Water volumes for hydrogen

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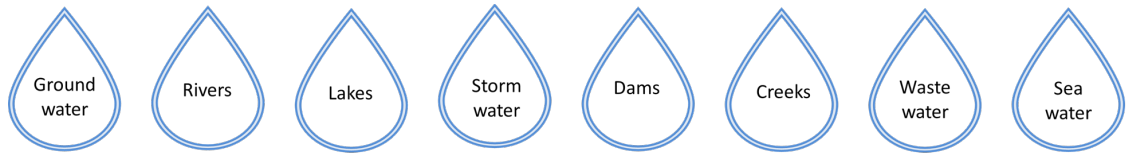
What do we need to know?

AUSTRALIAN HYDROGEN COUNCIL

What are the cost/practical differences in treatment for each water type?

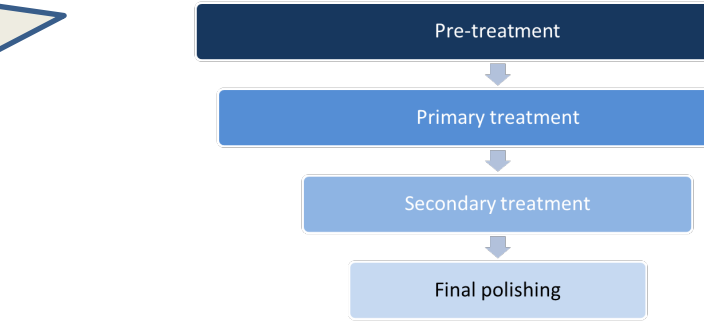
What are the efficiency losses and are those volumes gone or reused?

What's most likely to drive hydrogen production and how might it vary per state?



How should we address the issue of competing uses and community acceptance for these?

How do we account for actual or perceived water scarcity?



Waste/by-products

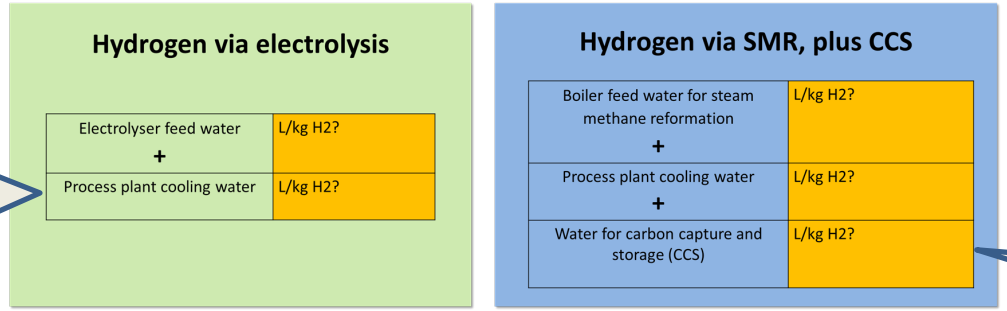
What waste are we talking about?

What are the issues we need to understand?

What is the answer to this, so that we can back solve with the above to estimate total volumes from the different sources?

In answering this, how should we think about the production volume only vs the broader lifecycle?

How much more water is required for different conversions, say to ammonia?



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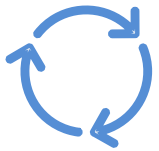
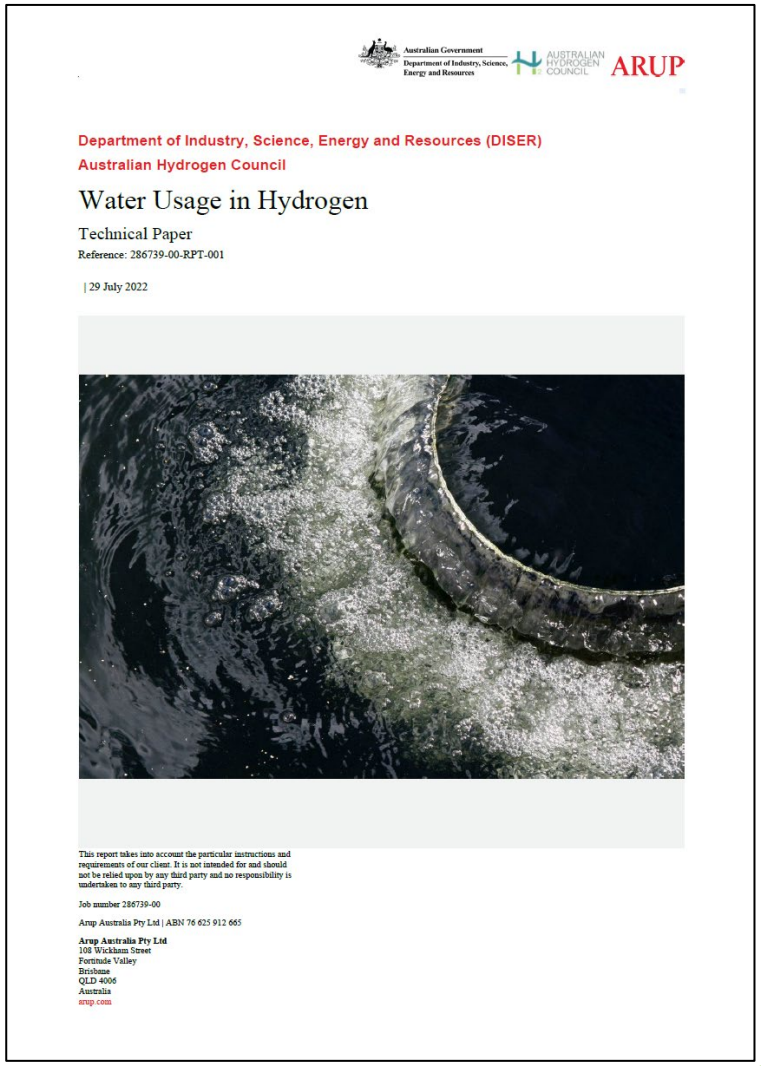


What further recycling is possible?

ARUP's report

- Undertaken for DCCEEW and AHC
- Technical paper, comprehensive assessment of volumes required
  - By source
  - By product
  - By cooling process and by wet/dry zones
  - Accounts for electrolyser types and age
- Intended to inform policy and public communications



Department of Industry, Science, Energy and Resources (DISER)
Australian Hydrogen Council

Water Usage in Hydrogen

Technical Paper

Reference: 286739-00-RPT-001

| 29 July 2022

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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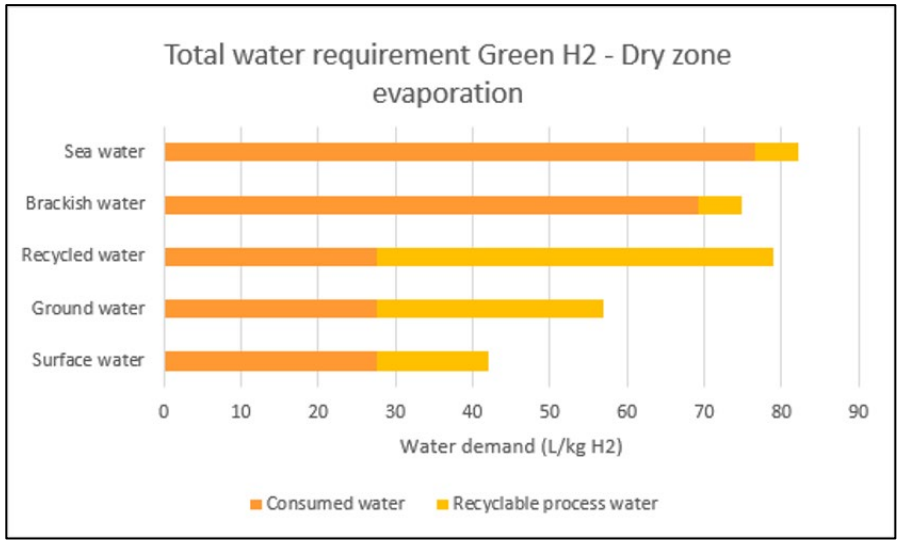
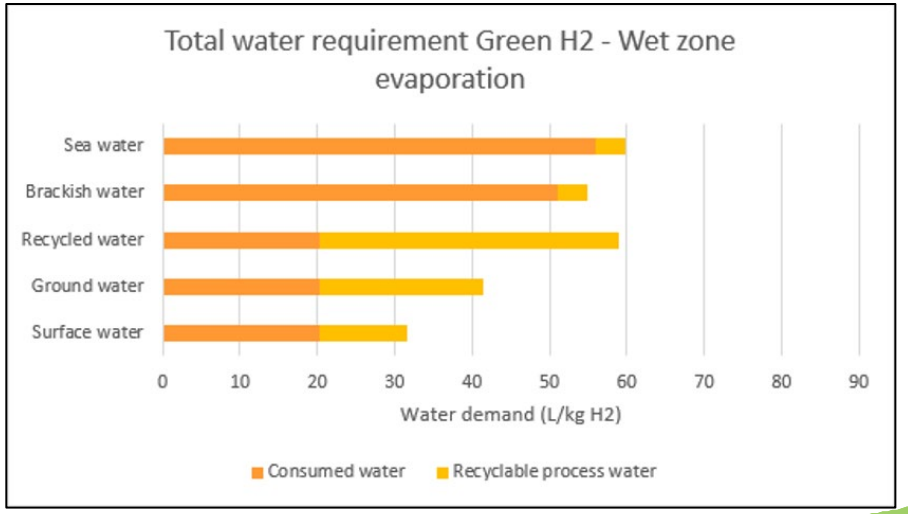
Green hydrogen – evaporative cooling

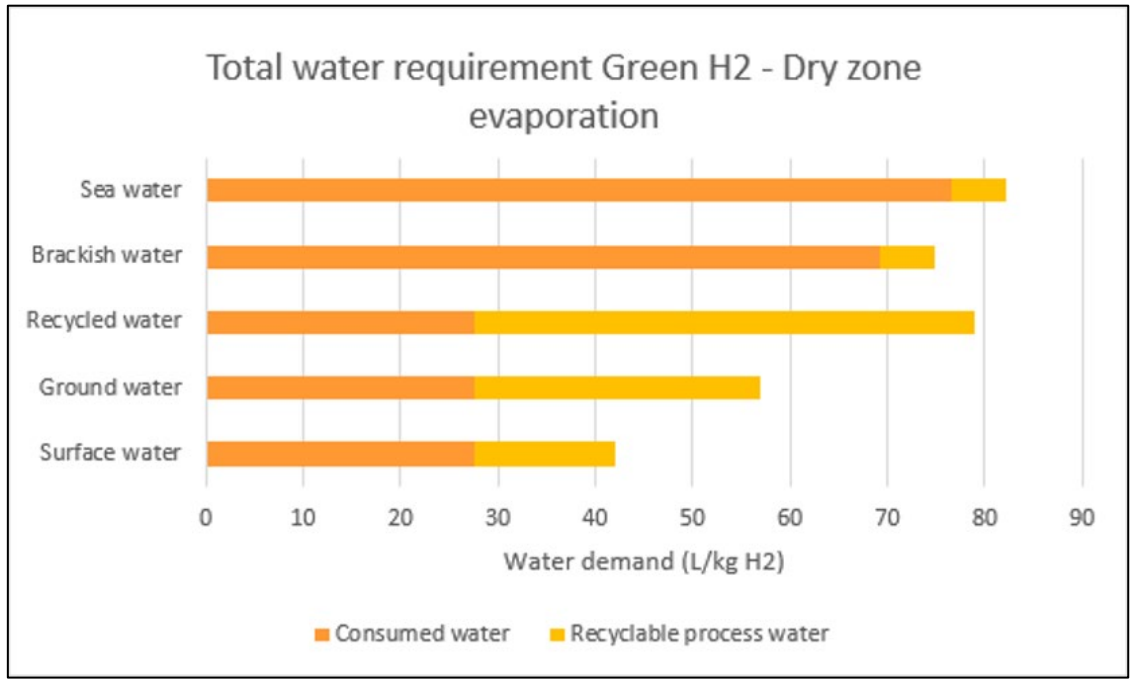
- Total water requirements vary by source water and cooling choices
- They also vary according to the age of the electrolyser, and whether the hydrogen production facility is in a dry or wet zone
- Consumed water is water that is used and not subsequently recovered
  - Consumed water for dry zone evaporative cooling option ranges from **28 litres/kg H2** (surface, ground and recycled) to **76 litres/kg H2** (sea)
  - Consumed water for wet zone evaporative cooling ranges from **20 litres/kg H2** (surface, ground and recycled) to **56 litres/kg H2** (sea)

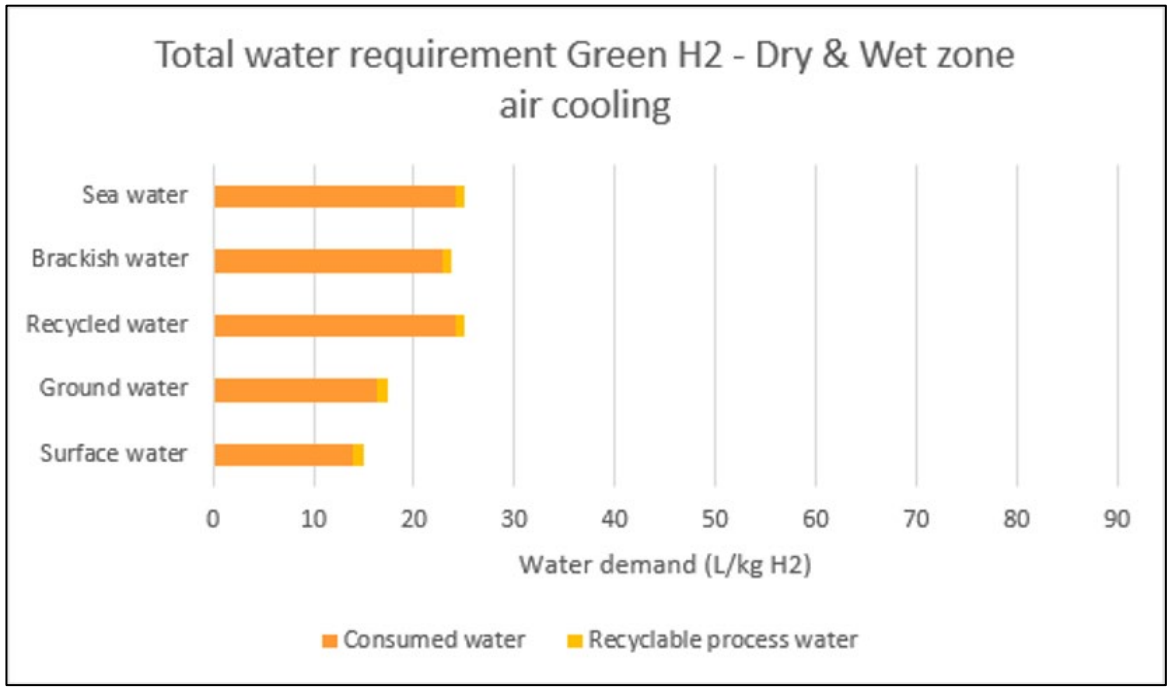




Green hydrogen – dry zone cooling alternatives

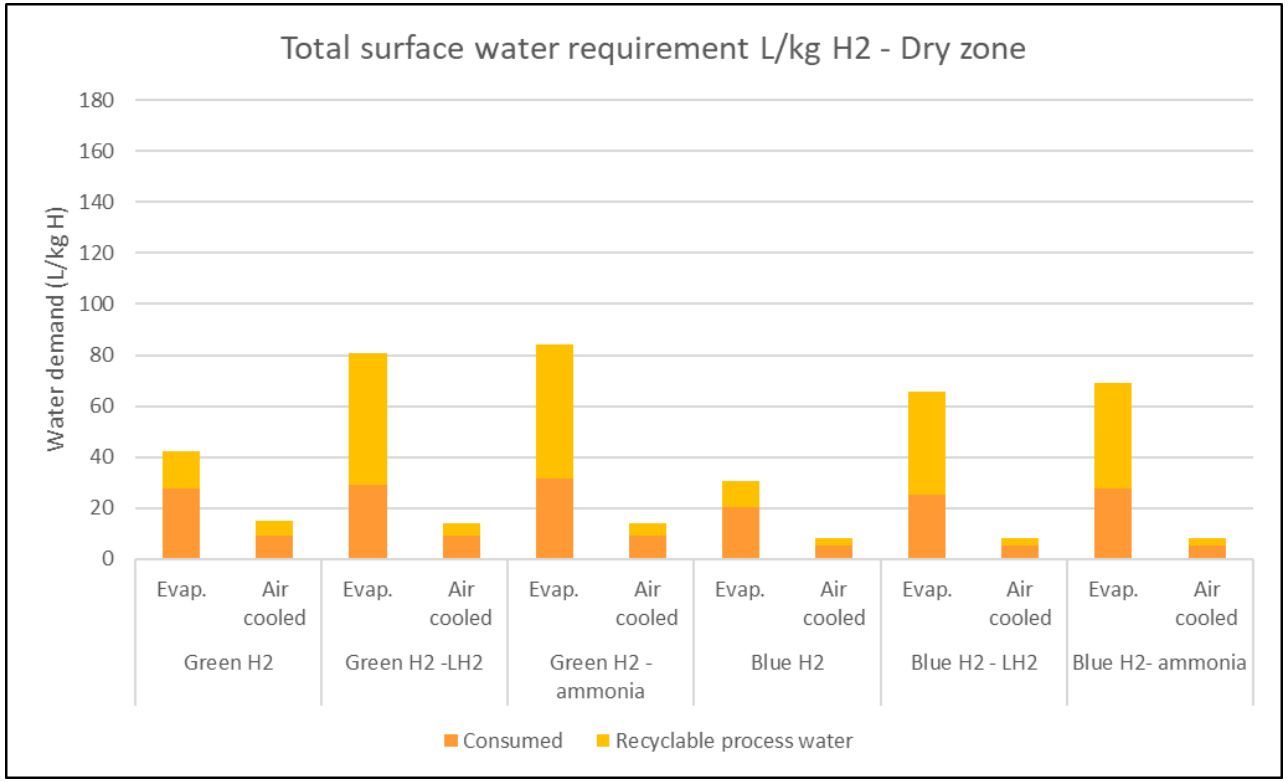
- Air cooling results in a significant drop in consumed water for several water sources, mainly seawater and brackish water
- There is no water difference between dry and wet zone air cooling (but is less effective in cooling for dry zone)





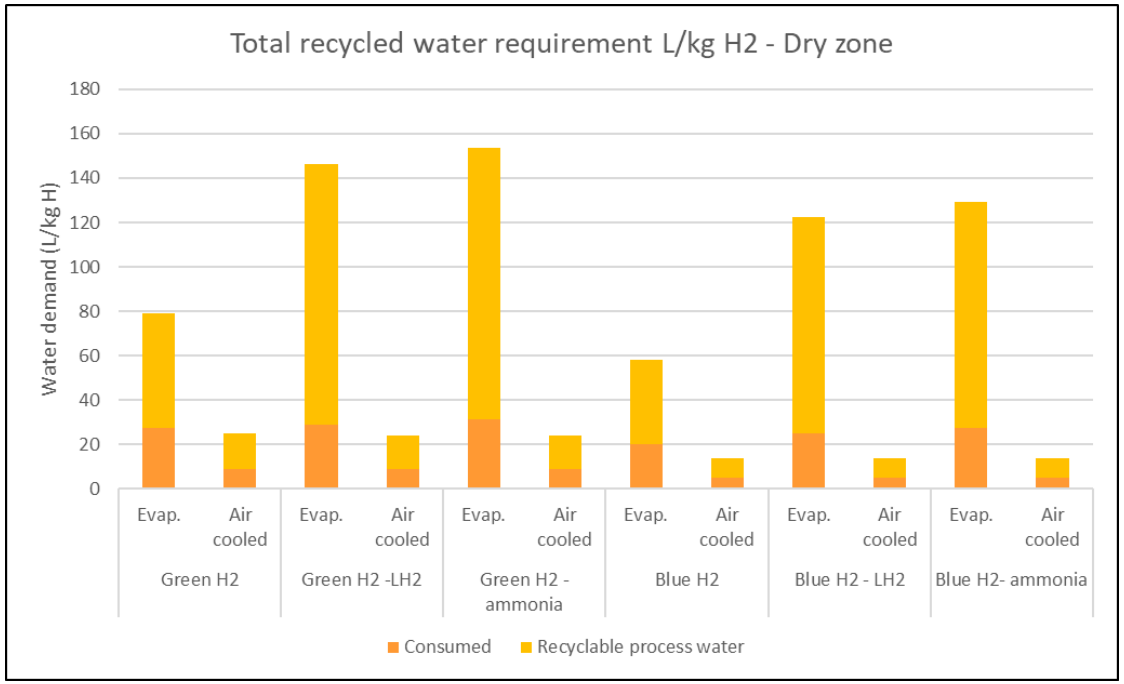
Different hydrogen products

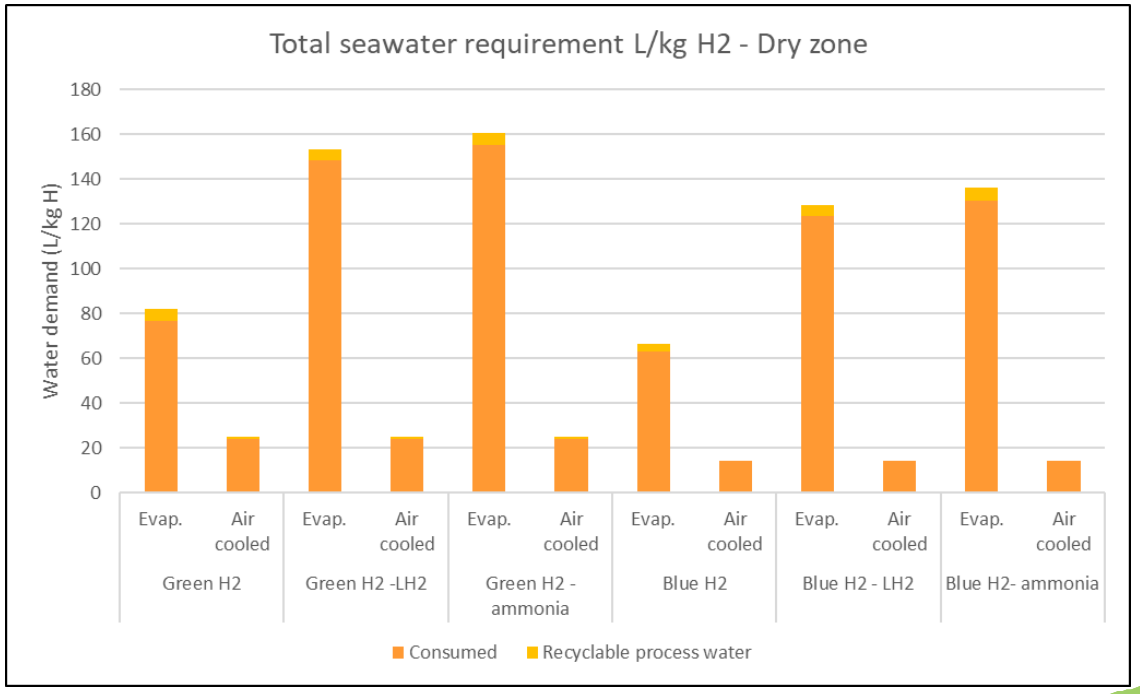
- Water requirements vary for different hydrogen products
- Much of the variation is driven by evaporative cooling for further processing into liquid form and ammonia
- And with surface water much of the evaporative cooling water can be recycled



Recycled water vs seawater

- Volumes of water are much greater using recycled or seawater but these are also more socially acceptable water sources
- And while total volumes between the two are similar, the proportion that is further recyclable is much higher when using recycled water





Total volume comparisons

- When multiplied out to National Hydrogen Strategy scenario hydrogen volumes, consumed water in 2030 is not high compared with other industries
- By 2050 the figures could equal or exceed the water used by the mining industry as a whole

Dry zone, evap cooling	Surface	Recycled	Seawater
Water volume, litres per kg	28	28	76
Deloitte 2030, GL for 1.8Mt H2	50.4	50.4	136.8
Deloitte 2050, GL for 34.1Mt H2	954.8	954.8	2591.6

Dry zone, air cooling	Surface	Recycled	Seawater
Water volume, litres per kg	14	24	24
Deloitte 2030, GL for 1.8Mt H2	25.2	43.2	43.2
Deloitte 2050, GL for 34.1Mt H2	477.4	818.4	818.4

Sector/scenario	Water (GL)
Total agriculture, forestry and fishing	7,319*
Total mining	842*
Coal mining and coal fired power stations in NSW and QLD 2020	383**
Total manufacturing	550*
Australian households 2016-17+	1,900***

* *ABS - 4610.0 Water Account, Australia, 2019-20*, released October 2021. Totals are use that's self-extracted or distributed, minus flows returned to the environment, and have taken out energy and water because too large (hydropower).
** Overton, I. (2020) 'Aren't we in a drought?', *The Conversation*, 5 May.
** * Australian Infrastructure Audit 2019, Chapter 9, p. 604.

Summary

- Water use for hydrogen is an important issue to understand
- The volumes required will be significant, but not necessarily a dealbreaker for the industry if the right sources and investments are made, and communities are engaged
- Surface and ground water may play a role but the bulk will need to come from manufactured water (recycled and desalinated water)
- The question then becomes one of how to plan for the future