



THE UNIVERSITY
of ADELAIDE

Australian standards on the storage and handling of hydrogen

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ELVHYS 5th safety workshop – 5th June 2025



Overview

1. Context – hydrogen in Australia
2. Hydrogen standards in Australia
3. Standards Australia Tech Spec “The Storage and Handling of Hydrogen”

And to be clear...

1. I don't represent all of Australia when it comes to hydrogen
2. I don't work for Standards Australia
3. I didn't write the Tech Spec

Hydrogen projects in Australia

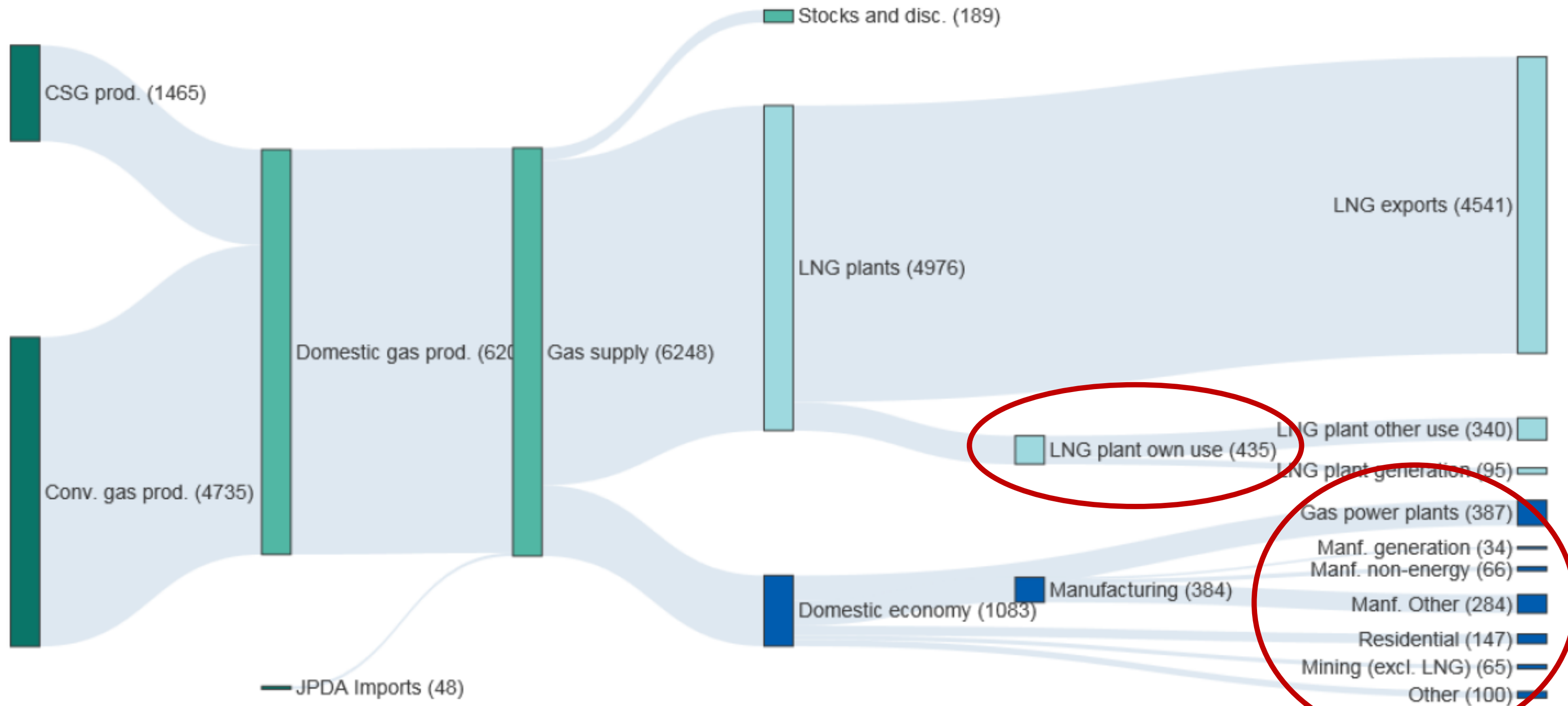
- Mix of:
 - Export
 - Ammonia
 - Methanol
 - Power
 - Mobility
 - Industrial
 - Gas networks



<https://research.csiro.au/hyresource>

Australia – natural gas flows

Australia has expertise in exporting liquefied fuel gases



Australia – liquefied hydrogen export



Recap

- **Hydrogen in Australia is still active**
- **Australia has experience in exporting liquefied fuel gases**
- **How to do it properly?**
 - ➔ specifications, procedures and guidelines that aim to ensure products, services, and systems are safe, consistent, and reliable
 - ➔ Standards

Standards Australia

- **Standards Australia is Australia's peak standards body**
 - Independent, not-for-profit, non-government (formed in 1922)
- **Australia's National Member Body to ISO and IEC**

... I am not their representative!

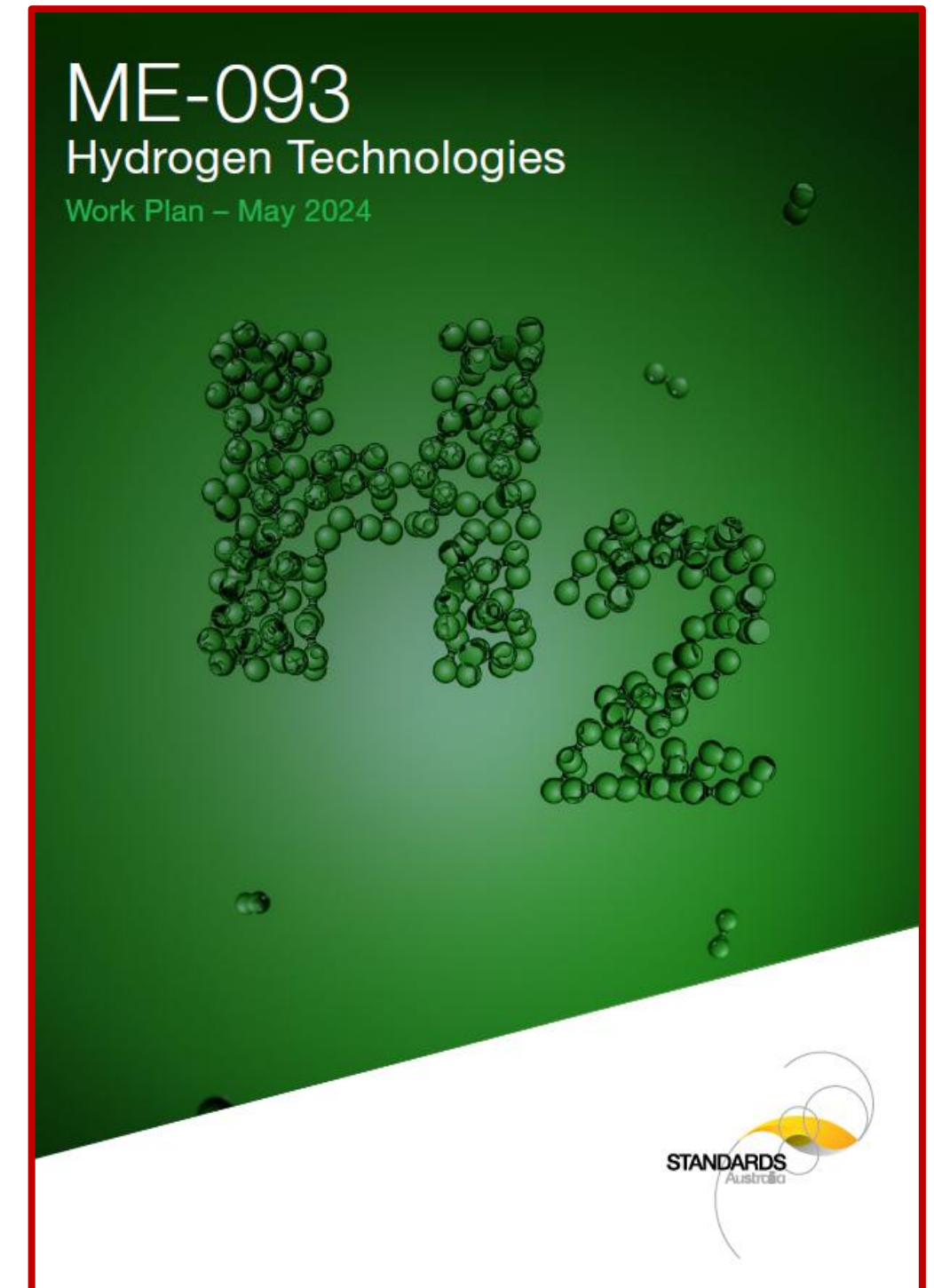


ME-093 Hydrogen Technologies committee

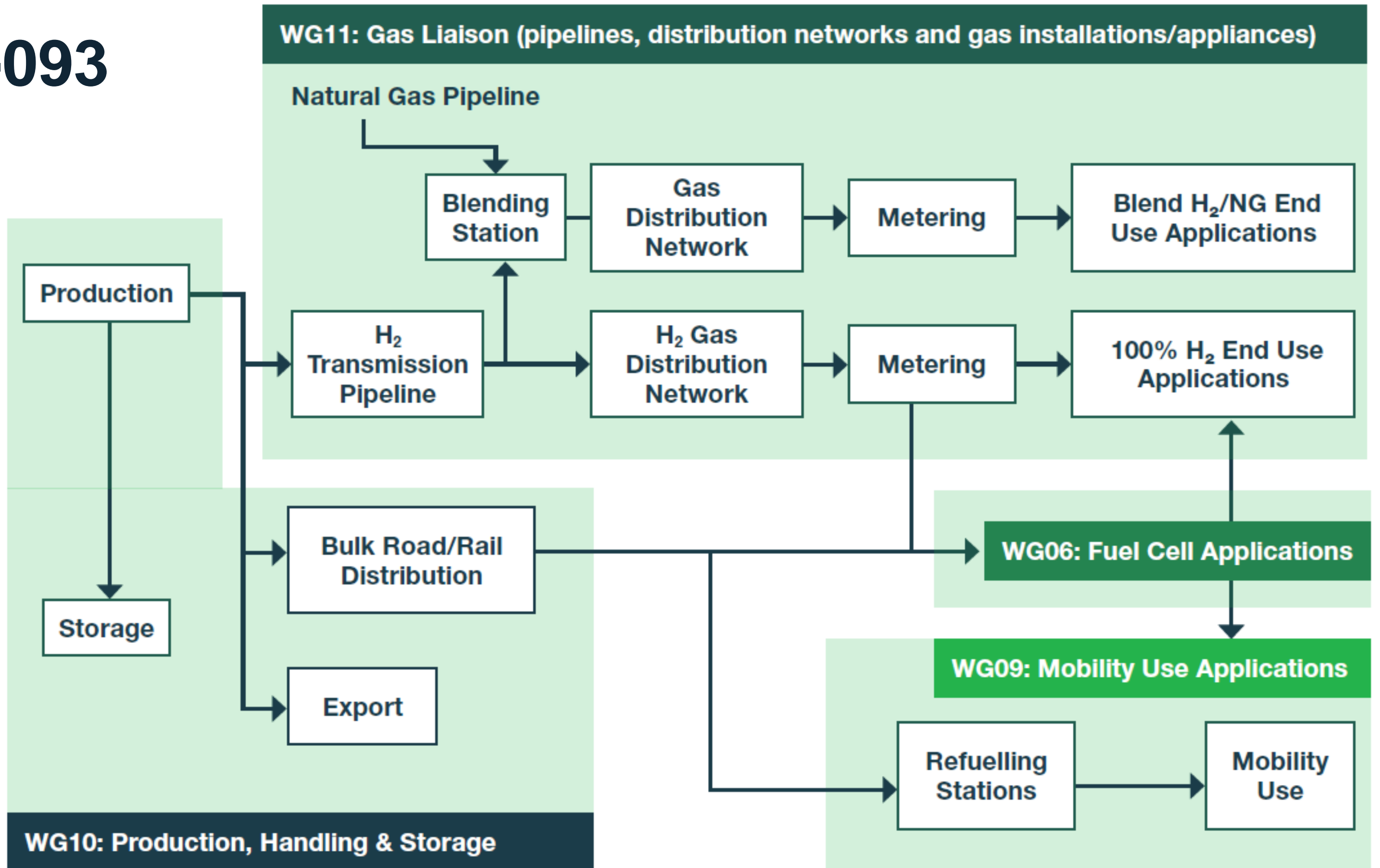
- **Formed April 2019**
- **Scope:**
 - All aspects of hydrogen, across the value chain as an energy carrier and fuel
 - Production
 - Storage and handling
 - Measurement
 - Transport, transmission and distribution of hydrogen (pure or blended)
 - End-use applications
 - refuelling
 - mobility
 - domestic and industrial appliances
 - power and heat generation

ME-093 Hydrogen Technologies committee

- **Main technical committee**
- **Four working groups**
 - Fuel Cell Applications
 - Mobility Use Applications
 - Production, Storage and Handling
 - Gas Liaison
 - Pipelines
 - Networks / network equipment
 - Appliances



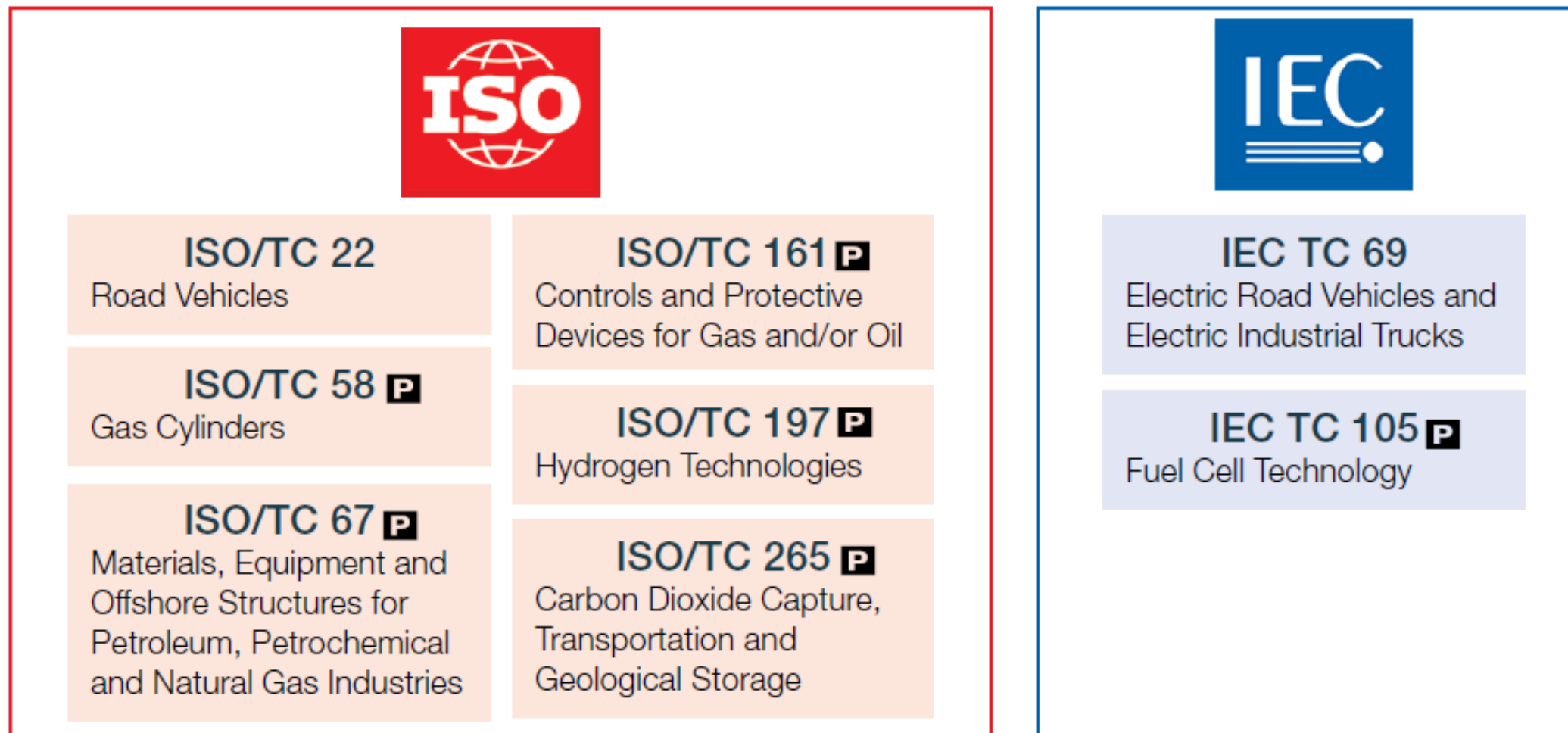
ME-093



ME-093 international engagement

- **Mirrors and participates in:**

- ISO/TC 197, Hydrogen Technologies
- IEC/TC 105, Fuel Cell Technology
- ISO/TC 8/SC 2, Ships and Marine Technology – Marine environment protection



ME-093 published standards — adopted

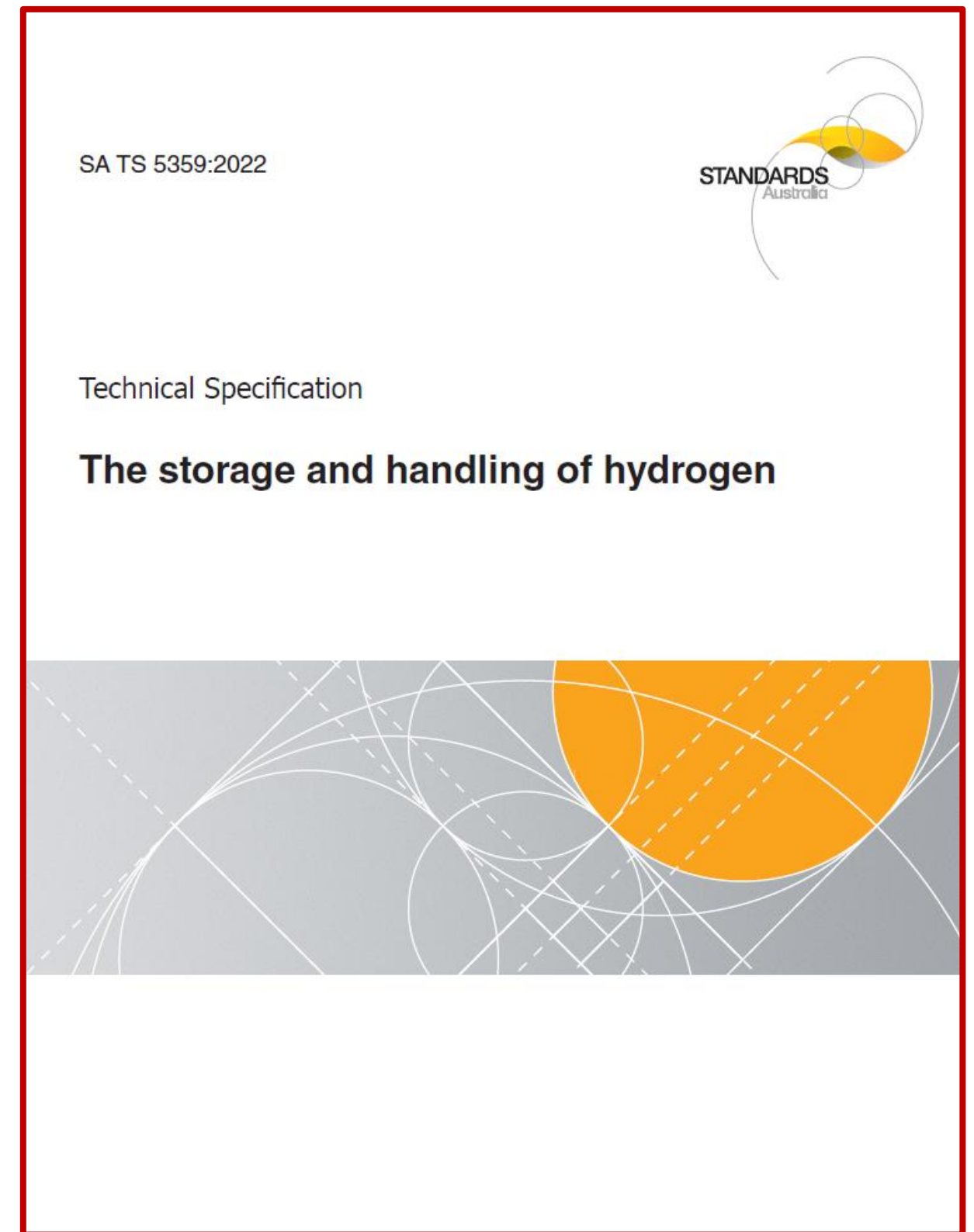
- **ISO/TC 197 (Hydrogen Technologies)**
 - Adopted 16 standards – safety, production, quality, mobility
- **IEC/TC 105 (Fuel Cell Technologies)**
 - Adopted 7 standards – stationary, portable, safety, installation
- **ISO/TC 8 / SC2 (Ships and Marine Technology)**
 - Adopted 1 standard – liquefied hydrogen loading arm

ME-093 published standards — national

- **SA HB 225:2023**
Guideline for blending hydrogen into pipelines and gas distribution networks
- **SA TS 5390:2024**
Gas Appliances – hydrogen-fired gas appliances
 - Co-developed with Gas Appliances Committee (AG-001)
- **SA TS 5359:2022**
The storage and handling of hydrogen

SA TS 5359: 2022

- **The storage and handling of hydrogen**
 - Sets out requirements and guidance for the safety and performance of hydrogen systems used for the purpose of storage and handling of hydrogen
- **Other Australian Standards**
 - AS/NZS 1596
The storage and handling of LP Gas
 - AS 3961
The storage and handling of liquefied natural gas



SA TS 5359: 2022

<https://store.standards.org.au/product/sa-ts-5359-2022>

1. **Scope and application**
2. **General requirements**
3. **Gaseous hydrogen**
4. **Liquid hydrogen**
5. **Appendix A – impact protection**
6. **Appendix B – vessel and tank types**

Broad range of considerations for safe storage and handling.

Clear and concise – references other documents.

SA TS 5359 – upgrade to AS 5359

- **Technical specification developed to address industry and regulatory concerns on the gap in existing technical requirements for safe and reliable operation of storage assets and the handling of hydrogen gas.**
 - TS approach ensured market needs could be met in a timely manner
- **Community has identified a need to update the document to encompass additional content for two key areas:**
 - (i) separation distances
 - (ii) liquid hydrogen
- **Specific request from industry and the regulatory authorities to upgrade the document to a full Australian Standard.**

SA TS 5359 – upgrade to AS 5359

- **Project is underway to upgrade the Tech Spec to a full Standard**
- **Have assembled a stellar team ... divide and conquer**
 - Workstream 1 – establish safe separation distances (prescriptive method)
 - Workstream 2 – liquid hydrogen storage and handling safety
 - Workstream 3 – broad review to elevate document to a full Australian Standard

Workstream 1 – separation distances

- **Table-based approach**
 - e.g. EIGA Doc 15/21
- **Performance-based approach**
 - Qualitative risk assessment
- **Ongoing activities**
 - What are the “sensitive receptors”?
 - How to determine distances for one-size fits all?
 - What tools to use to guide an assessment?

EIGA

DOC 15/21

Table 1 – Typical minimum horizontal safety distances for hydrogen stations

Typical type of outdoor exposure	Distance in metres of hydrogen from
1. Open flames and other ignition sources (incl. electrical)	5
2. Site boundary and areas where people are likely to congregate such as car parks, canteens, etc.	8
3. Wooden buildings or structures	8
4. Wall opening in offices, workshops, etc.	5
5. Bulk flammable liquids and LPG storage above ground in accordance with national codes, where they exist, for the particular substance. Otherwise	8
6. Bulk flammable liquid and LPG below ground	
6.1 Tank (horizontal distance from shell)	3
6.2 Vent or connections	5
7. Flammable gas cylinder storage, other than hydrogen	5
8. Gaseous oxygen storage (cylinders)	5
9. Liquid oxygen storage (not greater than 125 000 litre tank capacity) ²⁾	8 ¹⁾
10. Non-flammable cryogenic liquid storage, other than oxygen, <u>for example</u> argon, nitrogen ¹⁾	5 ¹⁾
11. Stocks of combustible material, <u>for example</u> timber	8
12. Air compressor, ventilator intakes, etc.	15

¹⁾ Where satisfactory arrangements are made to divert liquid spillage away from the hydrogen system, these distances may be reduced.

²⁾ For tank capacities greater than 125 000 litres see EIGA Document 127, *Bulk Liquid Oxygen, Nitrogen and Argon Storage Systems at Production Sites* [21].

Workstream 2 – liquid hydrogen safety

Current format...

- **4 Liquid hydrogen**
 - 4.1 Scope of section
 - 4.2 Properties
 - 4.3 Materials selection
 - 4.4 Minimization of vapour hazards
 - 4.5 Piping system
 - 4.6 Equipment
 - 4.7 Land and marine transfer of liquid hydrogen

Workstream 2 – liquid hydrogen safety

For consideration to be added...

- **ISO/TS 15916 (under development) — offers general guidance**
 - Tech Spec revision of ISO/TR 15916: 2015
 - Nick Hart to provide updates later in today's programme
- **Other ISO/TC 197 documents cover land vehicle refuelling**
- **EIGA, NFPA, NASA, Sandia, amongst (many) others**
- **For AS 5359, looking to consolidate existing knowledge from research bodies**
 - Especially ELVYS, PRESLHY

National Hydrogen Codes of Best Practice

- **Australian Government working on:**
 - National Code of Best Practice for Hydrogen Production Safety
 - National Code of Best Practice for Ammonia Production Safety
 - National Code of Best Practice for Hydrogen Refuelling Stations
 - National Code of Best Practice for Hydrogen Appliances, Plant, and Equipment Compliance
 - National Code of Best Practice for Ammonia Appliances, Plant, and Equipment Compliance
- **These — and other mandatory/guidance documents — are developed outside and/or in parallel with standards developments**
 - Regulations are subject to State-based legislation

Regulations in Australia

- Australian stereotype might be...
“don’t worry, everything will turn out okay”
- ... however, Australia is heavily regulated
- **Examples**
 - National and State workplace health and safety
 - Technical Regulators (e.g. network, utilities, installations, appliances)
 - Dangerous Goods codes
 - Major Hazard Facilities codes

*Standards are often referred to
(and/or Legislated) in Regulations.*

HyStandards (scenario-based tool)

<https://research.csiro.au/hylearning/hystandards/>

- Developed between Standards Australia and CSIRO

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Standard*	Title	Scope	Type
ADG Code Edition 7.8	Australian Code for the Transport of Dangerous Goods by Road & Rail	This Code provides detailed technical specifications, requirements and recommendations applicable to the transport of dangerous goods in Australia by road and rail.	Road Transport via Cylinders
ADG Code Edition 7.8	Australian Code for the Transport of Dangerous Goods by Road & Rail	This Code provides detailed technical specifications, requirements and recommendations applicable to the transport of dangerous goods in Australia by road and rail.	Road Transport via Tube Trailers
ANSI/CSA HGV 4.1: 2020	Standard for hydrogen-dispensing systems	Specifies mechanical and electrical requirements for dispensers of compressed hydrogen gas intended for fuel storage systems integral to fuel cell vehicles at pressures of 25, 35, 50, and 70 MPa. Dispensing systems covered by this Standard include a) HGV dispensers that integrate all dispensing system components in a single unit, including fuel metering and registering, flow control and safety management devices, heat exchangers, and vehicle fuel cylinder over-fill and over-pressure protection with listed hoses with nozzles; or b) HGV dispensers that are primarily the customer facing unit with fuelling hose assembly listed hoses, nozzles, and operator interface, and where the key components of flow metering and over-pressure and over-fill protection are located in a separate unit or part of the hydrogen fuelling station system. The following service pressures are applicable: 25, 35, 50, and 70 MPa.	Gaseous Hydrogen Vehicle Refuelling
ANSI/CSA HGV 4.10: 2021	Standard for fittings for use in compressed	Specifies methods for testing and evaluating fittings for use with compressed hydrogen gas and hydrogen-rich gas	Gaseous Hydrogen Vehicle Refuelling



Summary

- **Australia has hydrogen ambitions**
 - And expertise in exporting liquefied fuel gases
- **Standards needed for safe storage and handling of hydrogen**
 - Notwithstanding a plethora of existing standards
 - Including, but not limited to, liquid hydrogen
- **Watch this space**
 - And keep an eye out for requests to help 😊

Acknowledgements

- **Standards Australia**
- **ME-093 Technical Committee**
- **5359 drafting team**