INspire

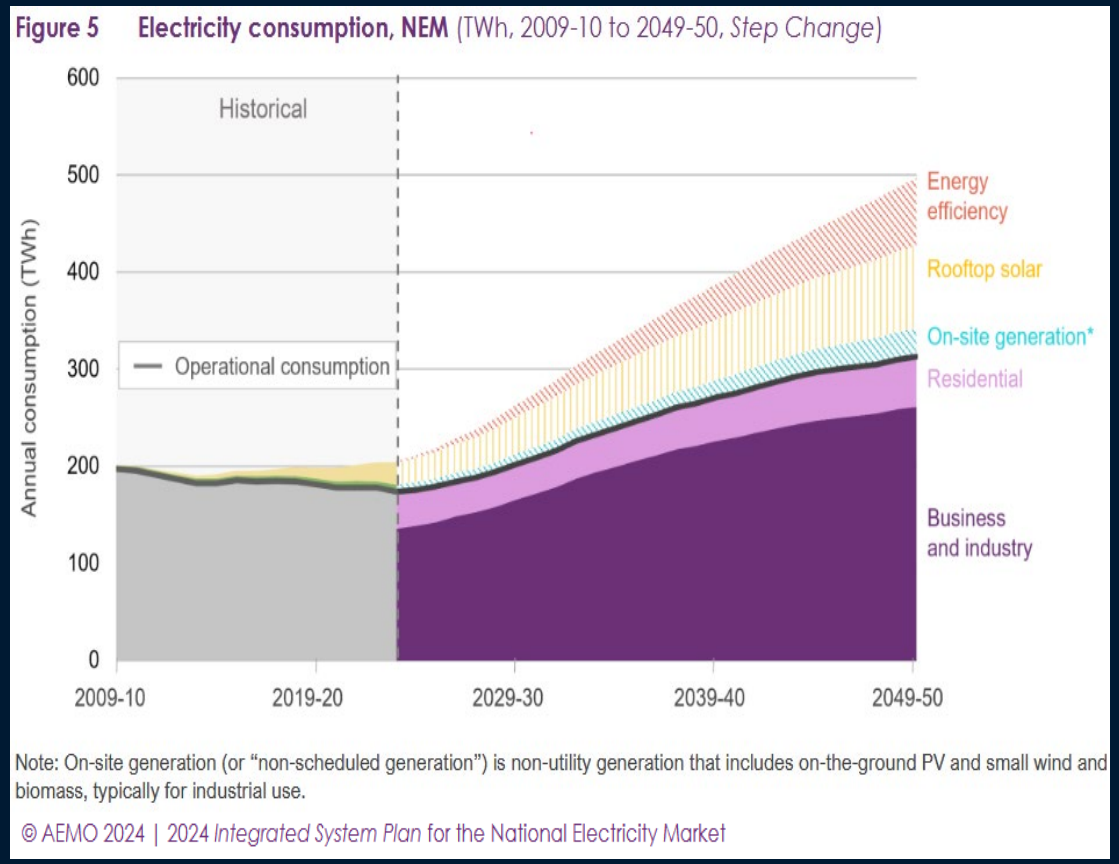
The Water-Energy Policy Nexus

What is important to think about when planning a low emission future?

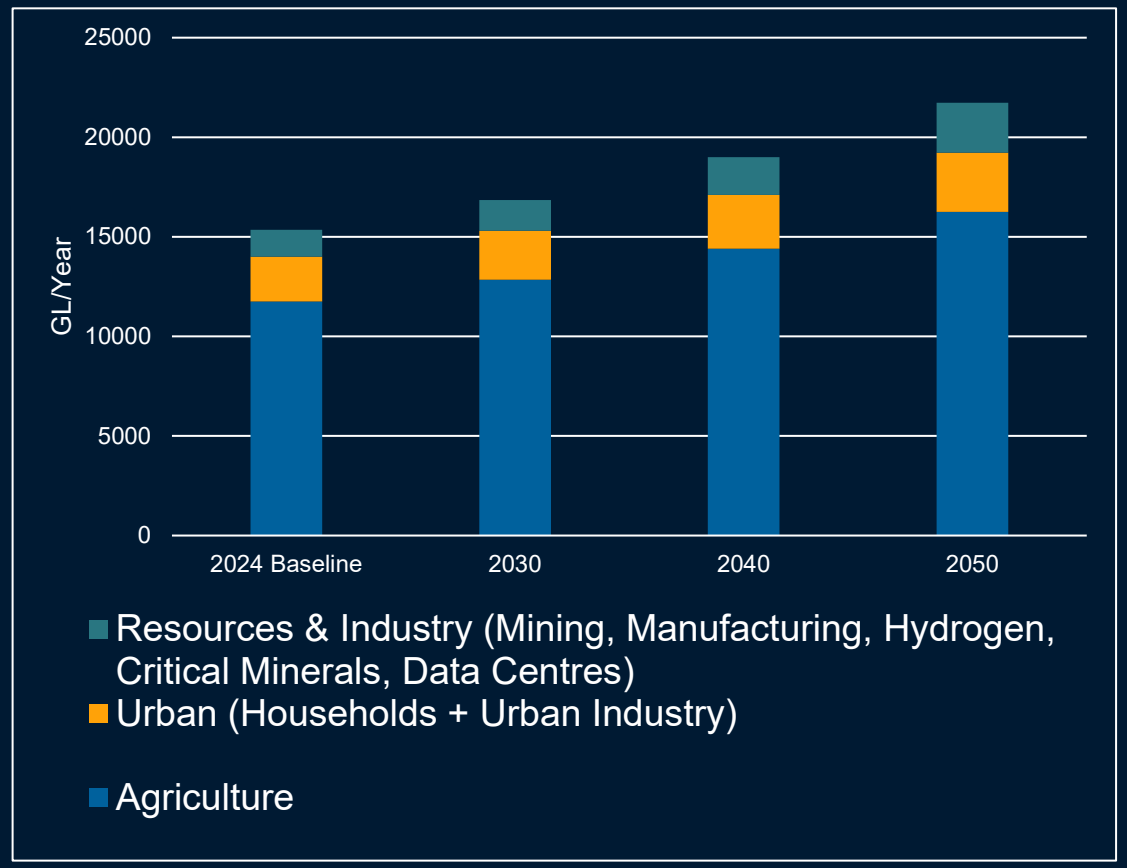
Artificial Intelligence (AI) has been used in background research and in the compilation of data for the preparation of graphics. This information is not to be relied upon without independent checking of the content. Aqua-In Pty Ltd is not responsible for any AI content generated using this presentation as the source.

Future Projections for Australia

Energy Requirements



Water Requirements



(AI Generated summary: Values rounded; projections use Infrastructure Australia growth rates, ABS sector baselines, and climate-adjusted demand trends.)

Additional information – slides not in main presentation but used in response to questions – placed here as in part related to increased energy demand.

Future challenges

Data Centre Power Use

- **100 MW AI Facility:** Consumes roughly **876 Gigawatt-hours (GWh) per year**. This is the entry-level baseline size for a modern, dedicated AI hyperscale facility.
- **200 MW AI Facility:** Consumes roughly **1,752 GWh per year**. This represents a mid-to-large tier AI cluster hub.
- **300 MW AI Facility:** Consumes roughly **2,628 GWh per year**. This is a massive, state-of-the-art flagship AI campus.

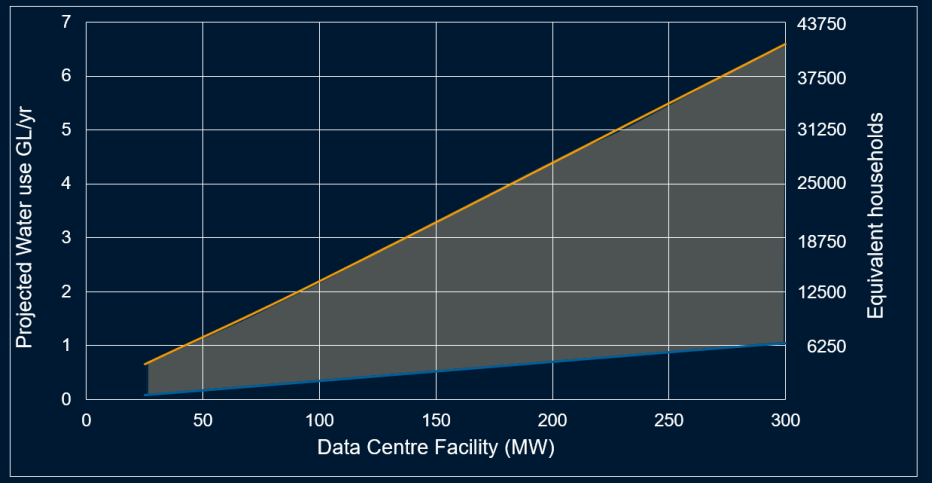
Current estimate that data centres use 2% of total Australian Annual generation capacity, increasing to 6% by 2030 (AEMO)

Other large users – Aluminium Smelters

22,800 to 23,500 Gigawatt-hours (GWh) of electricity annually across 6 smelters

Current estimate that smelters use approximately 10% of total Australian Annual generation capacity (check sources)

Data Centre Water Use



Source: Adapted from https://www.infrastructureaustralia.gov.au/ipl/secure-sustainable-water-for-growth/water-supply using AI where values are rounded; projections use Infrastructure Australia growth rates, ABS sector baselines, and climate-adjusted demand trends.

Importance of Energy Generation in Australia's Emissions Management

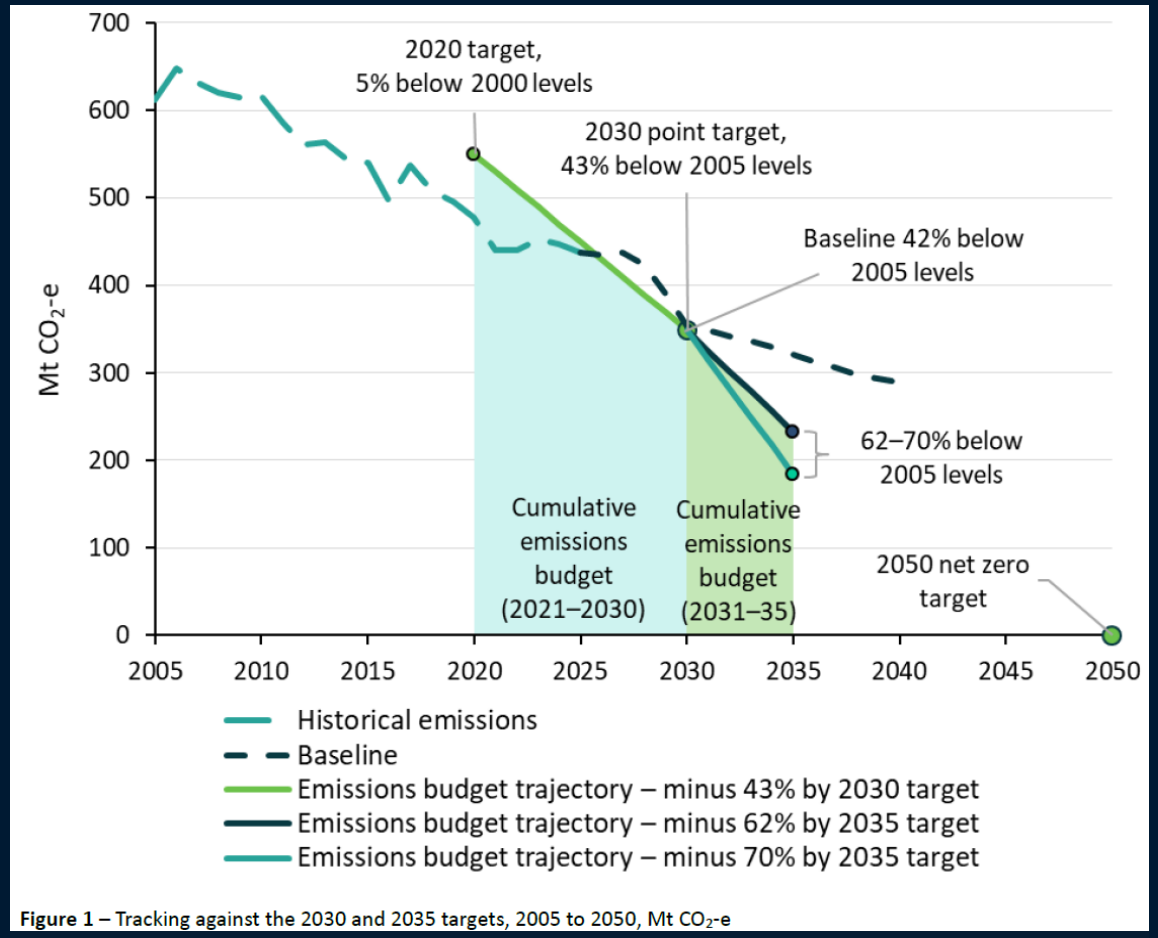


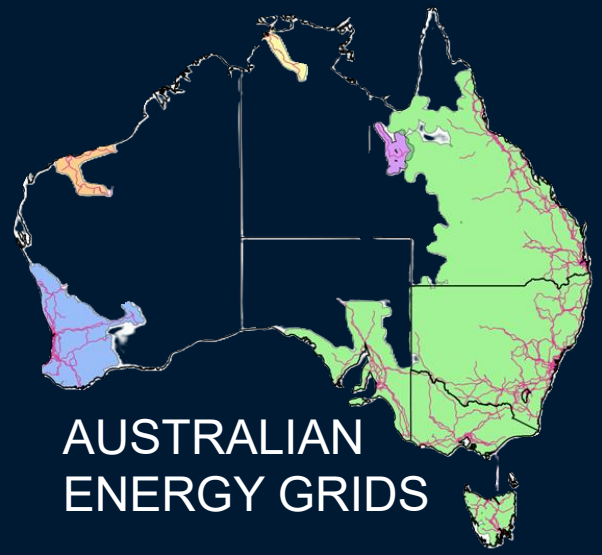
Figure 1 – Tracking against the 2030 and 2035 targets, 2005 to 2050, Mt CO_2-e

Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2025: Australia's emissions projections 2025

Emissions Sectors	2025 emissions	Change from 2025 to 2030	Change from 2030 to 2035
Total emissions	437 Mt CO_2-e	-84 Mt CO_2-e -19%	-32 Mt CO_2-e -9%
Electricity	148 Mt CO_2-e	-92 Mt CO_2-e -63%	-9 Mt CO_2-e -16%

Figure 2 (in part): Change in Emissions: DCCEEW 2025: Australia's emissions projections 2025

Bulk Energy Generation

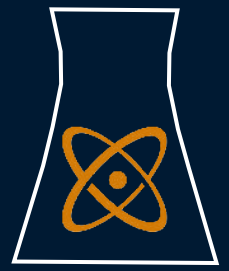


AUSTRALIAN ENERGY GRIDS

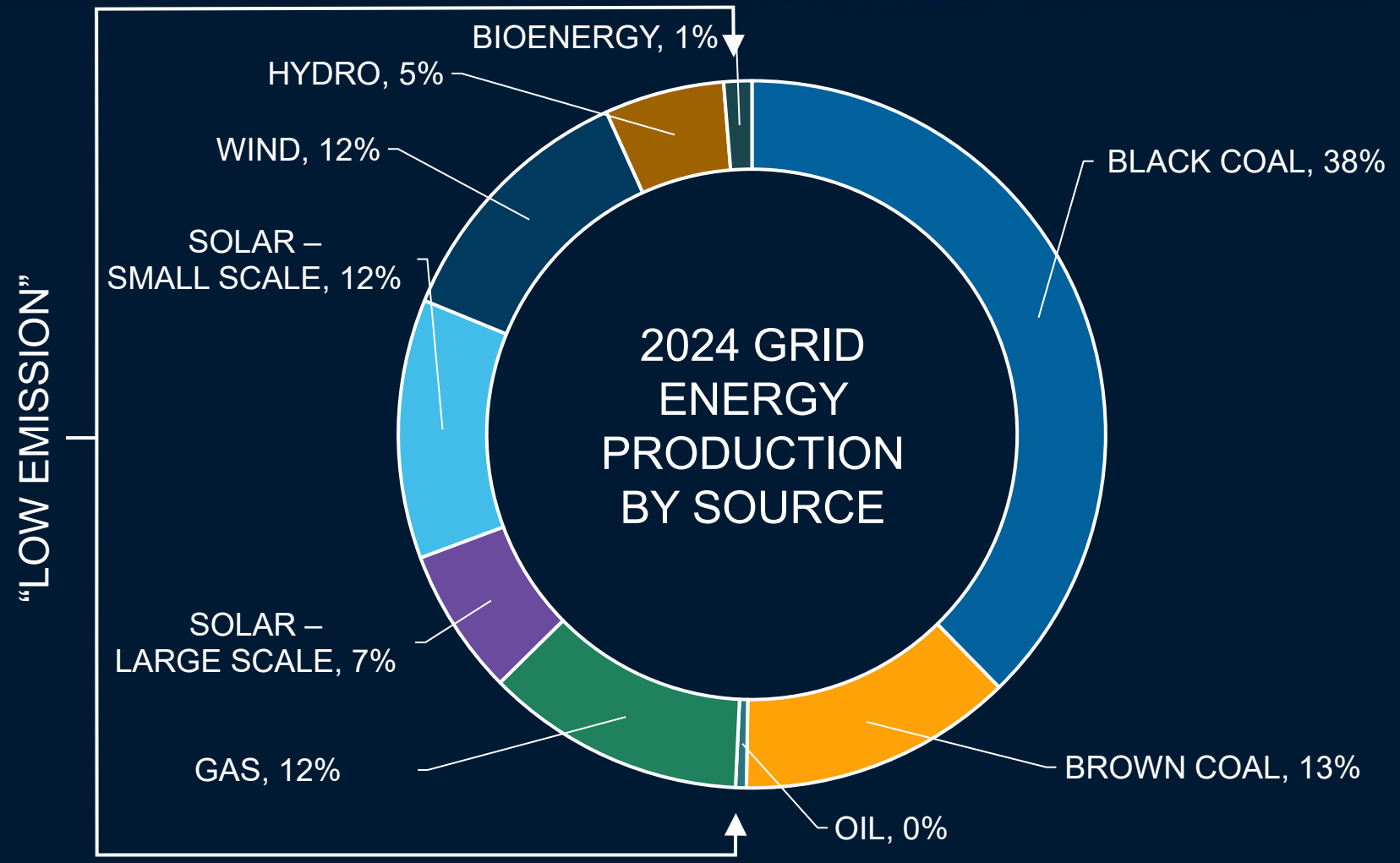
GEOTHERMAL

TIDAL

SOLAR CONCENTRATING

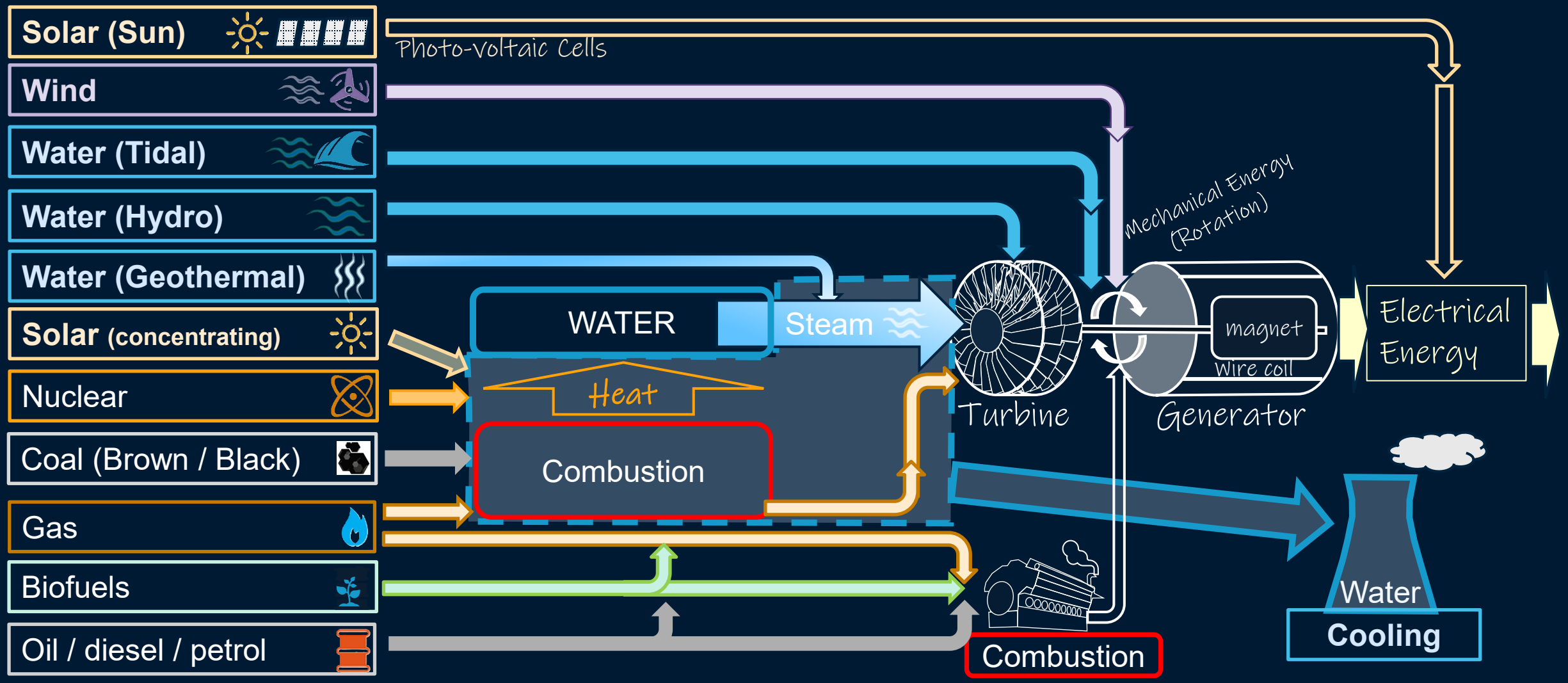


NUCLEAR

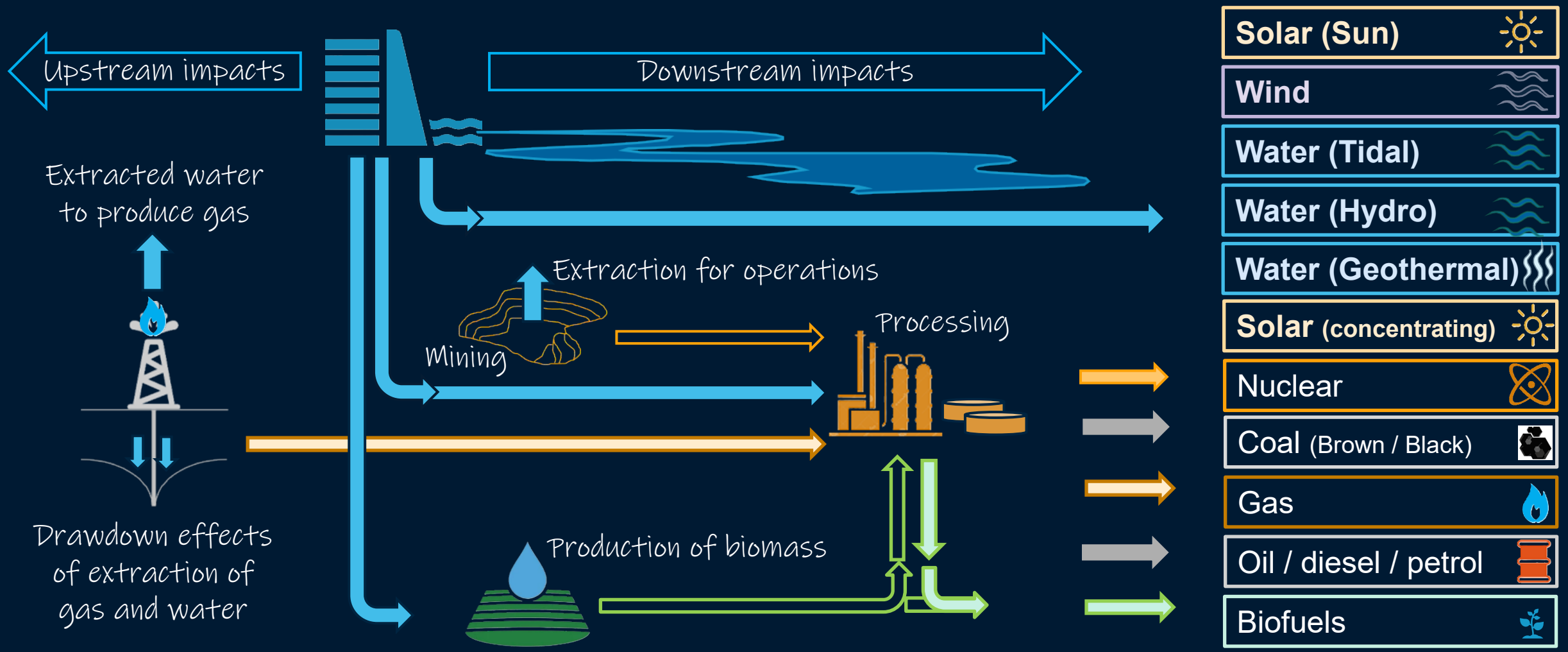


Australian Energy Statistics - Update Report 2025, Australian Government Department of Climate Change, Energy, the Environment and Water, August, Canberra.

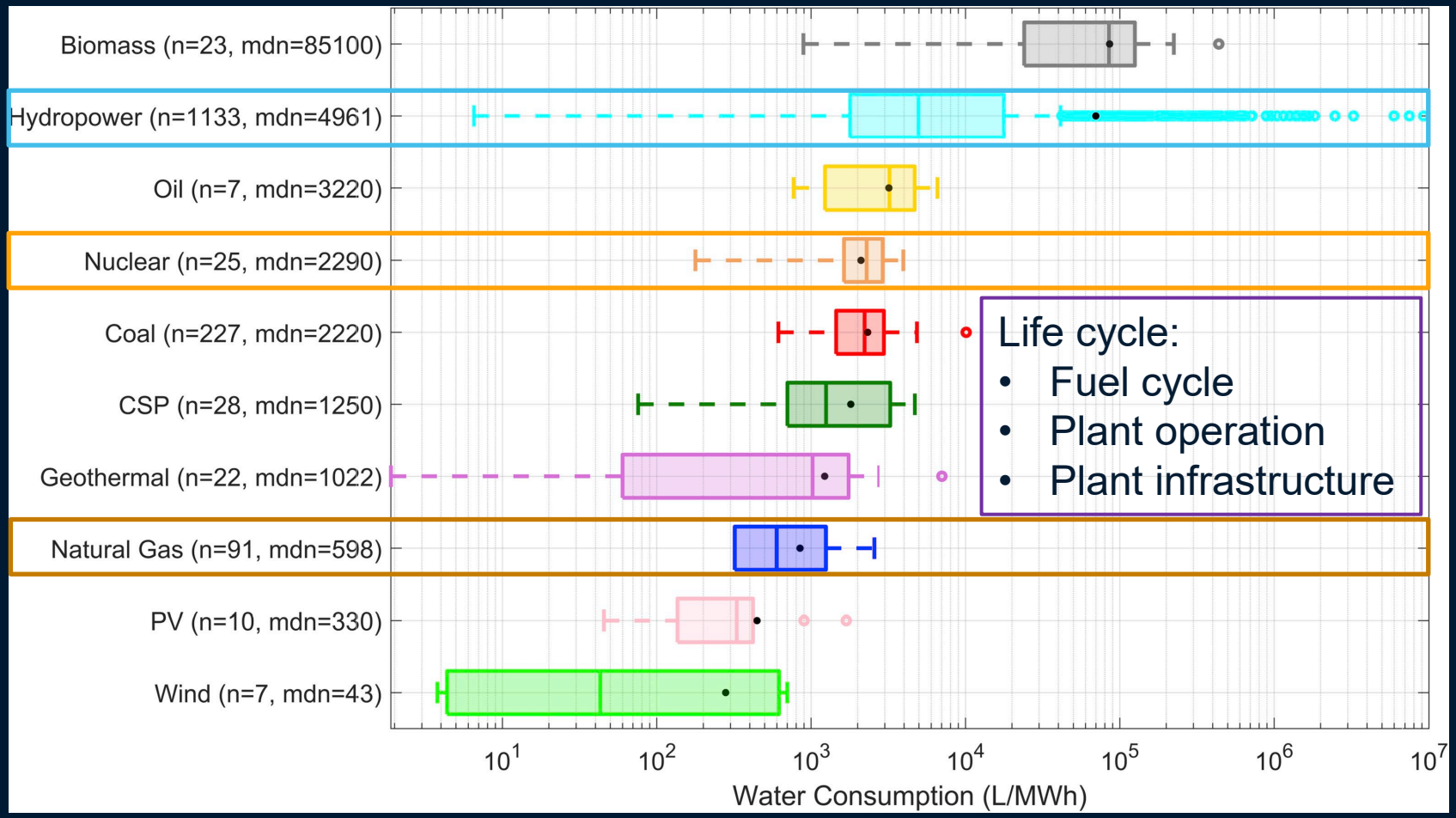
Water in the generation cycle

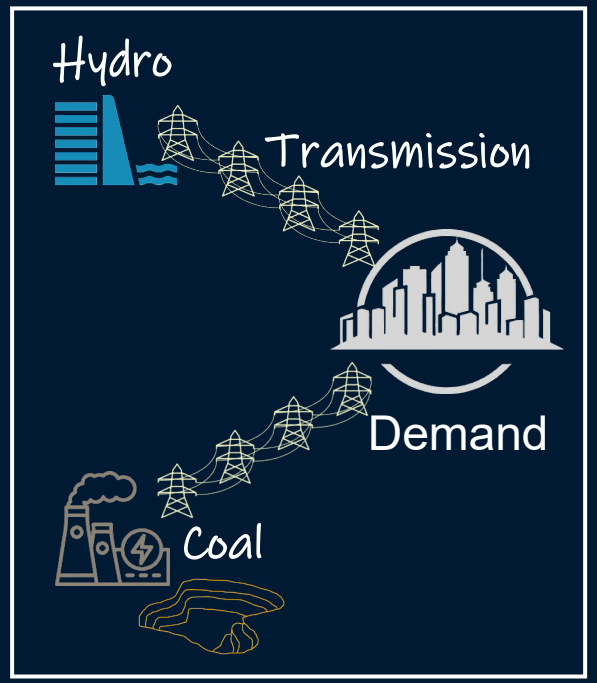


Water use in the “fuel cycle”



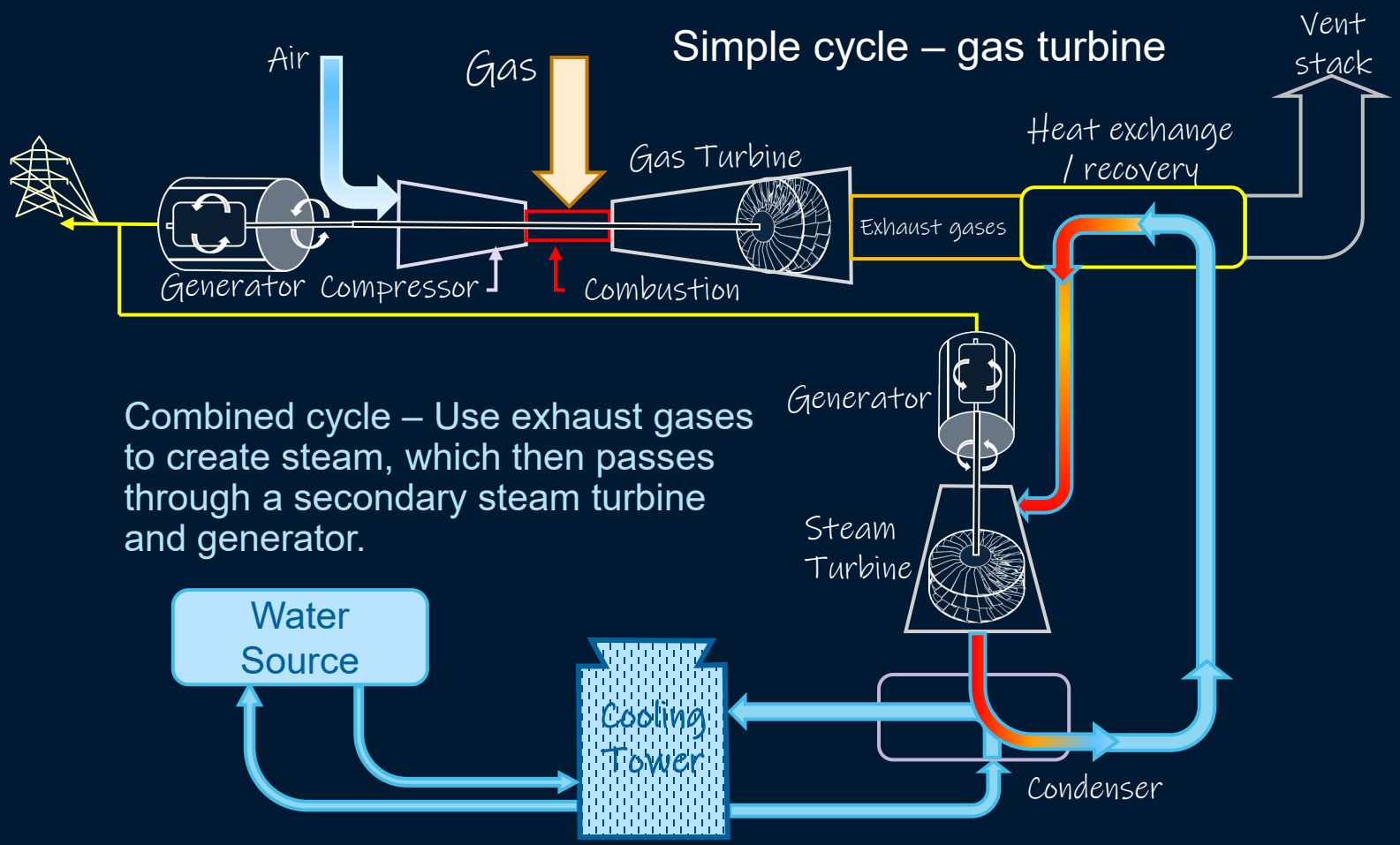
Big Picture “life cycle” water use per MW/hr



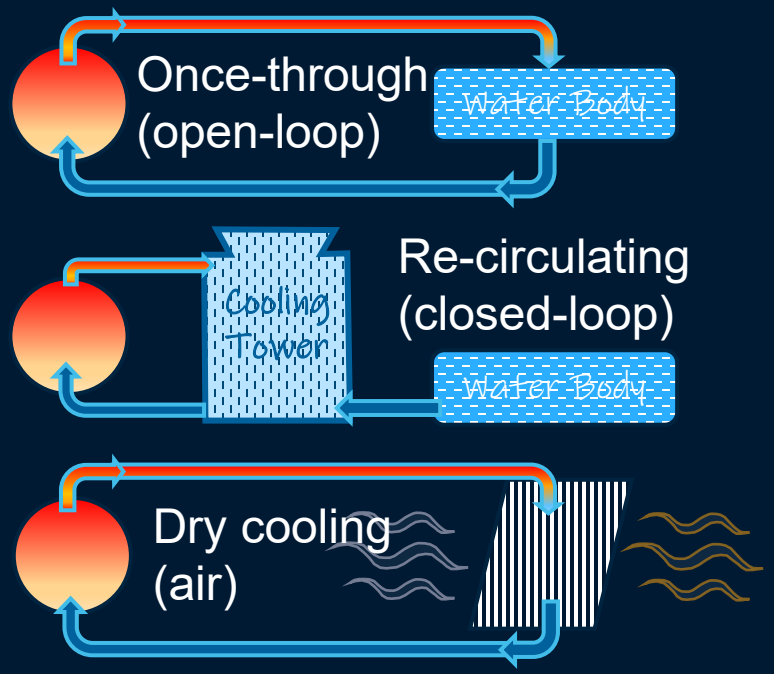


Yi Jin, Paul Behrens, Arnold Tukker and Laura Scherer, 2019. *Water use of electricity technologies: A global meta-analysis.* Renewable and Sustainable Energy Reviews, Vol 115, 2019.

Gas Power Generation

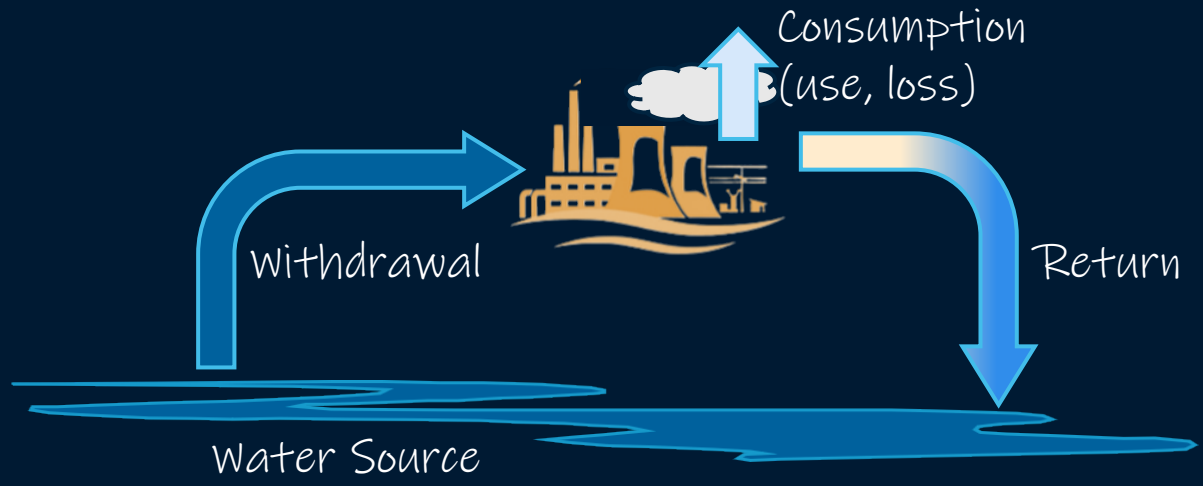


Natural gas (combined cycle) - Cooling



	Once-through		Recirculating		Dry-cooling	
	Withdrawal	Consumption	Withdrawal	Consumption	Withdrawal	Consumption
Upper (ML/GWh)	76	0.4	1.1	1.1	0.0	0.02
Lower (ML/GWh)	28	0.1	0.6	0.5	0.0	0.00

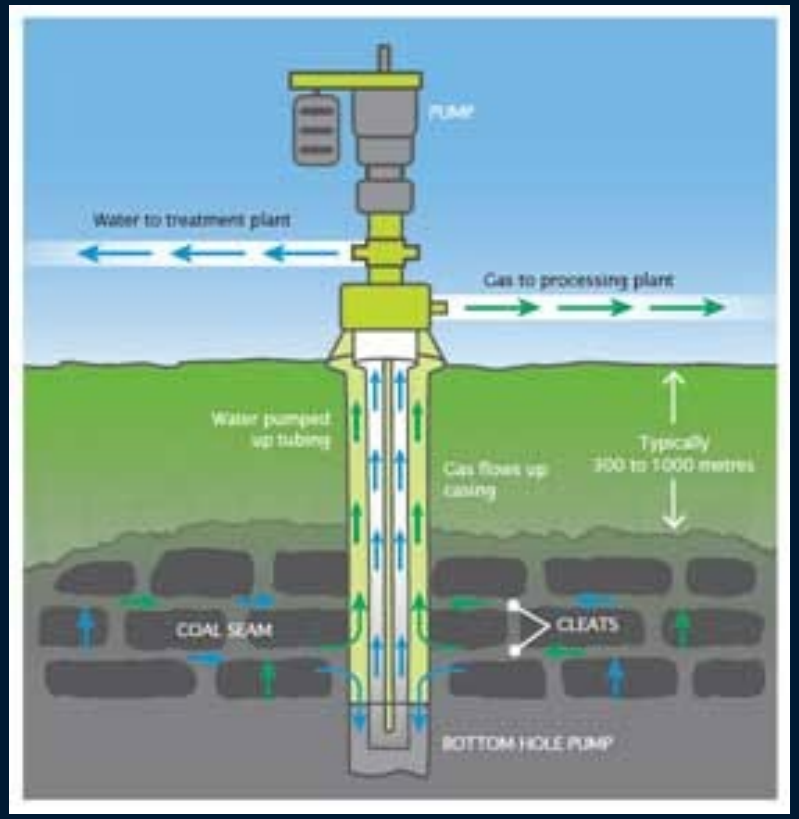
Converted from: Union of Concerned Scientists, How it Works: Water for Natural Gas. https://www.ucs.org/resources/water-natural-gas#sources



Water use - “Fuel source”

aqua-IN

Co-produced water



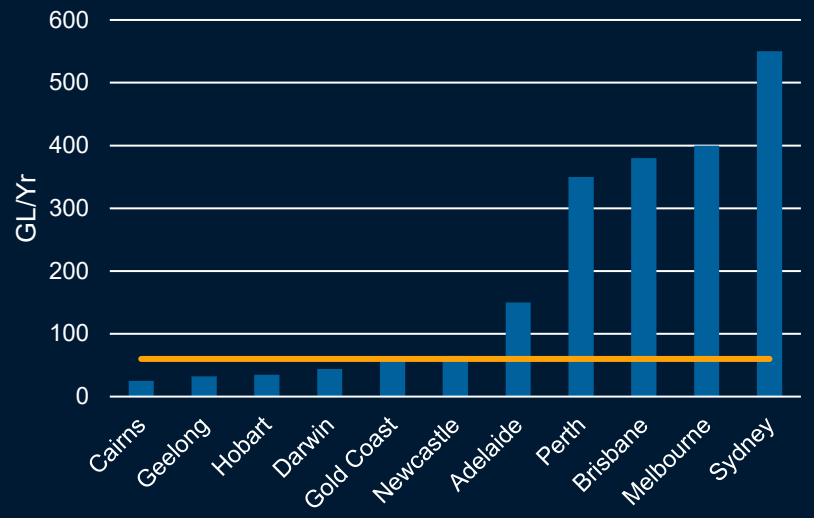
From: Fact sheet - Coal seam gas extraction and co-produced water, IESC, 2014

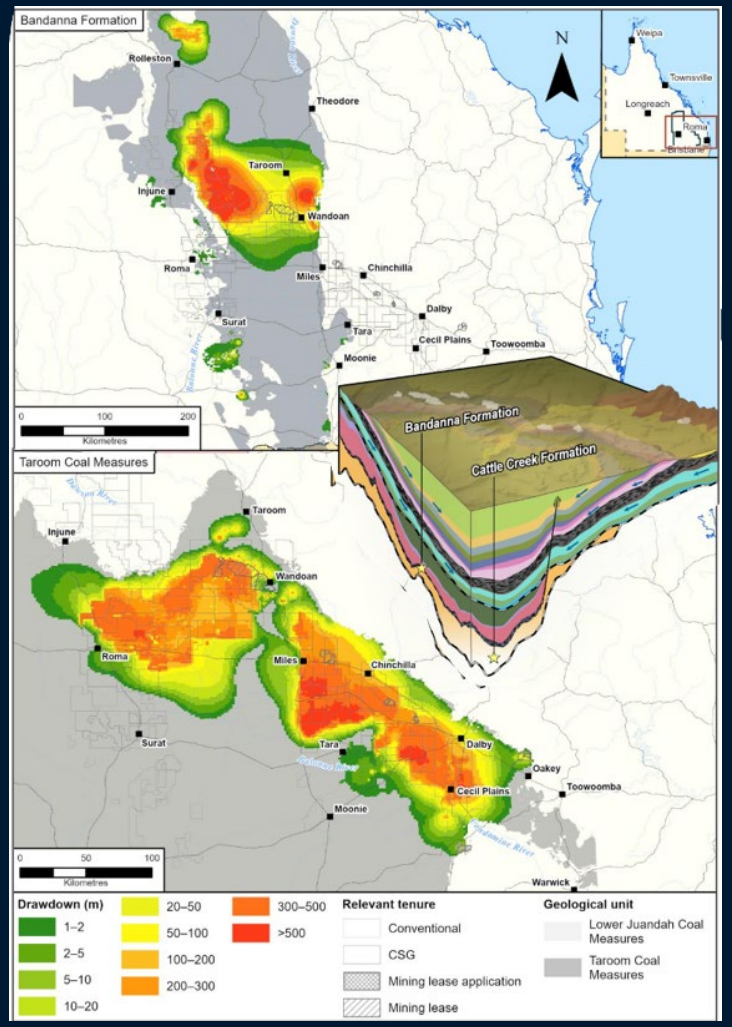
Coal-Seam Gas

Surat and Bowen Basin

- 60-80GL/yr
- Production of life of fields estimated at 1700GL

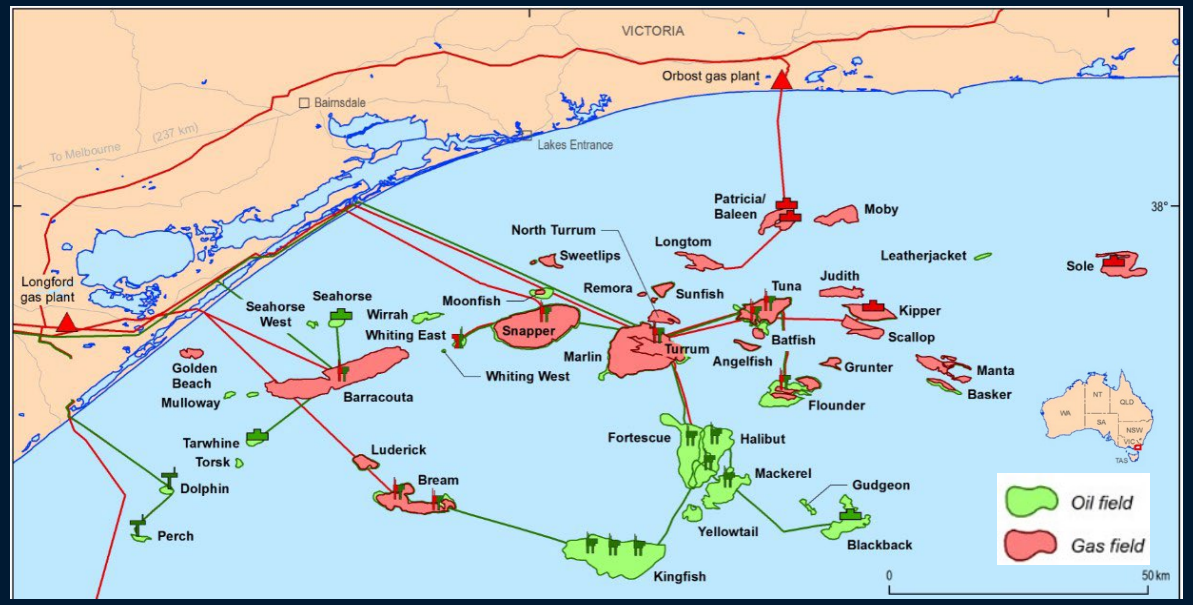
Underschultz et al., 2018 Coal seam gas associated water production in Queensland: Actual vs predicted.

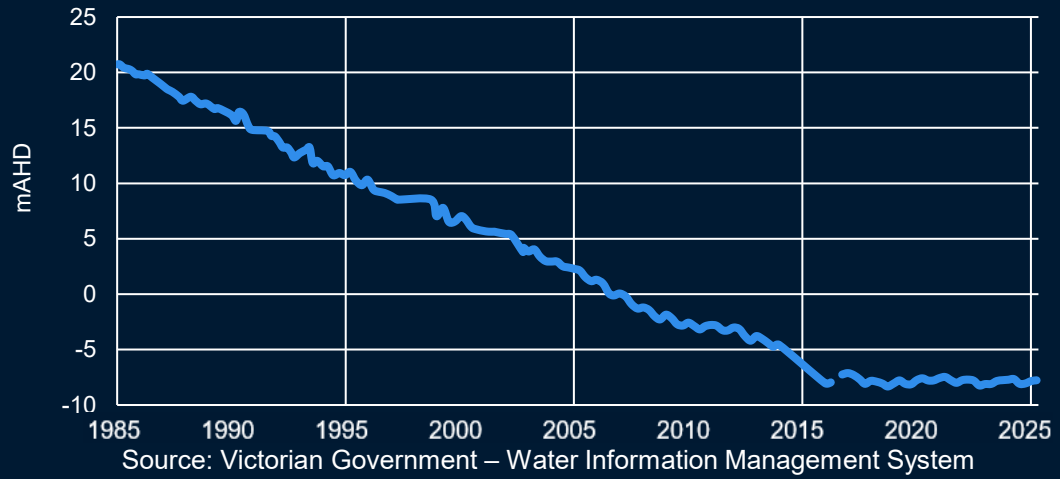




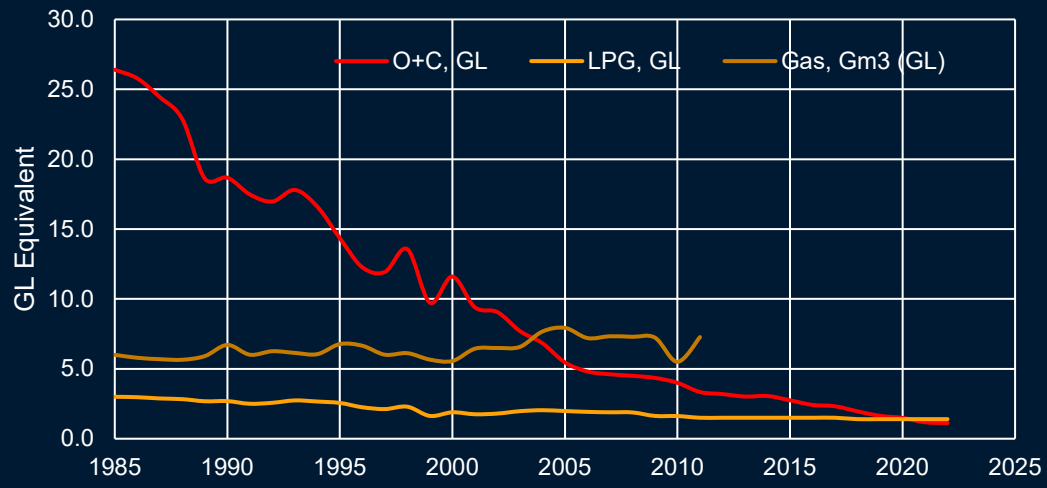
Adapted from OGIA, 2025: Underground Water Impact Report 2025. for the Surat Cumulative Management Area

“Conventional” Gas production





Source: Victorian Government – Water Information Management System

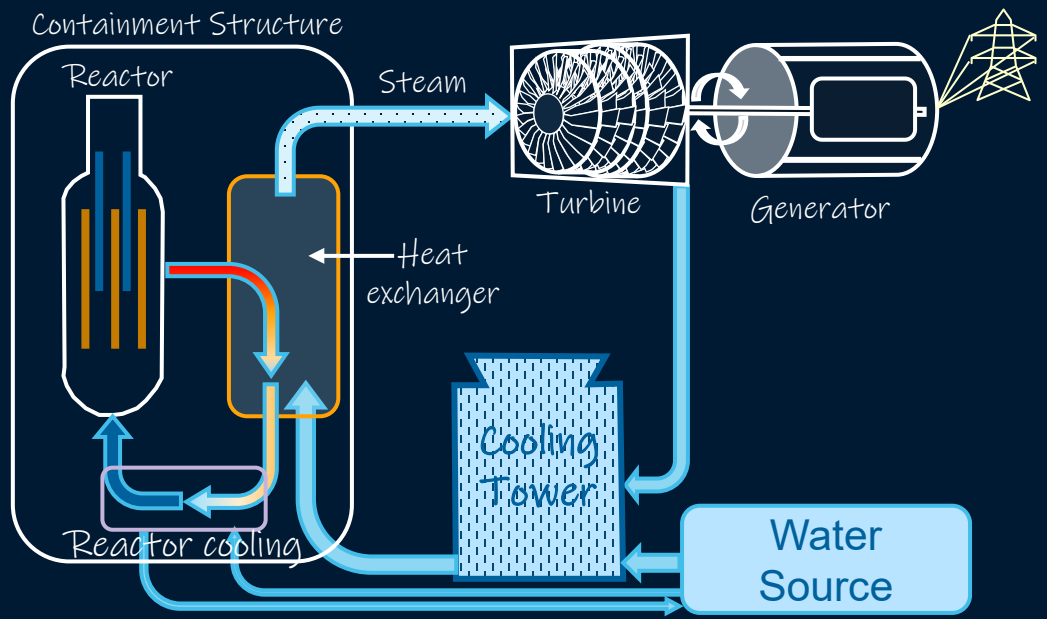


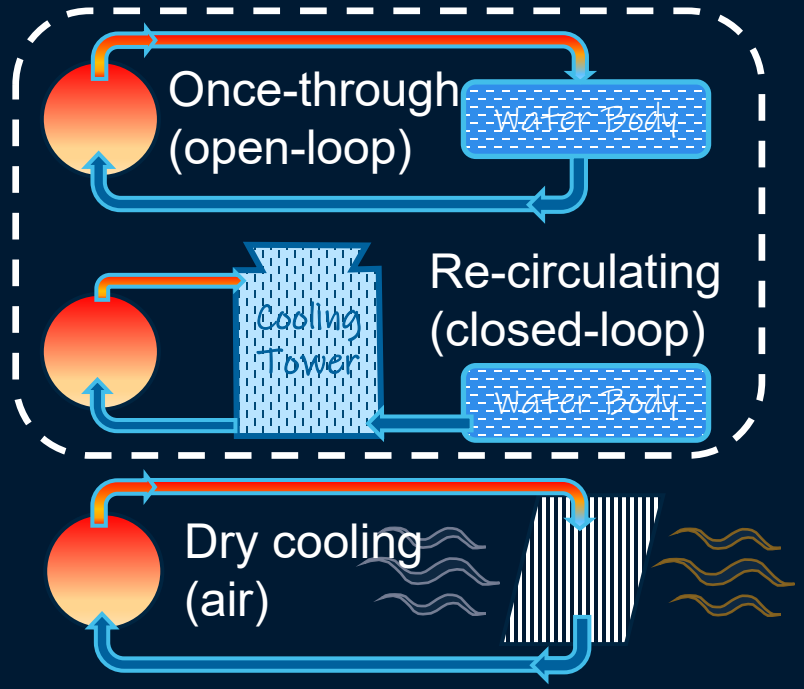
Statistics show at least 40GL (equivalent) being extracted, of which approx. 70% is co-produced water.

Sources:

- Victorian Government - Victoria’s Minerals, Petroleum and Extractive Industries – Annual Statistical Review
- GEOSCIENCE Australia: Australian Petroleum Statistics (All Victorian Basins)
- AI interpolation for gas data from 2011 to 2022

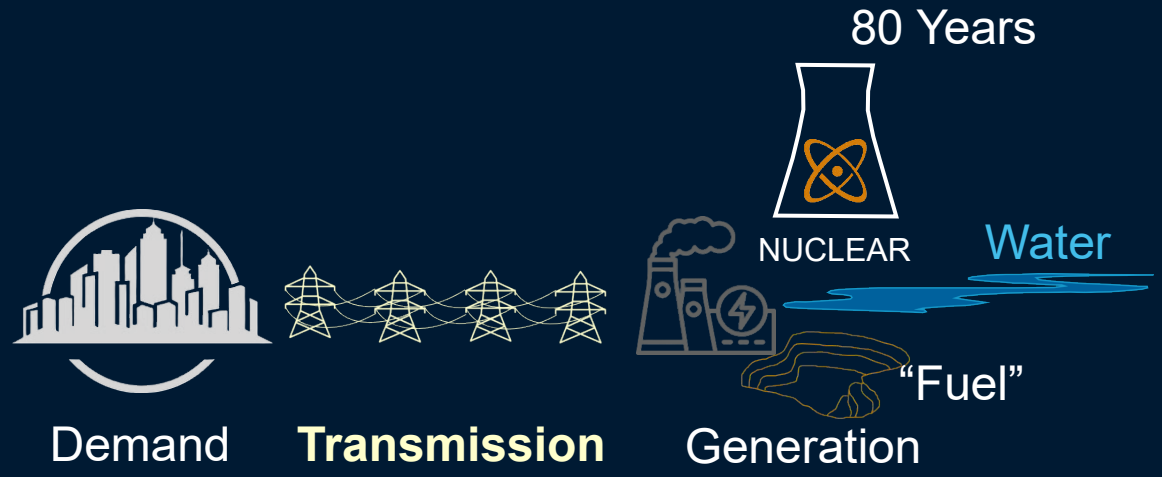
Nuclear power generation





Nuclear Energy Policy – case study

“Australian nuclear energy proposals, water availability and acquisition options”, Triple Helix Consulting, April 2025.

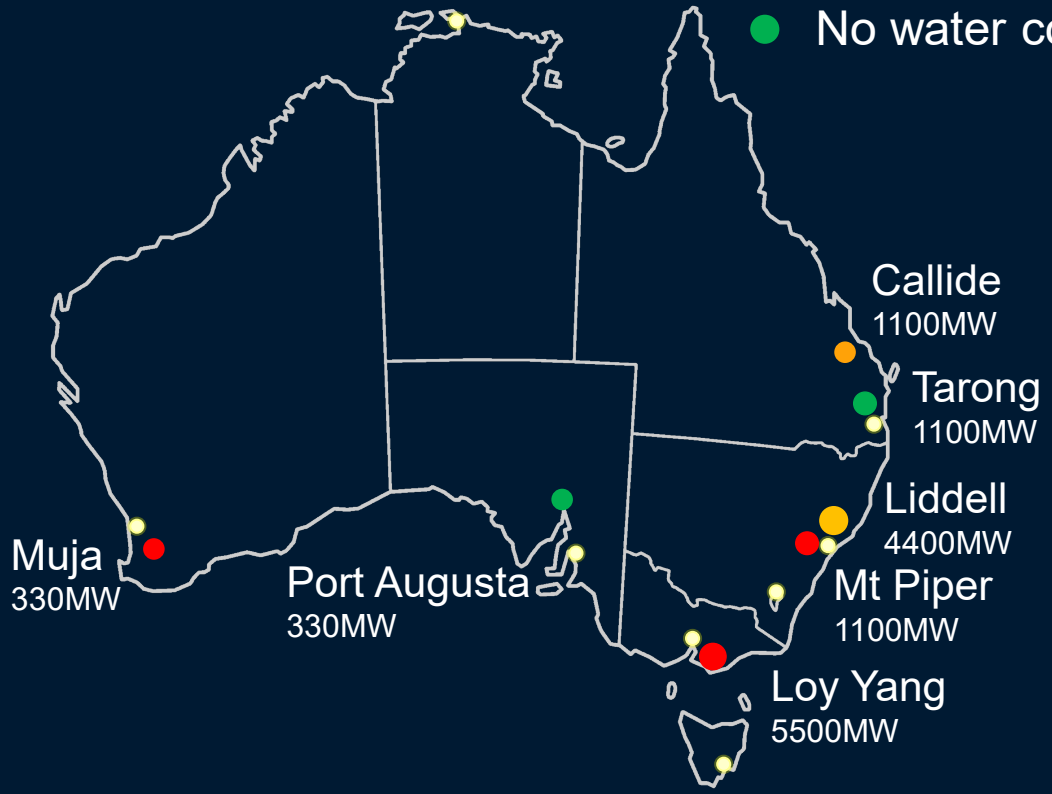


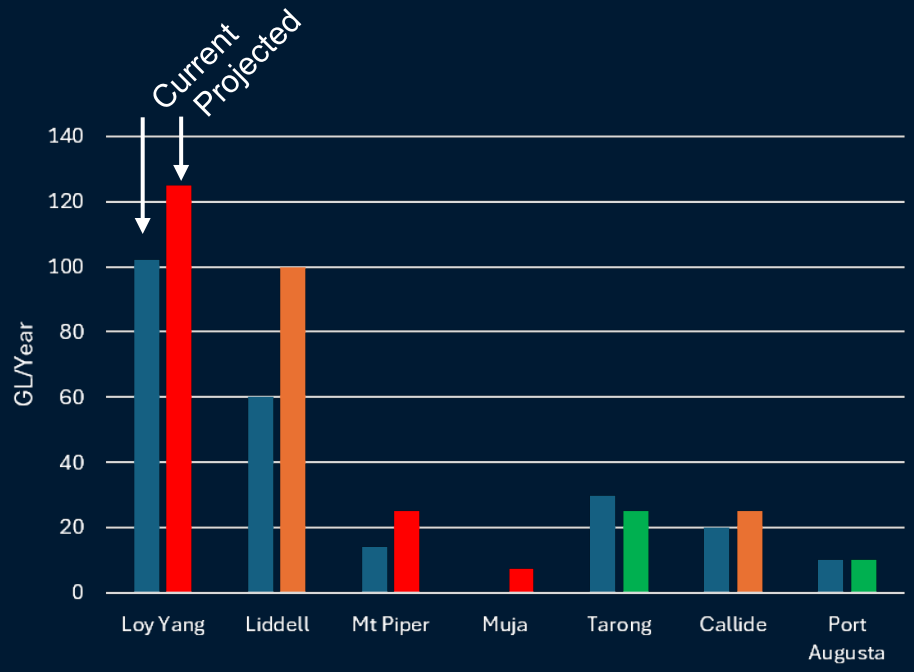
Assumptions

- Application of existing best practice technology
- Current projections of climate change impacts
- Existing water sources

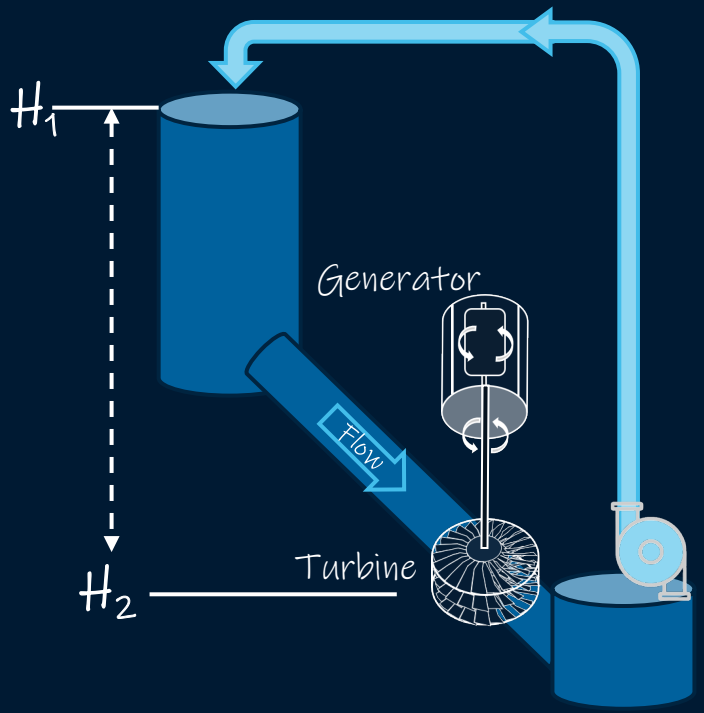
Nuclear Energy Policy – case study

- Current constraints on water
- Future constraints (climate variability and change)
- No water constraints

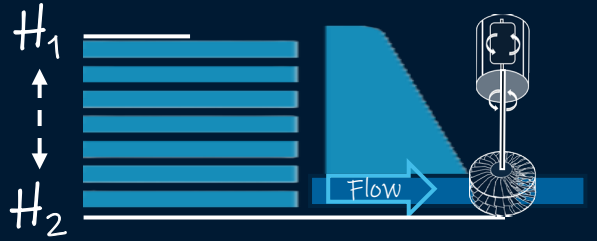




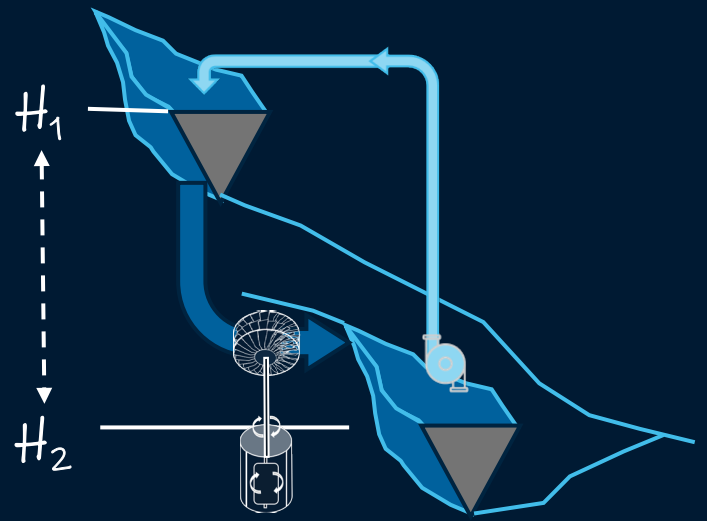
Hydro-power – large scale



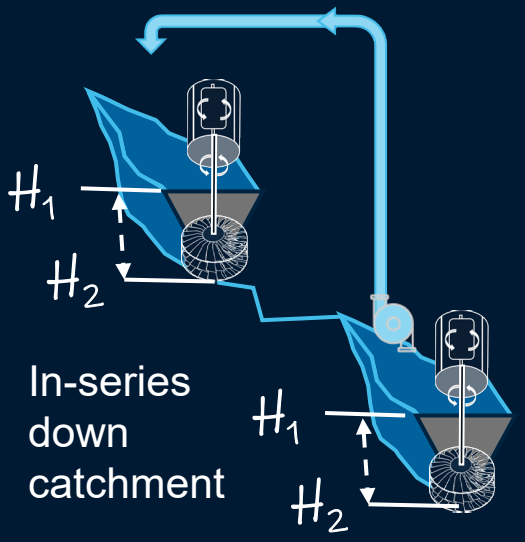
Pumped Hydro



Built into dam structure



Between catchments



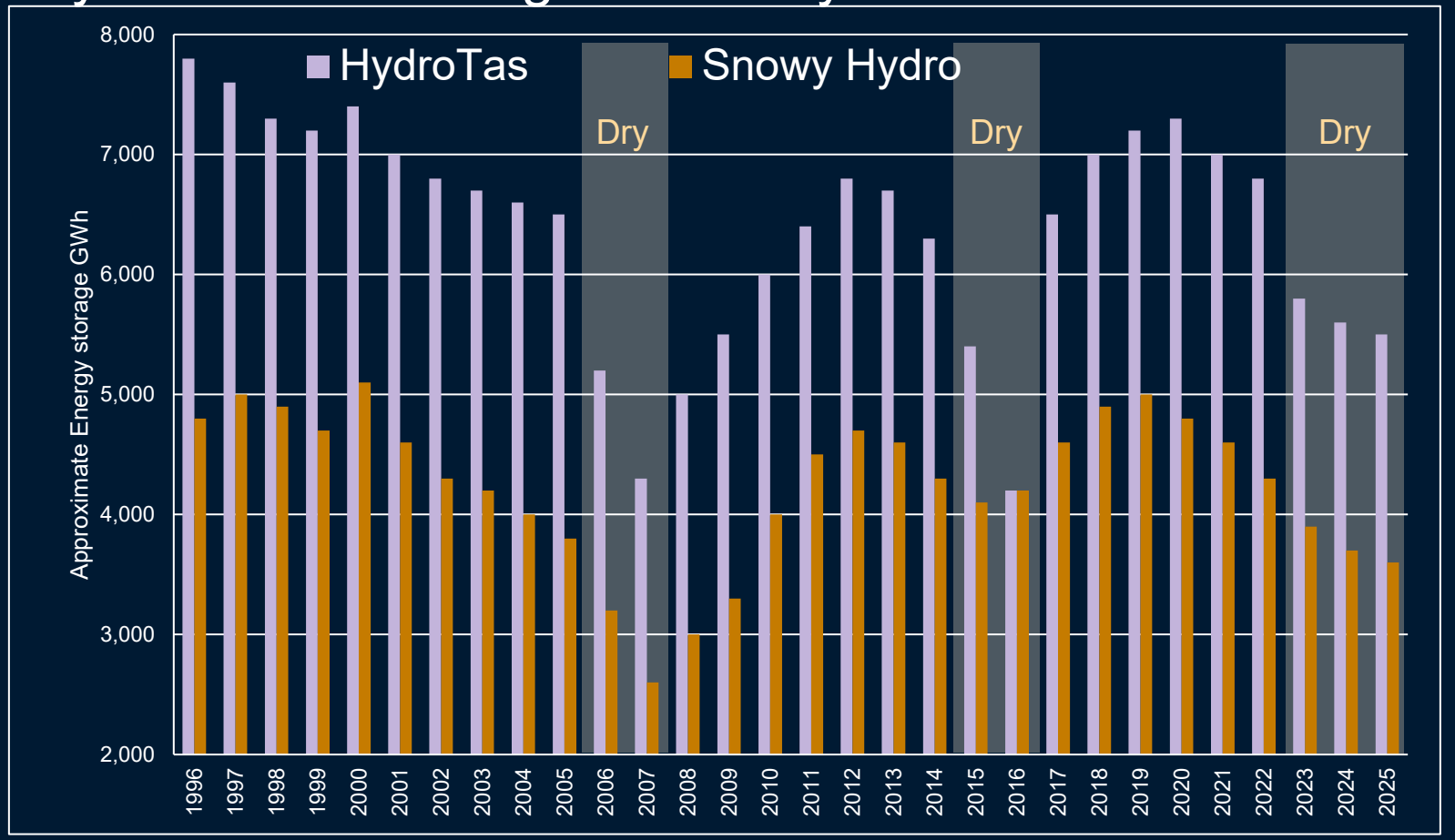
In-series down catchment

Hydro power challenges

Large Storage impacts

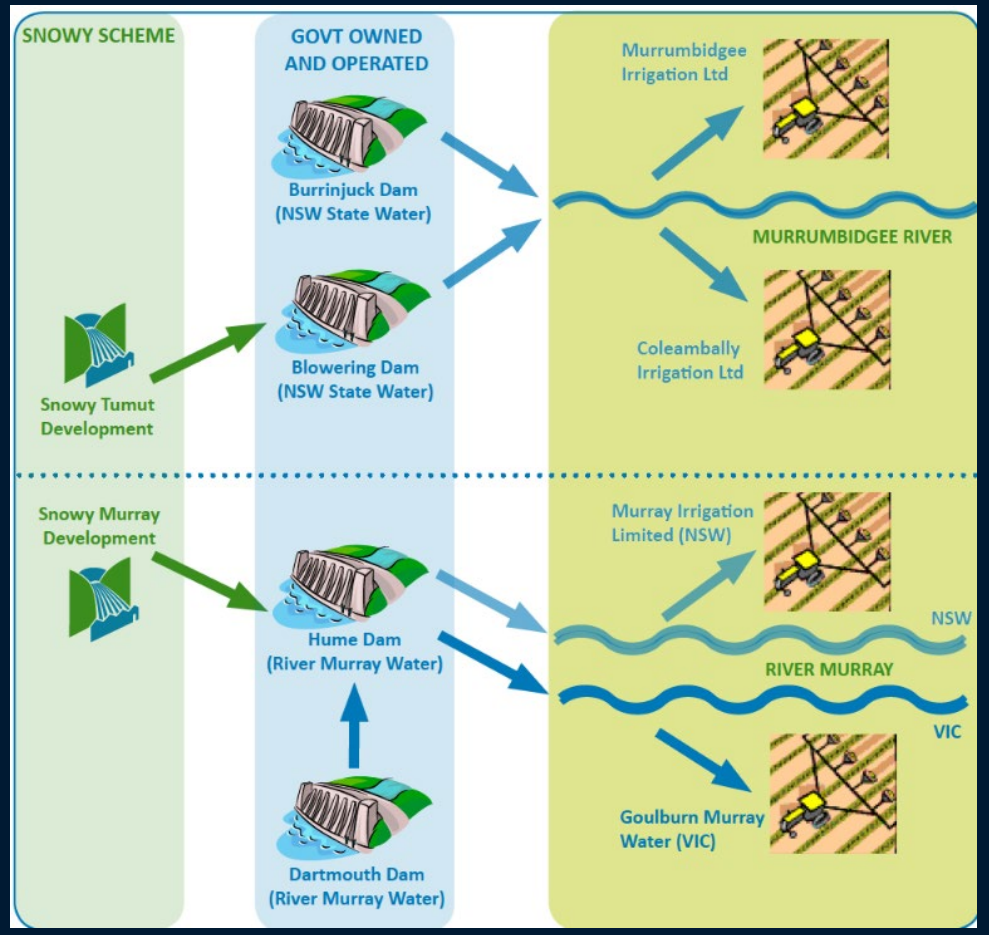
- LOSSES
  - Increased evaporation
  - System losses
- FLOW
  - Magnitude
  - Timing
  - Event duration
- ECOLOGICAL
  - Sediment transport
  - Downstream flow regimes
  - Fish migration and spawning
  - Floodplain disconnection
- SOCIAL
  - Reshape entire river basins
  - Social displacement

Hydro Power Storage variability



Source: AI summary from available HydroTas and SnowyHydro data. Individual year data may be extrapolated from available information using trend data and not be actual annual potential output.

Policy Challenges



Multiple Priorities

Priorities (example – Snowy-Hydro)

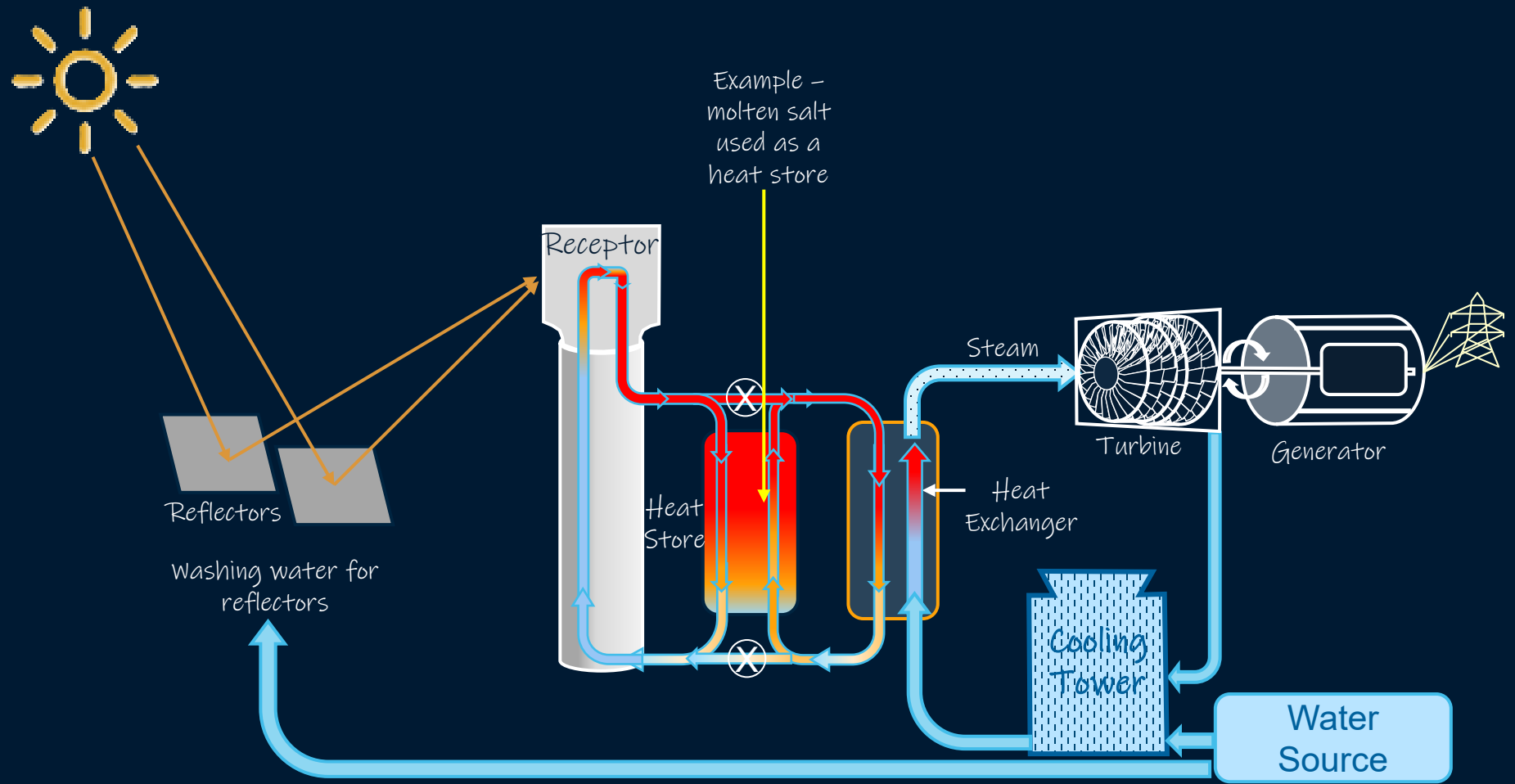
- Environmental flows
- Consumptive uses
- Hydropower generation
- Cultural Water

Policy Challenges

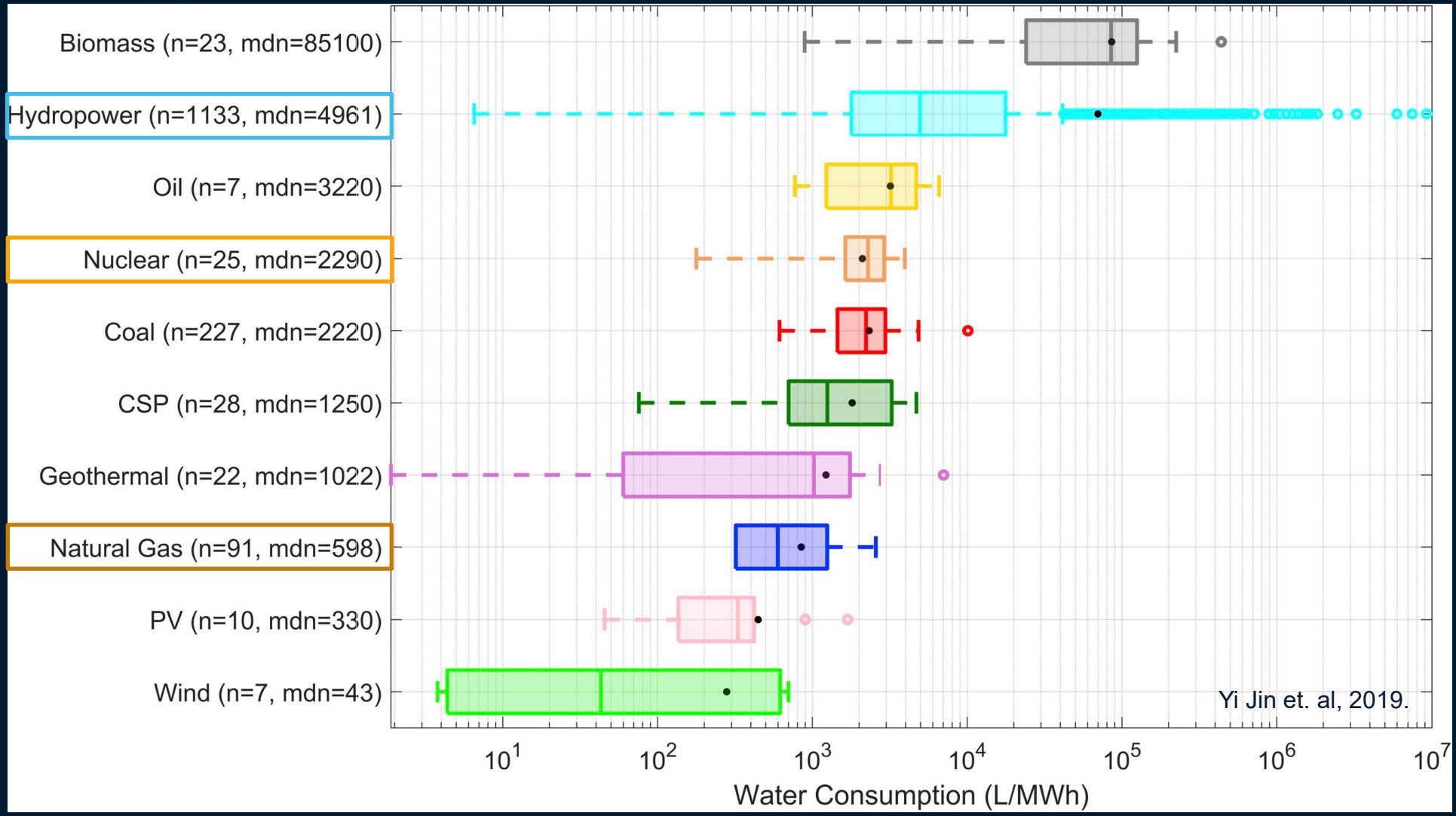
- In extreme conditions, where power demand is high, ensuring that the policy framework for both the use of water AND the overall energy system is clear is critical.

Not in presentation – for reference

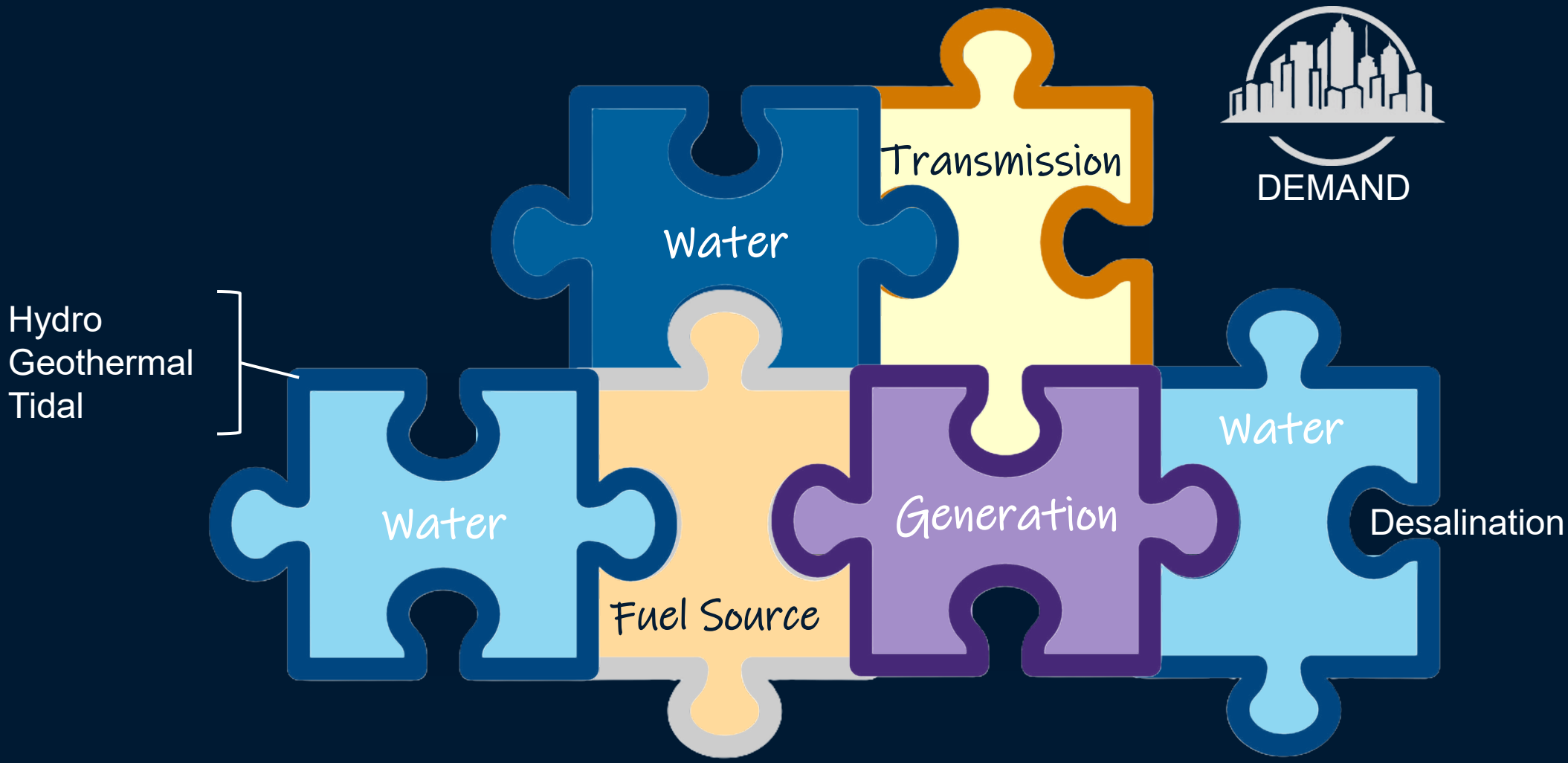
Concentrating Solar Power



Big Picture “life cycle” water use per kW/hr



Policy Framework



Policy Nexus

Competing DEMAND for water volume both within the FUEL CYCLE and GENERATION

- **increasing need for water to meet Environmental flows**
- **other consumptive uses**
- **cultural Water**

Competing TIMING of water extraction (and return)

- **waterway management is increasing the constraints on WHEN water can be taken from a system on a seasonal and potentially even shorter time periods**

Reducing SECURITY of water availability (in some cases)

- **Eg. changing climate**

In energy generation decision, water cannot be considered as part of the **IMPACT** assessment but must be considered in the **POLICY** decision making.

Some key references

(there are many references out there – search Energy-Water Nexus and you will see the variety of papers, research papers and opinions. The ones listed below are some that were used in preparing data in this presentation, but are by no means fully representative of all the information that is our there)

- Yi Jin, Paul Behrens, Arnold Tukker and Laura Scherer, 2019. *Water use of electricity technologies: A global meta-analysis.* Renewable and Sustainable Energy Reviews, Vol 115, 2019.
- Australian Government, Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2025: *Australia's emissions projections 2025*
- Australian Government, Department of Climate Change, Energy, the Environment and Water, August, Canberra. *Australian Energy Statistics - Update Report 2025.*
- Triple Helix Consulting, April 2025. *Australian nuclear energy proposals, water availability and acquisition options.*
- Radcliffe, John C. *The water energy nexus in Australia – The outcome of two crises.* Water-Energy Nexus Journal. Water-Energy Nexus | Journal | ScienceDirect.com by Elsevier
- Australian Conservation Foundation. *Nuclear will cost us more than time: an analysis of the waste and water problem* https://assets.nationbuilder.com/auscon/pages/55795/attachments/original/1742264061/ACF_Nuclear_WaterAndWasteAnalysis.pdf
- Union of Concerned Scientists, How it Works: Water for Natural Gas. https://www.ucs.org/resources/water-natural-gas#sources

Introducing Aqua-In Pty Ltd

Aqua-In, led by Chris McAuley, delivers 30 years of experience in water sector governance and consulting in Australia and Europe, across strategic guidance, capability training, and advancing water management.

Aqua-In Pty Ltd

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