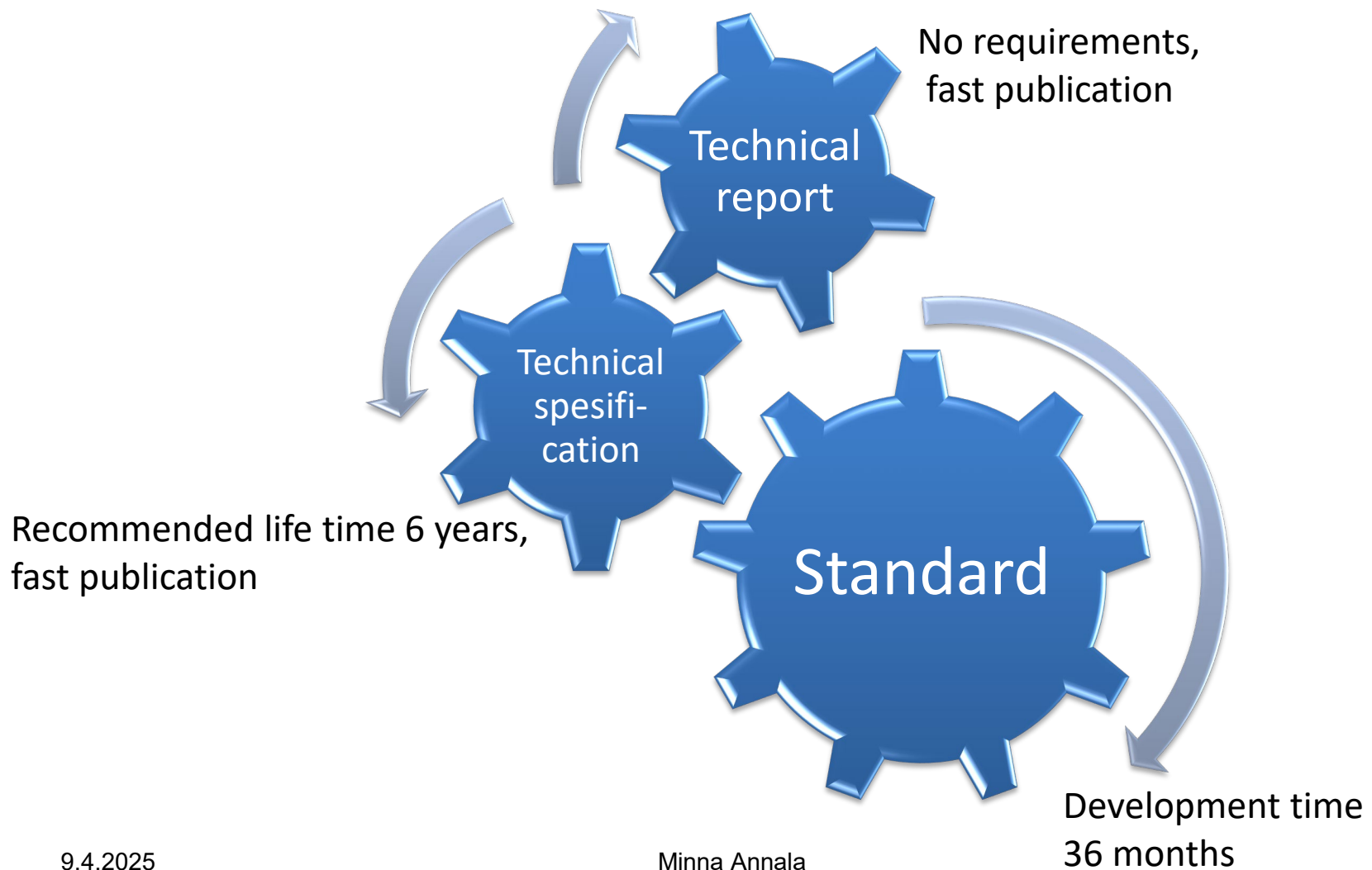
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Drafting of standards

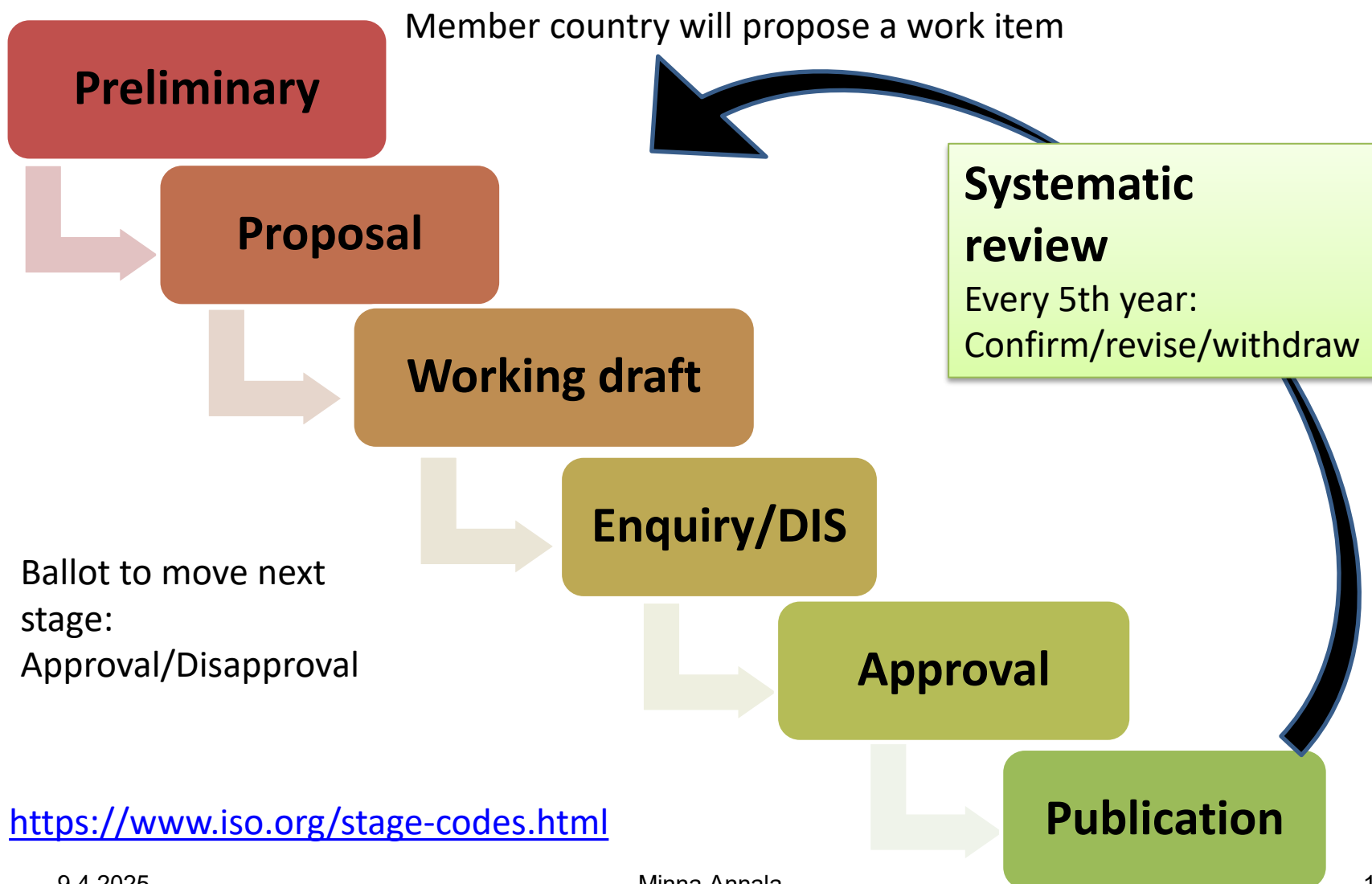
- The standards are drafted in technical committees and **working groups**
- All member countries are entitled to participate and nominate experts to European and international working groups. Experts are nominated by a national mirror group



Different deliverables



Development process and life cycle of standards



- **Standards are tools for certification**
 - Products or services have certified if they fulfill the requirements specified in the standards
- **What is accreditation?**
 - Accreditation is the verification of competence. It is a procedure that reliably states the competence of an operator according to international criteria. Customers, authorities and operators in the industry can rely on the service quality of an accredited operator and on the reliability of the results it produces. FINAS

EU and standardization

- The European Union uses standards to support regulation
 - In the EU, technical directives focus on essential requirements
 - The requirements in regulation are interpreted through the voluntary standards created to support them
 - A product that complies with standards is often automatically compliant with regulatory requirements
 - The standards needed by the EU are developed by CEN/CENELEC based on standardization request from EU
 - [Annual Union Work Programme 2025 for Standardization \(AUWP\)](#)
- A standard consistent with the directive/regulation, i.e. **a harmonized standard (hEN)**



- The CE marking indicates that the manufacturer or authorised representative of the product guarantees that the product conforms to the essential requirements set out in the applicable EU directives and regulations (toys, machinery, personal protective equipment etc.)
- Products equipped with a CE marking can move freely within the entire EU
- Certain products are assessed by a notified body before the CE marking is affixed to the product
- **PED directive 2014/68/EU**
 - harmonization of the laws of the Member States relating to the making available on the market of pressure equipment

EU and hydrogen standardization

EU regulations and hydrogen



Hydrogen classification in EU

	Hydrogen Classification					
	Low-Carbon Hydrogen			Renewable Hydrogen	Biomass Hydrogen (biogas)	Recycled Carbon Fuels (RCF)
	Gas Package	Taxonomy	ETD	RED	RED	RED / Gas Package
Scope	Fossil-origin H2 with reduced GHG footprint (through CC(U)S or nuclear)	Fossil & renewable origin H2 fulfilling the threshold and the DNSH criteria	Fossil & renewable origin H2 fulfilling the threshold and the DNSH criteria	RFNBOs: Hydrogen (and its derivatives) produced with additional renewable electricity	Hydrogen from biomass (e.g. through pyrolysis)	waste processing gas and exhaust gas of non-renewable origin which are produced as an unavoidable and unintentional consequence of the production process
GHG Reduction Target	-70%	-73.4% / 3tCO2eq/tH2	-73.4% / 3tCO2eq/tH2	-70%	-65% to -80% depending on use and feedstock	-70% / Comparator: 94gCO2/MJ
Methodology	LCA, RED Art. 30, verified by MS. By 31.12.2024, a DA is to establish a common methodology that avoids double counting of emissions savings	LCA (following RED II, Art. 28.5, Art. 30) OR ISO 14067:2018119 /ISO 14064-1:20181	LC-H2 to 'meet the technical screening criteria for [...] contributing substantially to climate change mitigation' (taxonomy)	RED II Recital 90/ Art. 27 applies (additionality) – DA to define specific methodology (Q4 2021). COM may also adopt DA Art. 29a 'for assessing [GHG] emissions savings'	Specific classification dependent on feedstock type (Annex IX); LCA assessment based on RED II Art. 30 (also annex V & VI)	RED II: Common methodology to be defined in a DA (Q1 2021); RED III: COM 'may adopt a delegated act' (Art. 29a) Gas Package: DA for low-carbon fuels (including RCFs) by Q4 2024
Regulatory Implications	Tariff Discounts	Can be labelled taxonomy compliant	Equivalent tax-rate of RFNBOs until 2033	May be counted towards RES target; low tax rate, tariff discounts	May be counted towards RES target (depending on feedstock, caps may apply), lower tax rate, Tariff Discounts	May be counted towards RES-T target, Equivalent tax-rate of RFNBOs until 2033, tariff discounts



- The actions on the green transition aim to support the following
 - Hydrogen technologies, components, and the transport and storage of hydrogen (Actions 20-21)

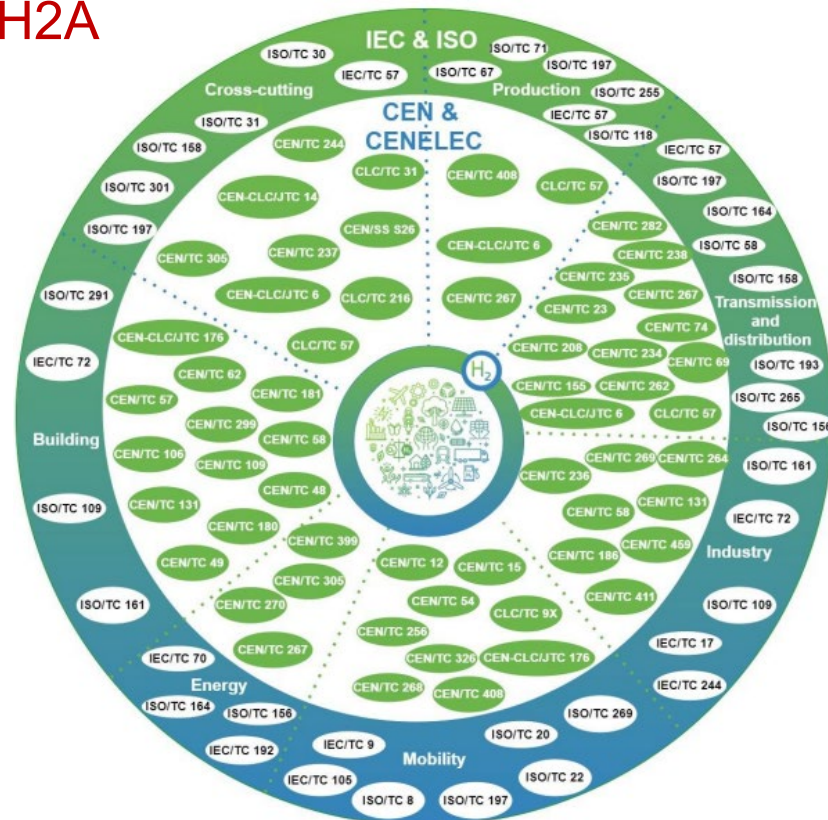
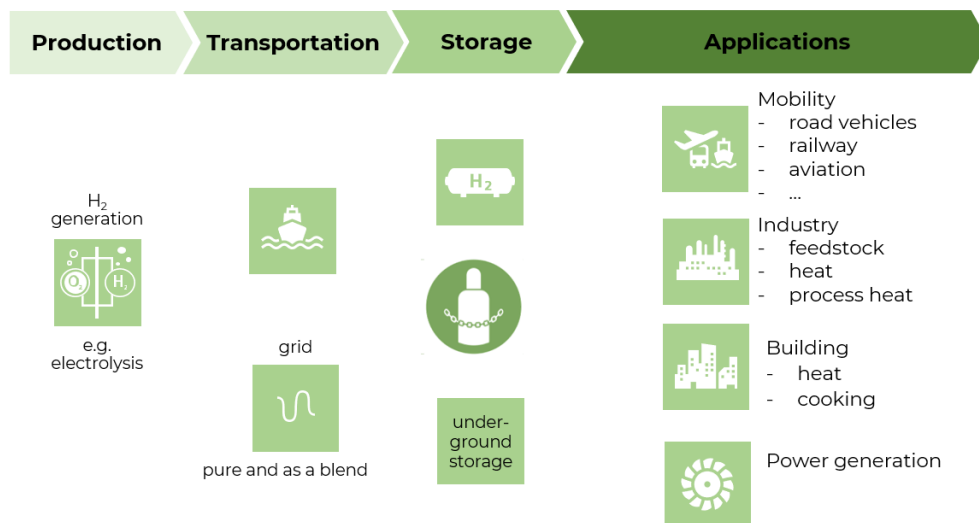
Ref.	Title	Reference	European standards / European standardisation deliverables	Specific objectives and policies for European standards / European standardisation deliverables
20	Hydrogen technologies and components	Proposal for a Regulation of the European Parliament and of the Council on the internal markets for renewable and natural gases and for hydrogen – COM/2021/804 final Directive (EU) 2023/2413 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652	Develop European standards on quality, technology and safety for the production and use of hydrogen.	This action aims to improve the development and maintenance of hydrogen infrastructure and technological components in the single market.
21	Transport and storage of hydrogen	Regulation (EU) 2022/869 on guidelines for trans-European energy infrastructure Directive (EU) 2024/1788 on common rules for the internal markets for renewable gas, natural gas and hydrogen	Revise existing standards and develop new European standards for hydrogen quality and safety, relevant for injection into the dedicated hydrogen network, and end uses, including hydrogen-based fuels.	Enabling and promoting the scaling up of transport and storage methods for hydrogen will facilitate the replacement of fossil fuels and feedstocks in hard-to-decarbonise sectors.

- **EU Commissio**
 - DG ENER - The European Hydrogen Strategy
 - Drafting standardization request 'Hydrogen'
 - Hydrogen in dedicated network (pipeline) incl. hydrogen quality, purity >98%
 - DG GROW
 - Ongoing work based on standardization request 'Alternative fuels infrastructure'
 - EU funding for standardization
 - EISMEA H2Qual Net – Hydrogen quality in dedicated gaseous grids
 - placed by EC DG Energy, contracted between EISMEA/EC and CEN; carried out by DIN and DS (2025)
- **European Clean hydrogen alliance ECH2A**
 - [ECH2A Roadmap on hydrogen standardisation](#) 2023-03-01
 - Commision's tool to draft hydrogen standardization request
- **CEN-CLC/Coordinatio group on 'Hydrogen'**
 - CEN-CLC/COG Gas Utilization
- **CEN-CLC/JTC 6 Hydrogen in energy systems**
 - CEN/TC 234 Gas infrastructure

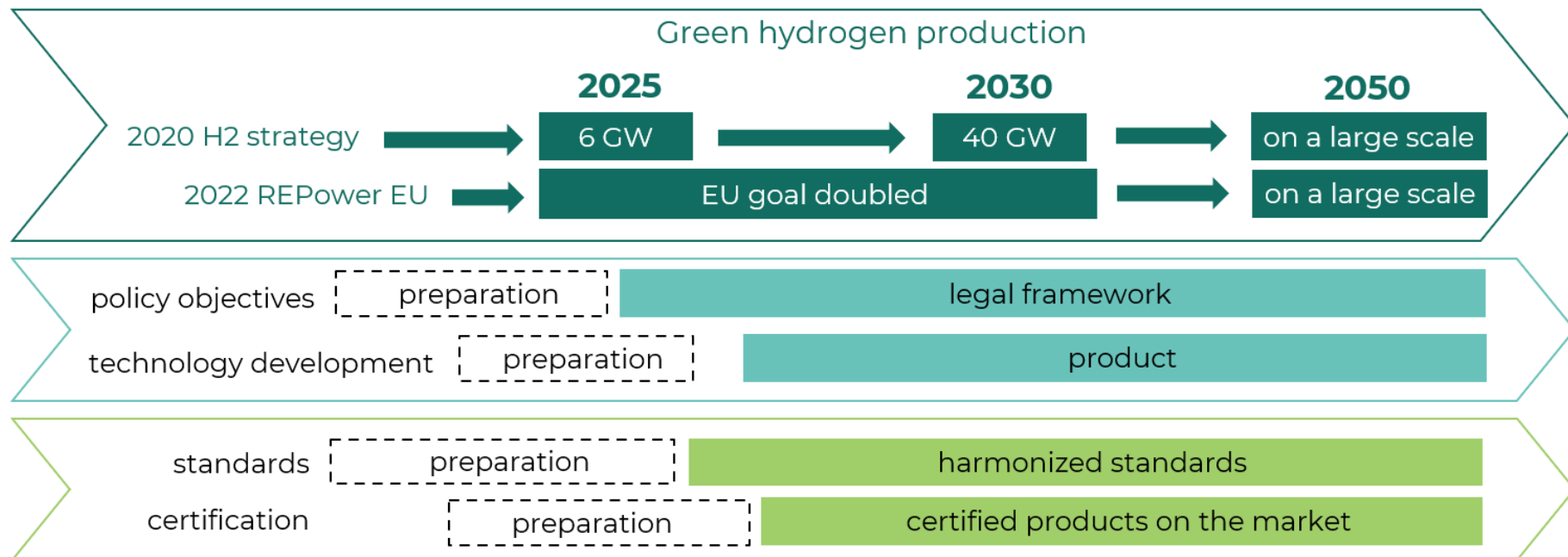
European Clean hydrogen alliance/ECH2A

- European Clean hydrogen alliance/ECH2A
 - [Roadmap on Hydrogen standardisation](#)

Hydrogen value chain



ECH2A roadmap: Policy framework



CEN-CLC/Coordination group 'Hydrogen'

-

- Over 50 technical committees listed in group's term of reference
 - CEN/CLC/JTC 6 "Hydrogen in energy systems"
 - CEN/CLC/JTC 10 "Material efficiency aspects for products in scope of Ecodesign legislation"
 - CEN/CLC/JTC 14 "Energy management and energy efficiency in the framework of energy transition"
 - CEN/CLC/JTC 17 "Gas Appliances with Combined Heat and Power"
 - CEN/TC 12 "Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries"
 - CEN/TC 15 "Inland navigation vessels"
 - CEN/TC 23 "Transportable gas cylinders"
 - CEN/TC 48 "Domestic gas-fired water heaters"
 - CEN/TC 49 "Gas cooking appliances"
 - CEN/TC 54 "Unfired pressure vessels"
 - CEN/TC 58 "Safety and control devices for burners and appliances burning gaseous or liquid fuels"

- CEN/TC 62 “Independent gas-fired space heaters”
- CEN/TC 69 “Industrial valves”
- CEN/TC 74 “Flanges and their joints”
- CEN/TC 106 “Large kitchen appliances using gaseous fuels”
- CEN/TC 109 “Central heating boilers using gaseous fuels”
- CEN/TC 121 “Welding and allied processes”
- CEN/TC 131 “Gas burners using fans”
- CEN/TC 144 “Tractors and machinery for agriculture and forestry”
- CEN/TC 151 “Construction equipment and building material machines – Safety”
- CEN/TC 155 “Plastics piping systems and ducting systems”
- CEN/TC 180 “Decentralized gas heating”
- CEN/TC 196 “Mining machinery and equipment – Safety”
- CEN/TC 208 “Elastomeric seals for joints in pipework and pipelines”
- CEN/TC 232 “Compressors, vacuum pumps and their systems”
- CEN/TC 234 “Gas infrastructure”
- CEN/TC 235 “Gas pressure regulators and associated safety devices for use in gas transmission and distribution”

- CEN/TC 236 “Non-industrial manually operated shut-off valves for gas and particular combinations valves-other products”
- CEN/TC 237 “Gas meters”
- CEN/TC 238 “Test gases, test pressures, appliance categories and gas appliance types”
- CEN/TC 244 “Measurement of fluid flow in closed conduits”
- CEN/TC 256 “Railway applications”
- CEN/TC 262 “Metallic and other inorganic coatings, including for corrosion protection and corrosion testing of metals and alloys”
- CEN/TC 264 “Air quality”
- CEN/TC 267 “Industrial piping and pipelines”
- CEN/TC 268 “Cryogenic vessels and specific hydrogen technologies applications”
- CEN/TC 269 “Shell and water tube boilers”
- CEN/TC 270 “Internal combustion engines”
- CEN/TC 274 “Aircraft ground support equipment”
- CEN/TC 282 “Installation and equipment for LNG”
- CEN/TC 286 “Liquefied petroleum gas equipment and accessories”
- CEN/TC 299 “Gas-fired sorption appliances, indirect fired sorption appliances, gas-fired endothermic engine heat pumps and domestic gas-fired washing and drying appliances”

- CEN/TC 301 “Road vehicles”
- CEN/TC 305 “Potentially explosive atmospheres - Explosion prevention and protection”
- CEN/TC 326 “Natural gas vehicles - Fuelling and operation”
- CEN/TC 337 “Road operation equipment and products”
- CEN/TC 342 “Metal hoses, hose assemblies, bellows and expansion joints”
- CEN/TC 393 “Equipment for storage tanks and for filling stations”
- CEN/TC 399 “Gas Turbines applications – Safety”
- CEN/TC 408 “Natural gas and biomethane for use in transport and biomethane for injection in the natural gas grid”
- CEN/TC 459 “ECISS - European Committee for Iron and Steel Standardization”
- CLC/TC 9X “Electrical and electronic applications for railways”
- CLC/TC 21X “Secondary cells and batteries”
- CLC/TC 31 “Electrical apparatus for potentially explosive atmospheres”
- CLC/TC 57 “Power systems management and associated information exchange”
- CLC/TC 216 “Gas detectors”

- Organization of the work – Cluster participation
 - Gap analysis, recommendations
 - No standard drafting

Hydrogen production	Hydrogen network	Industrial application	Transport and mobility	Energy sector integration	Building – Residential applications
CEN-CLC/JTC 6 CEN/TC 54, 69, 74, 197, 267, 408	CEN-CLC JTC 6 CEN/TC 12, 23, 57, 69, 74, 131, 155, 197, 208, 234, 235, 237, 267, 268, 282, 342, 393 CLC/TC 57	CEN/TC 54, 57, 58, 69, 131, 186, 196, 197, 234, 236, 264, 267, 269, 459	CEN/TC 12, 15, 23, 218, 256, 268, 274, 326, 301, 337, 408 CLC/TC 9X ERA	CEN/CLC/JTC 17 CEN/TC 69, 74, 197, 267, 270, 305, 399 CLC/TC 8x, 57	CEN-CLC/JTC 17 CEN/TC 48, 49, 57, 58, 62, 106, 109, 131, 151, 180, 238, 299
				TCs currently without cluster participation: CEN/TC 72, 121, 144, 232, 262, 286 CEN/CLC/JTC 10, 14 CLC/TC 21X, 31, 216	

Hydrogen standardization

National standardization group
Kemesta/SR 017 Vety ja kaasujen analytiikka

CEN/CLC/JTC 6

Hydrogen in energy systems

Hydrogen in CEN

- CEN/CLC/JTC 6 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.

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 refueling 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).

- **WG 1 Terms and Definitions**

- Work item: FprEN ISO 24078 'Hydrogen in energy systems – vocabulary' (yhteistyössä ISO/TC 197 kanssa) → formal vote started
 - Discussed terms such as 'gas network', 'hydrogen admixture', 'de-blending', 'metrology', '(energy) value chain', 'quality of energy carriers', 'safety'

- **WG 2 Guarantees of Origin**

- Follow work item of JTC 14: EN 16325:2025 Guarantees of Origin related to energy - Guarantees of Origin for Electricity, gaseous hydrocarbons, Hydrogen, and heating & cooling (publication 2025-05-21)

- **WG 3 Hydrogen safety**

- **Adapted new work item prEN ISO 19870-1 *Hydrogen Technologies – Methodology for Determining the Greenhouse Gas Emissions Associated with the Production of Hydrogen up to Production Gate***

- **Official work items**

- Safe use of hydrogen in built constructions
- Hydrogen Gas Safety in Enclosed Spaces

- Focus on basics of hydrogen safety

- Reference established documents on related topics e.g. process safety, fire safety, explosion prevention and protection, zoning to Hazardous Area Classification
- Differentiation in doc. between confined spaces / unconfined spaces, also related to:
 - Ventilation
 - Gas detection / zoning
- material compatibility and LH2 safety
- delayed ignition

- Relevant standards:

- ANSI/AIAA G-095A-2017 Guide to Safety of Hydrogen and Hydrogen Systems
- NFPA 2 incl. section on confined spaces (Hydrogen Technologies Code)
- IEC EN 60079-10-1 Explosive atmospheres - Part 10-1: Classification of areas - Explosive gas atmospheres
- EN 1127-1 Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology

- **Recommended to adapt ISO/TS 15916 *Hydrogen technologies — Basic considerations for the safety of hydrogen systems***

ISO/TC 197 Hydrogen technologies

Hydrogen in ISO

- [ISO/TC 197 Hydrogen technologies](#)
Standardization in the field of systems and devices for the production, storage, transport, measurement and use of hydrogen.
 - Established 1990
 - 23 working groups
- 22 published standards
- 34 work items under drafting
- Members
 - 41 participating members (incl Finland)
 - 16 observing members
- Subcommittee [SC 1 Hydrogen at scale and horizontal energy systems](#)
Standardization of large scale hydrogen energy systems and applications including aspects of testing, certification, sustainability and placement, and coordination with other relevant standardization bodies and stakeholders.
 - Established 2022

- Themes of working groups under TC
 - Components and Vehicular Applications
 - WG 1, WG 5, WG 18, WG 19, WG 22, WG 23, JWG 30, WG 31, WG 36, WG 39
 - Built Environment and Safety
 - WG 24, WG 29, WG 35, WG 37, WG 38
 - Production, Storage and Handling
 - WG 15, WG 21, WG 34
 - Stationary and Fuel Cell Applications
 - WG 27, WG 28, WG 32, WG 33

- **Kemesta/SR 017 follows**
 - WG 1 Liquid hydrogen - Land vehicles fuel tanks
 - WG 24 Gaseous hydrogen – Fuelling protocols for hydrogen-fuelled vehicles
 - WG 27 Hydrogen fuel quality
 - WG 28 Hydrogen quality control
 - WG 29 Basic consideration for the safety of hydrogen systems
 - JWG 30 (Joint ISO/TC 197 - ISO/TC 22 Road vehicles/SC 41 Specific aspects for gaseous fuels) Gaseous hydrogen land vehicle fuel system components
 - WG 32 Hydrogen generators using water electrolysis
 - WG 33 Sampling for fuel quality analysis
 - WG 34 Hydrogen generators using water electrolysis test protocols and safety requirements
 - WG 35 Liquid Hydrogen Land Vehicle Fueling Protocol

- WG 36 Gaseous hydrogen land vehicle refuelling connection devices - Part 3: Cryo-compressed hydrogen gas
- WG 37 Gaseous hydrogen - Fuelling stations - Mobile fuelling stations
- WG 38 Gaseous hydrogen - Fuelling protocols for hydrogen fuelled vehicles: communications between the vehicle and dispenser control systems
- WG 39 Hydrogen technologies - Interoperability - Interface between gaseous hydrogen trailer and hydrogen fuelling station
- WG 40 Revision of ISO 16110-2 Hydrogen generators using fuel processing technologies - Part 2: Test methods for performance

- **Not followed in Kemesta/SR 017**
 - WG 5 Gaseous hydrogen land vehicle refuelling connection devices
 - WG 15 Cylinders and tubes for stationary storage
 - WG 18 Gaseous hydrogen land vehicle fuel tanks and TPRDs
 - WG 19 Gaseous hydrogen fueling station dispensers
 - WG 21 Gaseous hydrogen fueling station compressors
 - WG 22 Gaseous hydrogen fueling station hoses
 - WG 23 Gaseous hydrogen fueling station fittings
 - WG 31 O-rings

- **WG 1 Liquid hydrogen - Land vehicles fuel tanks**
 - Revising standard ISO/CD 13985 Liquid hydrogen – Land vehicle fuel storage systems
 - WG Consultation on Garage Parking Scenario and ventilation values reasonable to assume
- sub-group on requirements for boil-off converters
 - System Function: reduction or removal of H₂ in acceptable level to atmosphere

- **WG 24 Gaseous hydrogen – Fuelling protocols for hydrogen-fuelled vehicles**
 - ISO/AWI 19885-3 *Gaseous hydrogen — Fuelling protocols for hydrogen-fuelled vehicles – Part 3: High Flow Hydrogen Fuelling Protocols for Heavy Duty Road Vehicles*
- WG 24 formed several TFs to focus discussions on key topics
 - TF6: Chapter 6 - General Vehicle Requirements (led by Steve Mathison)
 - TF7: Chapter 7 - General Dispenser Requirements (led by Karin Garandza)
 - TF8: Chapter 8 - General Process Requirements (led by Timo Mutka)
 - TF9: Chapter 9 - Communications Requirements (led by Duncan Smith)
 - TF11: Chapter 11 – Validation of the fueling protocol in the dispenser control systems (led by Erik Klett)
 - TF TEMP – Temperature stratification and how to address it in the fueling protocols (led by Matthias Kuntz)

- **WG 29 Basic considerations for the safety of hydrogen systems**

- Revise technical report to specification ISO/AWI TS 15916 Basic considerations for the safety of hydrogen systems

- a fuel → an energy carrier

- WG continued to review the comments from NP balloting

- 3.18

- confined space**

- area with limited access, as described in national regulations, which requires special considerations for entry

- [SOURCE: ISO 16972:2020, 3.58.]

- 3.3X

- enclosed space**

- space in which, by virtue of its enclosed, or partially enclosed nature, there arises a reasonably foreseeable risk associated with the release of flammable fluid, not expected to be present for a release into an open, naturally ventilated, space

- Note 1 to entry: See confined space for the foreseeable risk to personnel in enclosed, or partially enclosed space

- **WG 35 Liquid Hydrogen Land Vehicle Fueling Protocol**
 - ISO/DIS 13984 Liquid Hydrogen Land Vehicle Fueling Protocol
- **WG 37 Gaseous hydrogen - Fuelling stations - Mobile fueling stations**
 - ISO/AWI TS 19880-10 *Gaseous hydrogen — Fuelling stations — Part 10: Mobile fueling stations*
- **WG 38 Gaseous hydrogen - Fuelling protocols for hydrogen fuelled vehicles: communications between the vehicle and dispenser control systems**
 - ISO/AWI 19885-2 *Gaseous hydrogen — Fuelling protocols for hydrogen-fuelled vehicles — Part 2: Definition of communications between the vehicle and dispenser control systems*
 - Drafting in task forces
 - TF1: Joint TF between WG24/WG38 for communication protocol development of fueling protocols
 - TF2: Communication technology selection criteria
 - TF3: Cybersecurity requirements

- WG 34 Hydrogen generators using water electrolysis test protocols and safety requirements
 - ISO/FDIS 22734-1 *Hydrogen generators using water electrolysis — Part 1: Safety*

- **WG 27 Hydrogen fuel quality**

- Revised standard ISO 14687:2025 *Hydrogen fuel quality — Product specification*
 - Biggest changes: Remove ICE application for transportation from Grade A, Create a new Grade F for ICE for vehicles and other applications

- **WG 28 Hydrogen quality control**

- Revised standard ISO 19880-8:2024 *Gaseous hydrogen — Fuelling stations — Part 8: Fuel quality control*
 - Includes risk analysis

- **WG 33 Sampling for fuel quality analysis**

- Revised standard ISO 19880-9:2024 *Gaseous hydrogen — Fuelling stations — Part 9: Sampling for fuel quality analysis*

- Presented topics

- Hydrogen Economy in Korea and Strategies for Building Hydrogen Supply Chain (H2Korea)
- Safety management in the hydrogen supply chain (KGS)
- Development of the Liquid Hydrogen Supply Chain in Japan (R. Chishiro, KHI)
- Overview and Prospects for the Development of Hydrogen Supply Chain in Japan
- China's plan to build a hydrogen supply chain (Prof. Zheng & Dr. Yang)
- Role of ISO/TS 19870:2023 and 19870-1 standard to support global hydrogen product certification system (G. de Reals & A Tchouvelev)
- Updates on Hydrogen and Fuel Cell Activities in France

- **Presented new proposals**

- Progress update on Hydrogen Generator Using Metal Oxidation (PWI) by Korea and United States
- New PWI proposal on Water electrolysis technology Performance test by Korea
- New PWI proposal for Hydrogen tube trailer hose Performance test by Korea
- Liquid Hydrogen Pump for Hydrogen Fueling Stations by China

Subcommittee SC 1 Hydrogen at scale and horizontal energy systems

Under ISO/TC 197

ISO/TC 197/SC 1 Hydrogen at scale and horizontal energy systems

- **Groups in SC 1**

- AHG 2 H₂ and high H₂ content blends pipelines
- AHG 3 H₂ Shipping Interoperability & Sustainability
- JWG 3 Joint ISO/TC 197/SC 1 - IEC/TC 9 WG: Fuel system components for hydrogen fuelled rail vehicles

- WG 2 Aerial vehicle liquid hydrogen fuel storage system
- WG 4 Water electrolyzers in electricity grid services

- WG 1 Methodology for Determining the Greenhouse Gas Emissions Associated with the Production, Conditioning and Transport of Hydrogen to Consumption Gate
- WG 5 Methodology for Determining the Greenhouse Gas Emissions Associated with the Conditioning and Transport of Liquid Hydrogen up to Consumption Gate
- WG 6 Methodology for Determining the Greenhouse Gas Emissions Associated with the Conversion and Transport of Ammonia up to Consumption Gate
- WG 7 Methodology for Determining the Greenhouse Gas Emissions Associated with the Conversion and Transport of Liquid Organic Hydrogen Carrier up to Consumption Gate

- **AHG 2 H2 and high H2 content blends pipelines**
 - Discussion topic 1: questionnaire about what is the threshold value of high content H2, 2.5%? 5%? 10%? or higher
 - Presentation- Operation and Maintenance Daowu Zhou
 - Presentation- Analysis of the Development of Standards for Hydrogen Transmission Pipeline Design and Construction Zhi Wang
 - Presentation- Material Evaluation and Selection for Hydrogen Pipeline Tianlei LI
 - Presentation- Permeability Measurement of Plastic Materials by High-pressure Hydrogen Shin NISHIMURA
 - Presentation- US Gas Transmission Pipeline Practice Hydrogen Gas and Natural Gas BEN LUN
 - Presentation- Developing Standard of Hydrogen Pipeline JINYANG ZHENG

- Work items in WG1, WG5 – WG7: standard serie ISO 19870
- ISO/xx 19870-n Hydrogen technologies — Methodology for determining the greenhouse gas emissions
 - Part 1: Emissions associated with the production of hydrogen up to production gate
 - Part 2: Emissions associated with the conditioning and transport of liquid hydrogen up to consumption gate
 - Part 3: Emissions associated with the bi-directional conversion of hydrogen to ammonia and back, and transport of ammonia and hydrogen up to consumption gate
 - Part 4: Emissions associated with the bi-directional conditioning of hydrogen into LOHC and back, and transport of LOHC and hydrogen up to consumption gate

- **WG 4 Water electrolyzers in electricity grid services**
 - ISO/AWI TS 22734-2 Hydrogen generators using water electrolysis — Part 2: Testing guidance for performing electricity grid service

ISO/TC 158 Analysis of gases

Including Kemesta/SR 017

- Decision to revise **ISO 21087:2019 *Gas analysis — Analytical methods for hydrogen fuel — Proton exchange membrane (PEM) fuel cell applications for road vehicles***
- Reactivation joint working group JWG 7: Joint ISO/TC 158 - ISO/TC 197 WG: Hydrogen fuel analytical methods

Hydrgogen in other technical committees in ISO

ISO/TC 67 Oil and gas industries including lower carbon energy

• AHG 3: Hydrogen and ammonia opportunities and standardization needs within the O&G industry

	Alignment within ISO/TC67	Alignment with other ISO/IEC committees	Alignment with other owners and developers of standards and guidelines (Regional, national, industry specific)
Production of H ₂ /NH ₃	SC6/WG1 : Safety standards	TC197 : Electrolysers (WG34), H ₂ from fuels, PSA systems safety	EIGA (European Industrial Gases Association)
Transport	SC2 : Pipelines/steel, including proposed WG30 on Hydrogen Pipelines	TC8/SC25 : Maritime GHG reduction TC197/SC1/AHG2 : Pipelines for H ₂ /blends (onshore only?)	CEN/TC234 : Gas Infrastructure ASME : H ₂ pipelines DnV : H ₂ pipelines IMO : NH ₃ ships
Storage	SC4 : Well integrity SC9 : Cryogenic liquefied gases (?)	TC197/WG15 : Pressure vessels	API : Storage tanks CEN/TC 265 : Metallic tanks for the storage of liquids JESC : NH ₃ tank ASM : NH ₃ corrosion NORSOK : Wells BVEG : Well integrity
End use	WG14 : NH ₃ fired boilers	TC161 : Burners TC192 : Gas turbines TC197/WG27 : Fuel quality TC244 : Furnace safety	JIS : Gas turbines NFPA : Boilers, combustion systems, furnaces IMO : Safety of (marine) fuels
Cross cutting	SC6/WG1 : Process safety WG4 : Reliability and cost	TC17 : H ₂ embrittlement TC47 : NH ₃ sampling TC156 : Measurements/embrittlement TC197 : Detection, system safety, GHG emissions, vocabulary TC207 : Carbon footprint IEC : Explosive atmospheres/safety instrumented systems	CEN/TC234 : Gas Infrastructure NFPA : Safety ANSI/CGA : Safety CEN/CLC/JTC6 : H ₂ in energy systems CEN/TC 305 : Explosive atmospheres

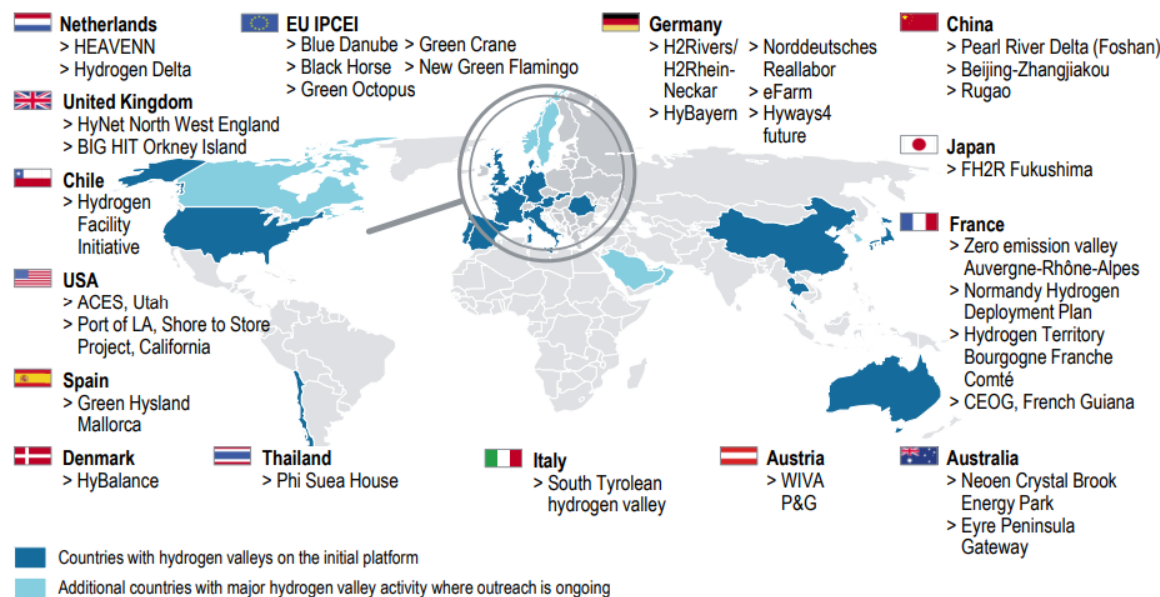
Challenge

How Finland is seen in hydrogen world map

Hydrogen Valleys have become a global phenomenon, with integrated projects emerging all around the world

A fast-growing landscape of globally leading projects ...

» ... featured on a new platform



Source: FCH JU, Inycom, Roland Berger

-  > 30 valleys from 18 countries
-  > 3,000 data points
-  10 in-depth best-practice profiles

You are challenged ...

**...to make Finland visible in
hydrogen world map!**

