

# Hydrogen Standards Forum

OUTCOMES REPORT

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WEDNESDAY, 17 OCTOBER 2018



## About Standards Australia

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Founded in 1922, Standards Australia is an independent, not-for-profit organisation, recognised by the Commonwealth Government as the peak non-government standards development body in Australia. It is charged by the Commonwealth Government to meet Australia's need for contemporary, internationally-aligned standards and related services. The work of Standards Australia enhances the nation's economic efficiency, international competitiveness and contributes to community demand for a safe and sustainable environment.

**[www.standards.org.au](http://www.standards.org.au)**

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## Introduction

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The hydrogen sector in Australia is gaining momentum. The potential role of hydrogen across the Australian industry to decarbonise, improve fuel security, and create new investment opportunities is being recognised. As the Australian economy transitions to a low-carbon future, in line with our international commitments, hydrogen is recognised as a 'clean' energy source and feedstock, which can support this transition.

Investment signals from nearby trade partners to develop hydrogen supply chains means Australia is incredibly well positioned to lead in large-scale production, storage and transportation for both a domestic market as well as export opportunities.

The hydrogen sector has shifted from exploring technological viability to realising market potential. However, this shift requires a coordinated and strategic response from industry and governments alike.

In response to these recent developments, Standards Australia hosted a Hydrogen Standards Forum to establish what standards are needed to ensure safety, efficiency, and international compatibility as the hydrogen industry grows. The standards setting provides a sound starting point for a thorough gap analysis, determining priorities, and effective strategic planning.

This report outlines the Hydrogen Standards Forum outcomes and next steps. It is intended to be used as a reference document to guide further engagement, and to help inform stakeholders of the strategic direction of future standards development and international participation in the hydrogen sector.

## 1. Background

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In 2018, Standards Australia became involved in discussions with both CSIRO Futures and Hydrogen Mobility Australia (HMA) about how standards could assist the development and evolution of the hydrogen industry in Australia.

Standards Australia contributed to the [CSIRO Futures Hydrogen Roadmap Report](#) by undertaking a standards gap analysis to identify where opportunities existed in Australia to adopt critical hydrogen standards. This included identifying existing natural gas standards and standards that may require revision to incorporate the introduction of hydrogen into the gas network.

Standards Australia also engaged one of the peak hydrogen industry groups, [Hydrogen Mobility Australia \(HMA\)](#), to discuss how standards can support the further development of the hydrogen industry in Australia. Specifically, Australian involvement in international standards development and adoption was a key consideration.

## 2. Stakeholder Consultation

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On 17 October 2018, Standards Australia facilitated a half-day forum to:

- Provide a snapshot of the current standards in the sector
- Identify the priority areas for standards adoption
- Identify areas for further engagement
- Determine the next steps and timelines

A wide range of stakeholders were invited to participate in the Hydrogen Forum to ensure broad views regarding the future standards needs of the hydrogen sector were captured. This included stakeholders from industry, government, regulators, consumers and academia. A list of organisations that attended the forum is listed in Appendix A.

Standards Australia developed a Discussion Paper to help facilitate discussions at the Hydrogen Forum. The paper can be [downloaded here](#).

## 3. Forum Agenda

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The Hydrogen Forum comprised of presentations from Standards Australia and a number of guest speakers, as well as a breakout session to discuss priority areas and establish next steps.

Agenda:

1. Standards Australia presentation – what we do and how we do it
2. A hydrogen standards snapshot (Appendix B)
3. Presentations from the following guest speakers:
  - a. CSIRO Futures – Max Temminghoff
  - b. Energy Networks Australia (ENA) – Dennis Van Puyvelde
  - c. Hydrogen Mobility Australia (HMA) – Billy Chan and Claire Johnson
4. Breakout sessions – a discussion of the following questions<sup>1</sup>:
  - a. Of the international standards committees listed in the discussion paper:
    - i. On which should Australia remain/become a participating member?
    - ii. If not, why not?
  - b. Of the relevant standards listed in the discussion paper, which should we look to adopt in Australia?
    - i. Which standards are most relevant to your group?
    - ii. Are there any standards that are needed but don't exist?
    - iii. Have we missed any existing relevant standards from the list?

In order to understand the various needs of the different aspects of the hydrogen supply chain, the participants were allocated to four groups:

- |               |                   |
|---------------|-------------------|
| 1. Production | 3. Transportation |
| 2. Storage    | 4. Use cases      |

Each of these groups addressed questions set out in Hydrogen Forum Agenda, Section 4, relevant to their group.

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<sup>1</sup> The stimulus materials for this discussion were all provided to the forum participants in the [Hydrogen Technologies Standards Discussion Paper](#) and are available on the Standards Australia website.

## 4. Discussion

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There was unanimous support for Australia to become a participating member of ISO/TC 197, Hydrogen Technologies.

Participation on IEC TC 105, Fuel Cell Technologies, was also discussed. It was recommended that Australia should initially become involved as an Observing member of this committee.

It was recommended that Australian stakeholders should proceed to adopt all of the standards currently published by ISO/TC 197 for Australia's competitive advantage. This international harmonisation would also provide Australia with a better understanding of future developments and opportunities in the industry.

### 4.1 Production

The group recommended that specific priority should be given to adopting the following standards:

- ISO 22734, *Part 1 and 2 Hydrogen generators using water electrolysis process – Industrial, commercial, and residential applications*
- ISO 14687, *Hydrogen fuel quality – Product specification* [under development]

### 4.2 Storage

The group recommended adopting:

- ISO 16111, *Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride*
- ISO 19884, *Gaseous hydrogen – Cylinders and tubes for stationary storage* [under development]

The group also discussed that it would be necessary to adopt standards that are domain or site specific, for example for refuelling stations or loading gas carriers for export.

It was recommended that a sub-committee or ad hoc group be created to review all of the current ISO and AS standards relevant to storage and handling, and identify where adoptions or revisions need to be made.

### 4.3 Transportation

This group recommended that Australia should continue to participate on:

- ISO/TC 67, Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries
- ISO/TC 161, Controls and protective devices for gas and/or oil
- ISO/TC 58, Gas cylinders

It was also recommended that Australian stakeholders should consider the adoption of all relevant ISO/TC 58 standards relevant to gas cylinders, especially:

- ISO 11114-4:2017, *Transportable gas cylinders – Compatibility of cylinder and valve materials with gas contents – Part 4: Test methods for selecting steels resistant to hydrogen embrittlement*

It was identified that a number of existing natural gas standards cover areas of transportation, distribution and pipelines, and may require review for their relevance for hydrogen. These include:

- AS 2885 series, *Pipelines – Gas and Liquid Petroleum*
- AS 4645 series, *Gas distribution networks*
- AS 4041, *Pressure piping*
- AS 1210, *Pressure vessels*

The group recommended that relevant hazardous areas standards may require a review, in instances of dispersion of hydrogen. They suggested that the Australian committee EL-014, Equipment for Explosive Atmospheres, needs to be involved in discussions relating to this issue.

The group discussed that standards for materials used in gas transportation and distribution might also require revision, such as AS/NZS 4645.3, *Gas distribution networks, Part 3: Plastics pipe systems*.

The group also identified the need to explore whether ammonia transport is sufficiently covered in any existing standards.

## **4.4 Use Cases**

The group discussed two main areas of use cases for hydrogen: gas appliances and hydrogen mobility.

### **4.4.1 Gas Appliances**

The group discussed whether the scope of ISO/TC 197 covered gas appliances and identified that more work would need to be done to investigate this further.

The group discussed that Australian Standards for gas appliances currently exist and would potentially need to be revised to incorporate specific design requirements if hydrogen was introduced into the gas network.

If this was identified as necessary, it was recommended that the proposed revisions of relevant standards could be captured in one project proposal.

### **4.4.2 Hydrogen Mobility**

In relation to hydrogen mobility, the group discussed that there are currently no Australian or adopted International Standards in this area, and this gap needs to be addressed.

It was suggested that the below standards be considered for adoption by Australian stakeholders as they are the most relevant International Standards to hydrogen mobility are:

- IEC 62282-3-200, *Fuel cell technologies – Part 3-200: Stationary fuel cell power systems – Performance test methods*
- IEC 62282-3-300, *Fuel cell technologies – Part 3-300: Stationary fuel cell power systems – Installation*
- ISO/DIS 19880, *Gaseous hydrogen – Fuelling stations – series*.

## 5. Outcomes

The key outcomes from the forum are captured below. These outcomes have been grouped into short term, medium term and long term recommendations for the purposes of informing next steps and indicative timelines.

### 5.1 Short Term Recommendations

These recommendations should be completed by end of 2018.

Activity	Who	Indicative due date
Prepare an international participation proposal in order to establish international participation on ISO/TC 197 – Hydrogen Technologies	Hydrogen Mobility Australia	December 2018
Constitute an Australian mirror committee to mirror the work of ISO/TC 197	Standards Australia	December 2018

### 5.2 Medium Term Recommendations

These recommendations should be started in early 2019, with a view to be completed by July 2019.

Activity	Who	Indicative due date
Prepare an international participation proposal in order to establish international participation, as Observing Members, on IEC TC 105, Fuel Cell Technology.	Stakeholders	July 2019
Identify relevant standards that should be adopted in Australia as a priority, either as identical adoptions, or with national modifications. All of the standards identified as part of the Hydrogen Standards Forum, which have been captured in Appendix C, should be considered.	Stakeholders	July 2019
Prepare project proposals identifying all standards for adoption, and submit this proposal to Standards Australia for approval.	Stakeholders	July 2019
Establish a Hydrogen Advisory Group to coordinate standardisation activities across multiple relevant committees.	Standards Australia	July 2019

### 5.3 Long Term Recommendations

These recommendations require on-going work by relevant stakeholders and should be embarked upon as the market requires them. No specific timeframe is recommended for these activities.

Activity	Who	Indicative due date
Identify any gaps in existing standards, and either develop new Australian Standards or International Standards to meet industry needs.	Stakeholders (assisted by Standards Australia)	On-going
Identify whether any existing Australian gas standards require revision following potential technical changes from hydrogen technology uptake. This should be informed by the Hydrogen Advisory Group, as well as relevant Standards Australia committees.	Stakeholders (assisted by Standards Australia)	On-going

## 6. Next Steps

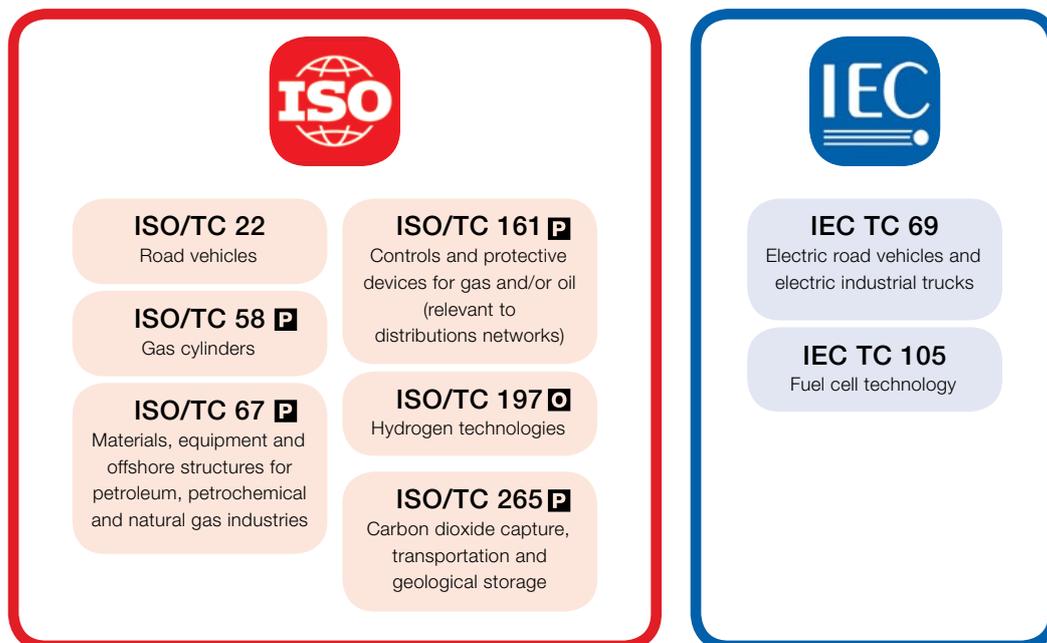
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1. Proposal for international participation on ISO/TC 197, Hydrogen Technologies, to be:
  - a. Circulated to all interested hydrogen stakeholders for information, and
  - b. Submitted to Standards Australia's Production Management Group (PMG) for approval in December 2018.
2. Standards Australia to constitute mirror committee to ISO/TC 197, and submit to PMG for approval in December 2018.

## Appendix A – Organisations in Attendance

Air Liquide Australia Limited	Gas Energy Australia
ANT Energy Solutions	GPA Engineering
APA Group	H2 Australia
Australian Pipelines and Gas Association	H2H Energy Pty Ltd
Assure International	H2U - The hydrogen Utility
Atlantic Power Exchange	Hydrogen Mobility Australia
Australian Association for Hydrogen Energy	Hyundai Motor Company Australia
Australian Gas Infrastructure Group	Invest Victoria
BOC	ITM Power Pty Ltd
Caltex	Jemena
Coregas	Mumford Commercial Consulting
CSIRO	Office of the Chief Scientist (Commonwealth Government)
Department for Energy and Mining South Australia	Rheem Australia
Department of Infrastructure, Regional Development and Cities	School of Materials Science and Engineering, UNSW Sydney
Department of the Environment and Energy	Select Solutions
Energy Networks Australia	Siemens
Energy Pipelines CRC	Swagelok
Energy Safe Victoria	The Australian Gas Association
Evoenergy	Toyota Australia
Gas Appliance Manufacturers Association of Australia	

## Appendix B – Hydrogen Standards Snapshot



Membership: **P** Participating **O** Observing

## Appendix C – Standards Identified for Potential Adoption in Australia

Designation	Title	International Committee
Production		
ISO/DIS 14687 [Under development]	Hydrogen fuel quality – Product specification	ISO/TC 197
ISO/DIS 22734 [Under development]	Hydrogen generators using water electrolysis process – Industrial, commercial, and residential applications	ISO/TC 197
ISO 14687-1:1999	Hydrogen fuel – Product specification – Part 1: All applications except proton exchange membrane (PEM) fuel cell for road vehicles	ISO/TC 197
ISO 14687-2:2012	Hydrogen fuel – Product specification – Part 2: Proton exchange membrane (PEM) fuel cell applications for road vehicles	ISO/TC 197
ISO 14687-3:2014	Hydrogen fuel – Product specification – Part 3: Proton exchange membrane (PEM) fuel cell applications for stationary appliances	ISO/TC 197
ISO 16110-1:2007	Hydrogen generators using fuel processing technologies – Part 1: Safety	ISO/TC 197
ISO 16110-2:2010	Hydrogen generators using fuel processing technologies – Part 2: Test methods for performance	ISO/TC 197
ISO/TS 19883:2017	Safety of pressure swing adsorption systems for hydrogen separation and purification	ISO/TC 197
ISO 22734-1:2008	Hydrogen generators using water electrolysis process – Part 1: Industrial and commercial applications	ISO/TC 197
ISO 22734-2:2011	Hydrogen generators using water electrolysis process – Part 2: Residential applications	ISO/TC 197
Storage		
ISO19884 [Under development]	Gaseous hydrogen – Cylinders and tubes for stationary storage	ISO/TC 197
ISO 16111	Transportable gas storage devices – Hydrogen absorbed in reversible metal hydride	ISO/TC 197
Transportation		
ISO 11114-4: 2017	Transportable gas cylinders – Compatibility of cylinder and valve materials with gas contents – Part 4: Test methods for selecting steels resistant to hydrogen embrittlement	ISO/TC 58
ISO/TR 15916	Basic considerations for the safety of hydrogen systems	ISO/TC 197
Use Cases		
IEC 62282-3-200	Fuel cell technologies - Part 3-200: Stationary fuel cell power systems - Performance test methods	IEC TC 105
IEC 62282-3-300	Fuel cell technologies - Part 3-300: Stationary fuel cell power systems - Installation	IEC TC 105
ISO/DIS 19880-1	Gaseous hydrogen – Fuelling stations – Part 1: General requirements [Under development]	ISO/TC 197

