Technical & Commercial Conference

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Research is enabling Australia's pipeline conversion to hydrogen

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FUTURE FUELS CRC

About Future Fuels Cooperative Research Centre

Industry-led collaboration between 80 companies, all State governments and six leading universities, co-funded by the National Government

Australian Government
Department of Industry, Science and Resources

AusIndustry
Cooperative Research Centres Program

APGA Australian Pipelines & Gas Association

Energy Networks Australia

GAMAA

Tasmanian Government

GOVERNMENT OF WESTERN AUSTRALIA

NSW GOVERNMENT

SOUTH AUSTRALIA

energysafe VICTORIA

Jemena

Australian Gas Infrastructure Group

Resources Safety & Health Queensland

THE UNIVERSITY of ADELAIDE

RMIT UNIVERSITY

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

DEAKIN UNIVERSITY AUSTRALIA

UNIVERSITY OF WOLLONGONG AUSTRALIA

THE UNIVERSITY OF MELBOURNE

Decarbonizing gas transmission & distribution networks with renewable gas

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Australian Energy Market Operator’s, state governments’ and industry’s net-zero pathways require decarbonisation of Australia’s gas networks

CO_2

This will **save 61mt** of CO2e emissions, equal to 12% of Australia’s current emissions

$

Enabling renewable gas in existing infrastructure can deliver a **system-wide cost benefit** in combination with the electrification pathway

Ongoing collaborative research is vital

International research links

Over 100 projects already running, supporting over 50 PhDs

- Future Fuel Technologies, Systems and Markets
- Social Acceptance, Public Safety, Security of Supply and Policy & Regulatory Changes
- Network Lifecycle Management

Hydrogen Pipelines Code of Practice

A definitive but always evolving code

1 Introduction, scope and purpose

2 Background, current research and key knowledge gaps

3 Australian and International Standards - the AS2885 series

4 Hydrogen as a Fluid, decompression and dispersion, ignition and radiation

5 Pipeline System Compatibility for Hydrogen Service, metallic and plastic/elastomer materials

6 Carbon Steel Line pipe for Hydrogen Service - overview of hydrogen embrittlement

7 Hydrogen Pipeline design (metallic) - design philosophy and safe envelopes for design and operation

8 Welding

9 Conversion of Pipelines for Hydrogen Service - specific requalification process with a flowchart/decision matrix.

10 Operations and Maintenance

11 Composite Materials

12 Safety

Chapter 5 - Pipeline System Compatibility for Hydrogen Service

- Core aspects of both metallic and plastic/elastomer materials
- System equipment of note including large bore valves, pressure regulators, flow meters, filters & strainers, isolation joints and instruments
- Major equipment such as pipeline compression and gas heaters and burners

Chapter 6 - Carbon Steel Line pipe for Hydrogen Service

- Overview of hydrogen embrittlement and further detail on hydrogen concentration, pressure and permeation
- Impact on mechanical properties relating to fatigue, fracture toughness and hardness

Chapter 7 - Hydrogen Pipeline design (metallic)

- Core chapter on design philosophy and seeking safe envelopes for design and operation
- Specific sections on safe envelopes, materials section, design factor selection, fracture control, fatigue, stress & strain, pressure testing considerations, station design, instrument and control design and construction

Chapter 9 - Conversion of Pipelines for Hydrogen Service

- Specific requalification process with a flowchart / decision Matrix
- Gas blending, design factor selection and revised MAOP (Maximum Allowable Operating Pressure), change of operating conditions and remaining life review
- Guidance for assessment of existing data and operational history including PMS (Pipeline Management System), design and construction records, integrity management records, fatigue assessments and coating and cathodic protection

Lessons learned

- Natural Gas pipelines have decades of best practice, driving a 0.8 design factor
- Existing industrial hydrogen pipes do not require fluctuating storage requirements that are valuable in transmission pipelines
- Must balance flexibility to apply the latest developing knowledge with ensuring safe design and operation
- Global effort needing intellectual property from many jurisdictions
- Broad author and review group, including engineering consultants, operators and technical regulators

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