

Interim results on water use in H2 production

Briefing to the Australian Hydrogen Council
19th October, 2022

NET ZERO AUSTRALIA



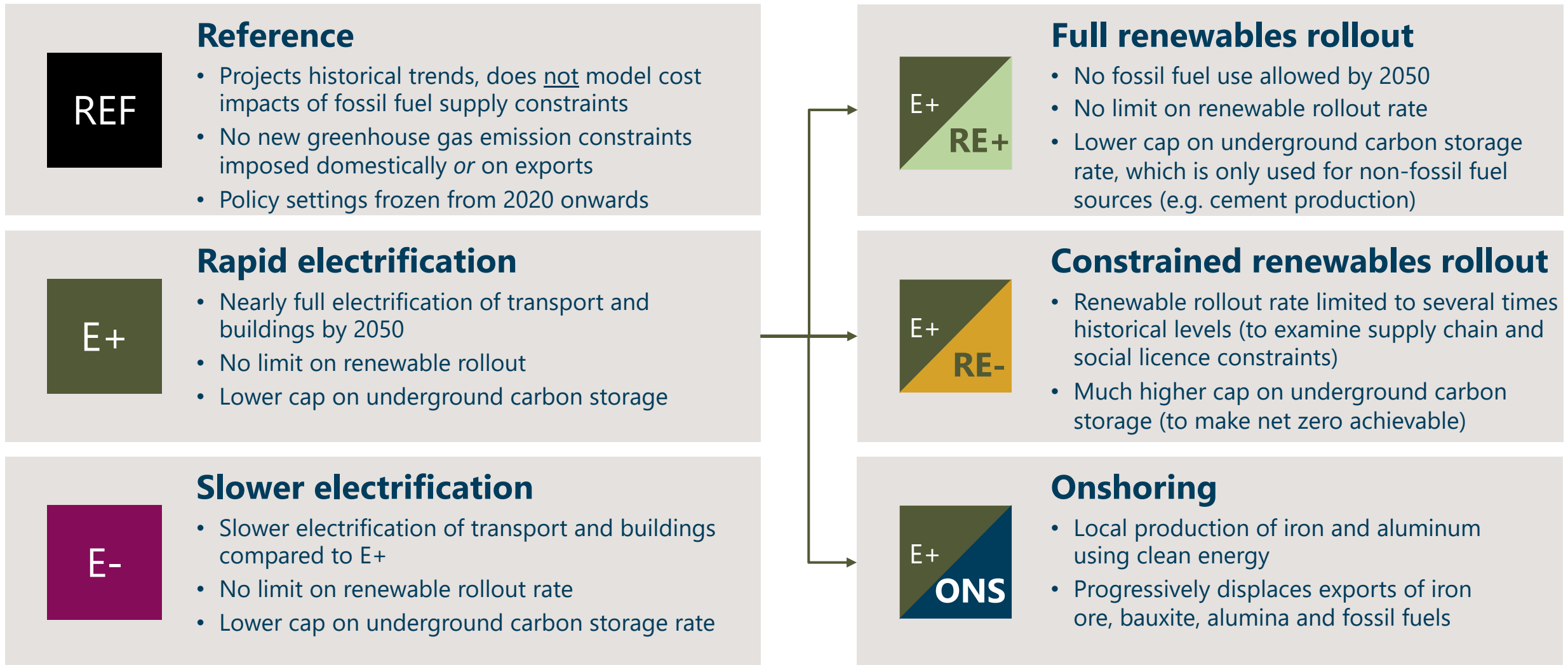
Background: our interim energy system results

Full details at: <https://www.netzeroaustralia.net.au/>

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We modelled six varied scenarios



The Reference Scenario has *no emissions objective*. All other Scenarios are 'net zero' for both the domestic and exported emissions separately, and start from current emissions, and track in a line to net zero emissions by 2050 (domestic) and 2060 (export). None of the scenarios are forecasts. 3

About the study

What *does* this study do?

Illustrates pathways to net zero to help everyone appreciate:

- scale, complexity and cost
- different pathways
- how we all might contribute
- how change could be managed.

What *doesn't* this study do?

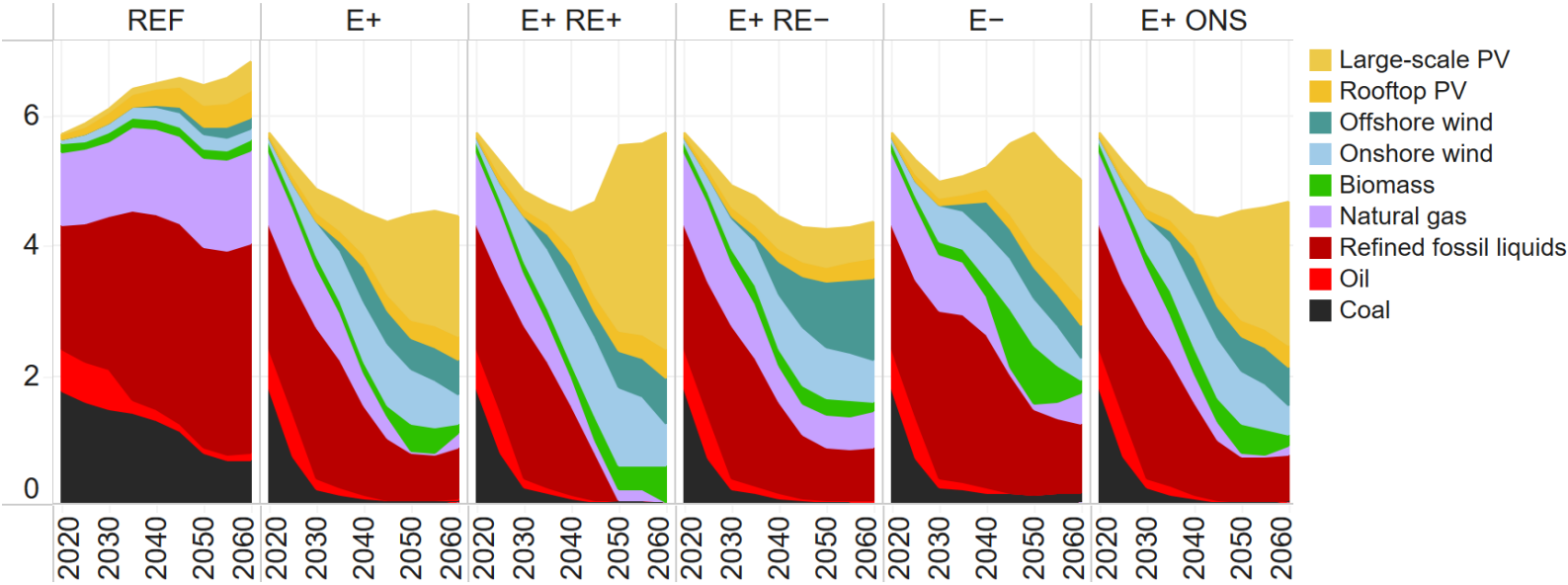
- predictions or recommendations
- consider fossil fuel supply constraints
- costs of inaction on climate change
- model demand for clean energy exports.

Renewables will produce most or all domestic energy by 2050 (Graph 1 of 2)



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Projected domestic primary energy (Exajoules/year)



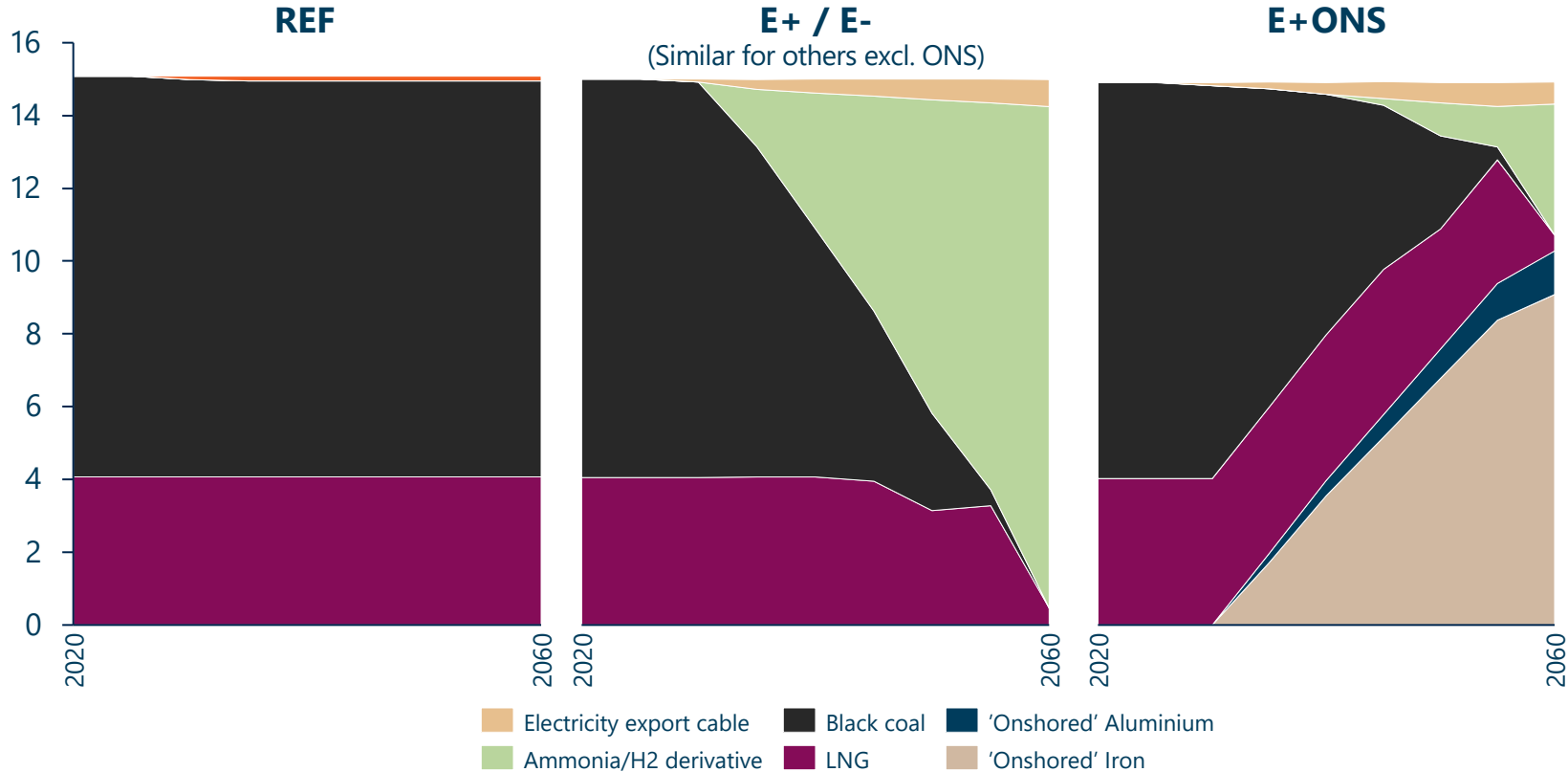
- **Solar and wind** will be the main sources of renewable energy for domestic use
- The required **rate at which renewable energy capacity is added** will be much higher than historical levels
- **Natural gas and oil products** will play a significant role in all Scenarios (with CCUS), except if they are not permitted (which is modelled in E+RE+).



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Clean energy can replace our fossil fuel exports

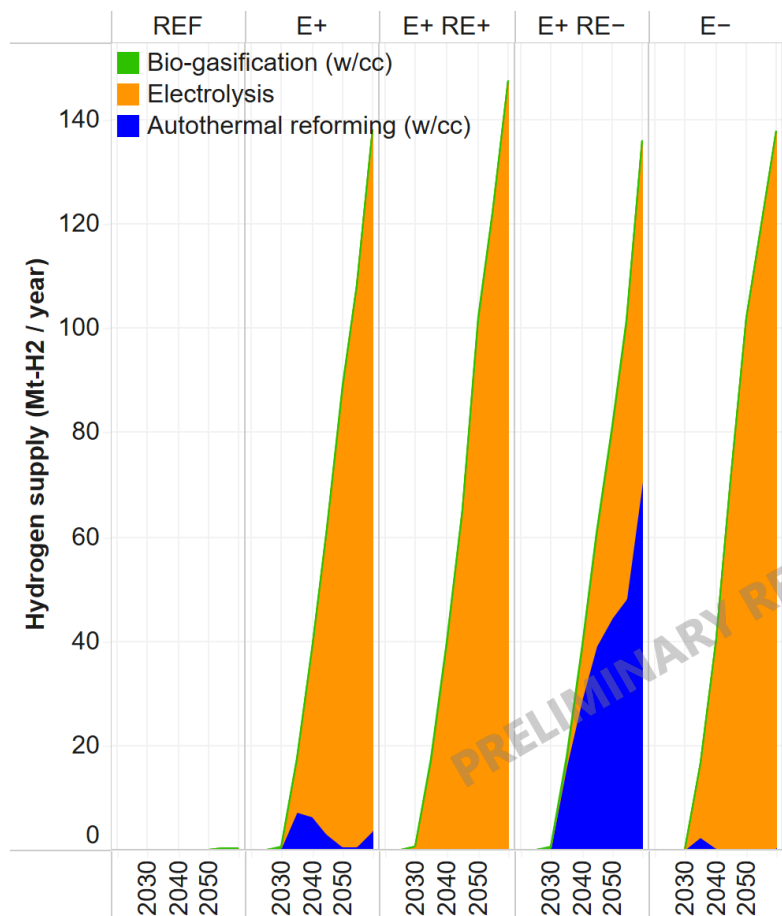
Energy exports (Exajoules/year)



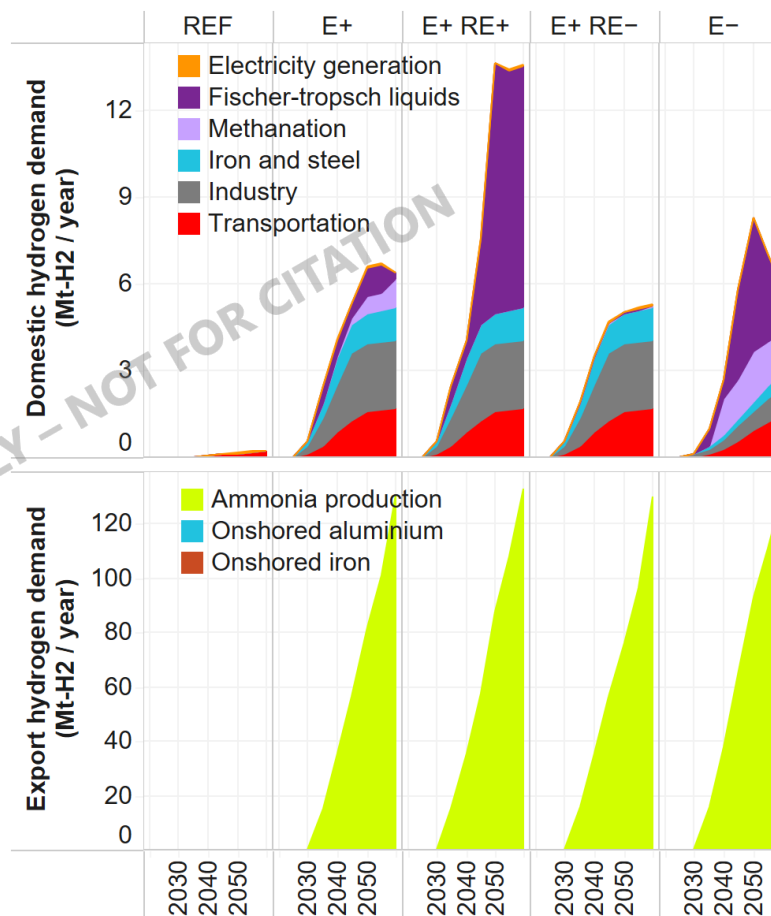
- Australia has the resources to build a new **clean export industry** by:
 - producing **clean energy carriers**
 - **'onshoring'** the processing of minerals using clean energy.
- **'Green' hydrogen** from solar is projected to be the **largest clean energy export**; 'Blue' hydrogen could contribute a major share if there are renewable build rate limits and high rates of carbon storage.

Most Australian hydrogen will be produced through electrolysis and exported

Projected hydrogen supply, by technology (Mt-H₂/year)



Projected hydrogen use, by sector/technology (Mt-H₂/year). Note difference of 10x in y-axis scale



KEY TAKEAWAYS

- More than 140 Mt/year of hydrogen produced to substitute current fossil energy exports with clean carriers
- Haber-Bosch ammonia production assumed for exports
- Electrolysis dominates hydrogen production capacity in most scenarios
- Blue hydrogen supplies a small early share in E+ and E-, none in E+RE+, and substantial share in E+RE- due to increase in maximum CCUS capacity

Early downscaling

E+ in 2050, solar and wind with transmission

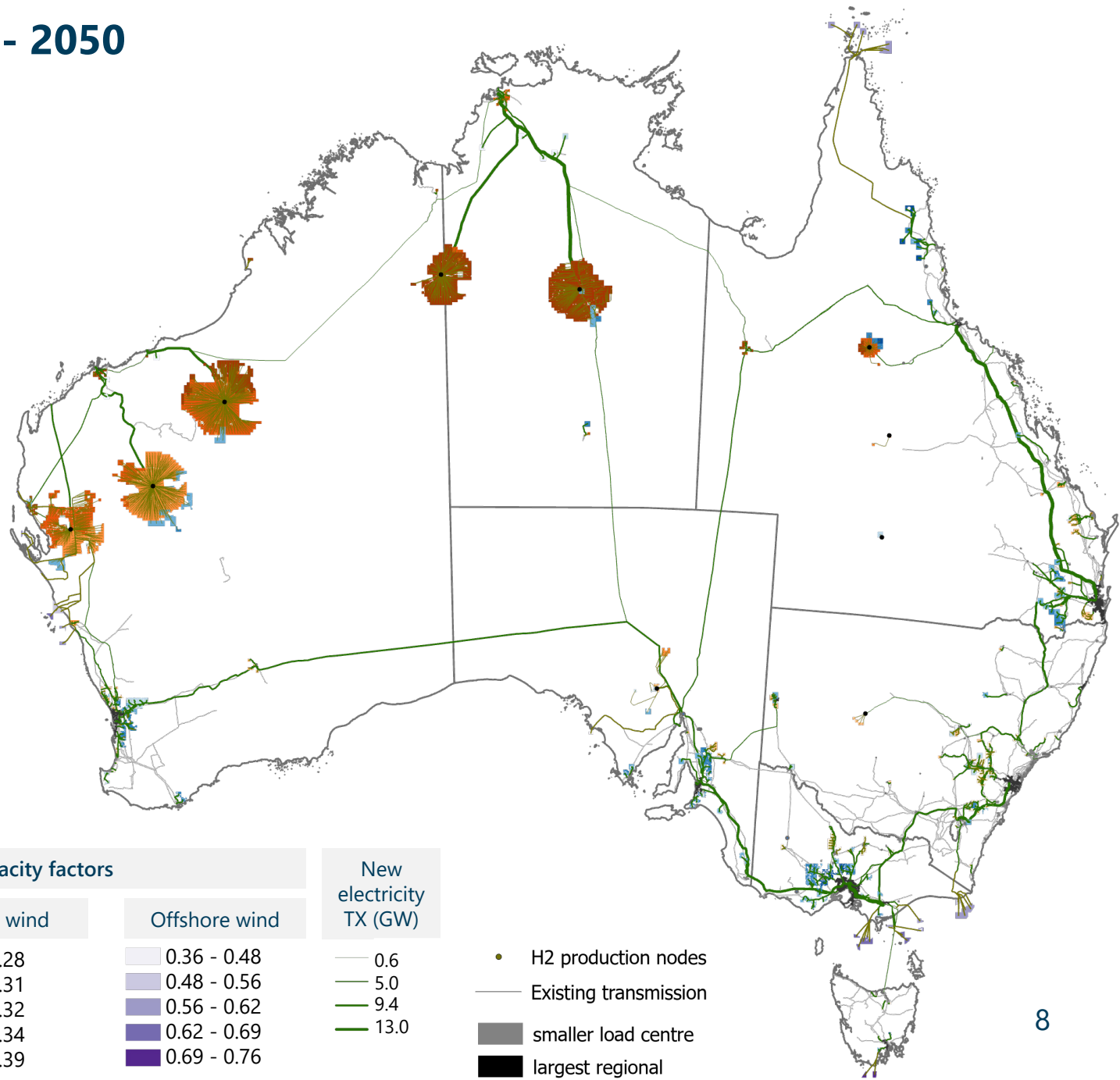
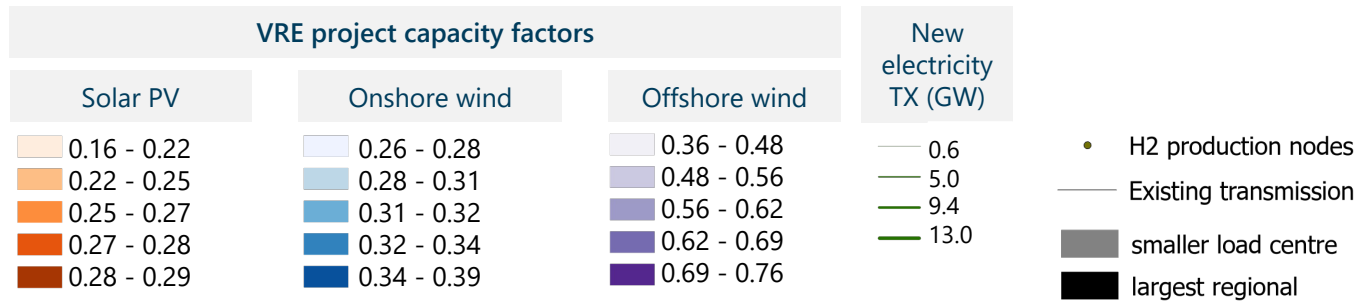
Net Zero Australia projects:

- 1.9 TW solar PV (2,242 projects)
- 132 GW onshore wind (194 projects)
- 42 GW offshore wind (36 projects).

Electricity generation is about **40x the capacity of the National Electricity Market** (in 2022).

NATIONAL MAP - 2050

INDICATIVE ONLY
Purpose of downscaling is to show scale and pace of change, not to identify specific projects



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Method

Identify analysis type (consumption) and key technologies

electrolysis, haber-bosch, ATR, biogasification, mining/extraction, FF generation, DAC



Identify step wise (not lifecycle) energy-water conversion factors for technologies

e.g. RO+EDI water consumed per MW used by electrolysis with PEM air cooling



Calculate water demand by scenario and energy activity

e.g. water demand from electrolysis in E+ scenario in QLD for export



Identify water sources to meet estimated water demand

e.g. All additional water needs will be met with desalination (possible exception Ord river in NT)



Map water demand by scenario and source at state and regional level

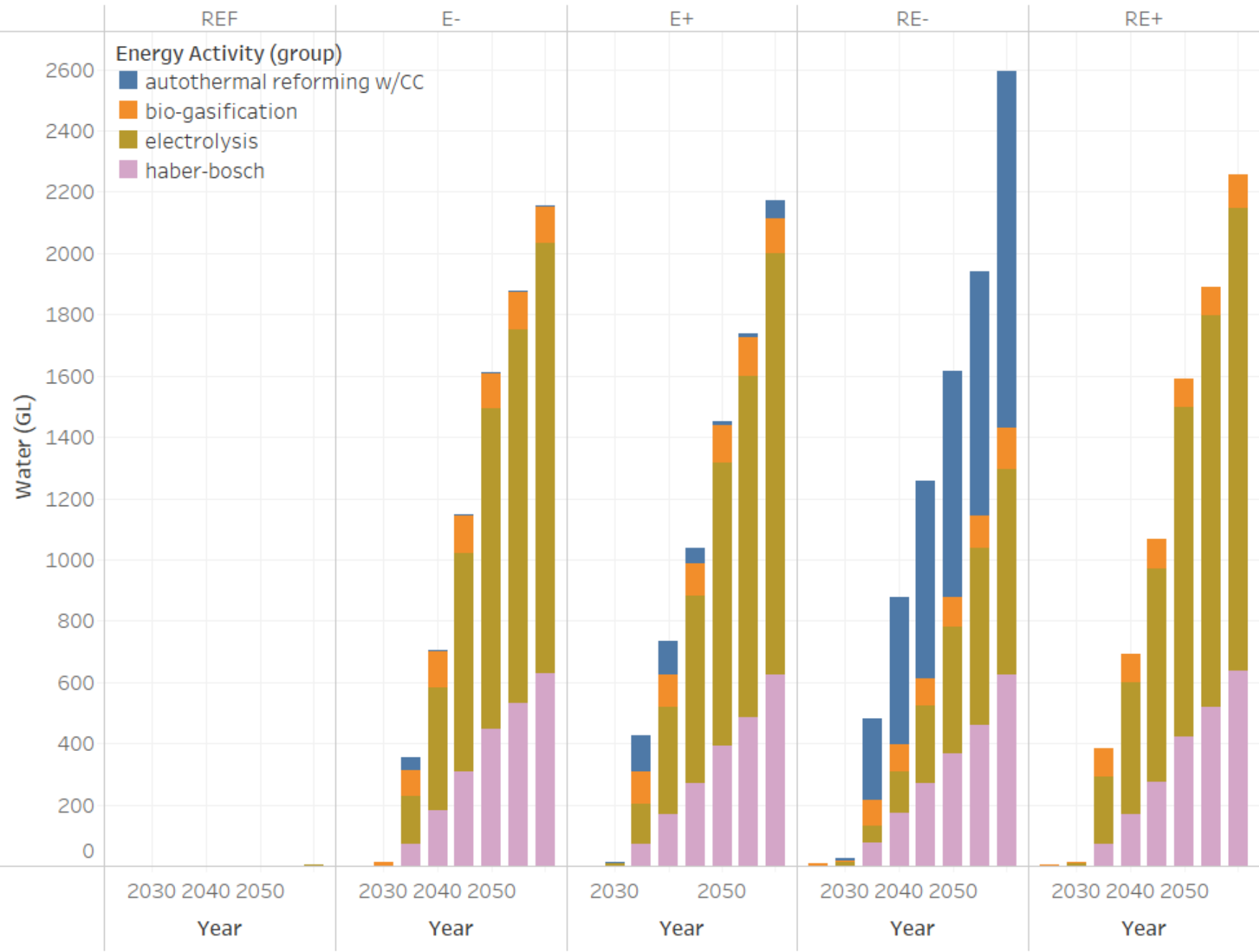
e.g. Track freshwater and desalinated water demand in NZAu regions and in WA



Specify brine management, desalination plant and pipeline characteristics and approximate locations

e.g. Document/map desalination plant, pipeline and brine management characteristics

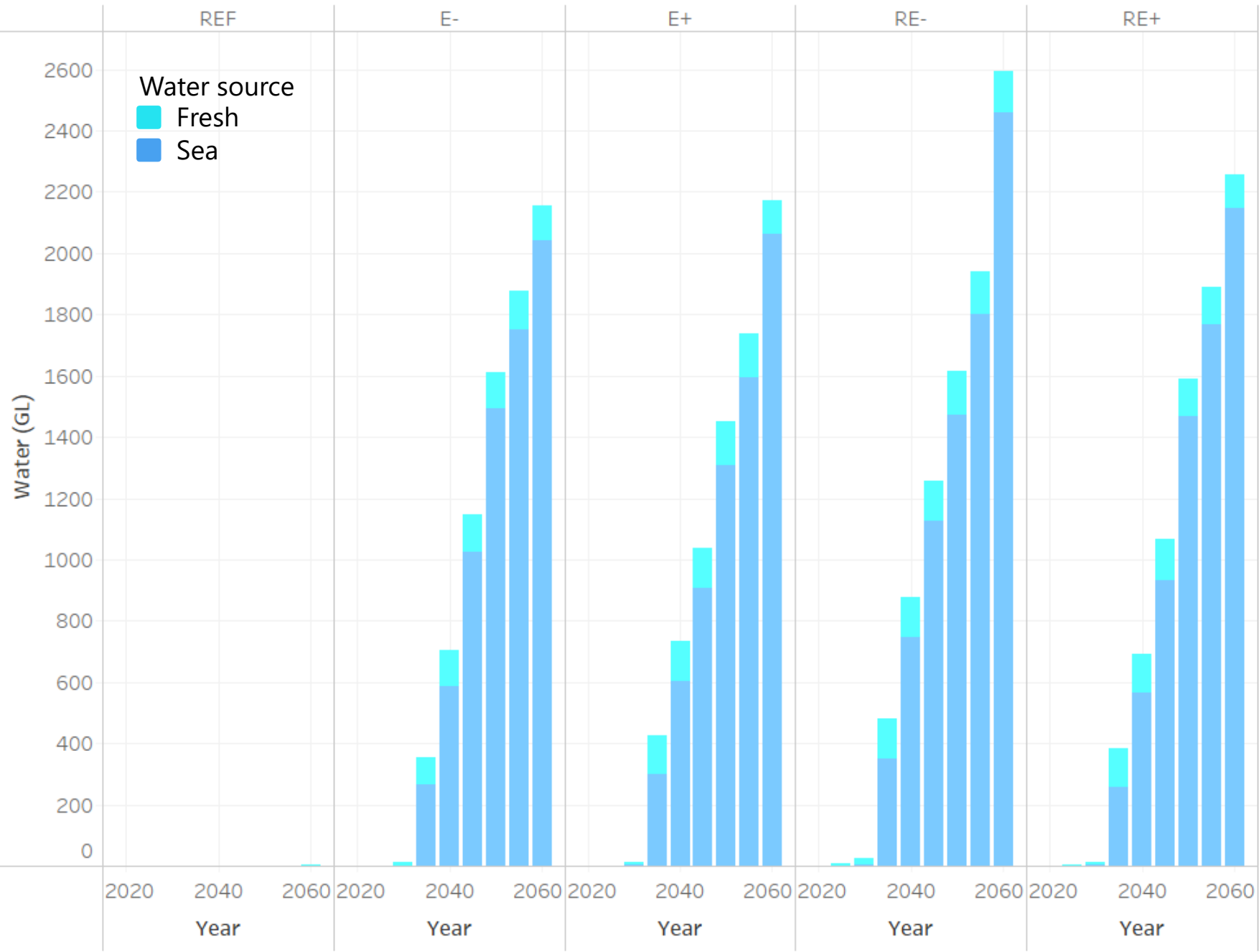
Total water demand (GL) by energy activities



H2 Water demand by energy activity:

- Main difference between scenarios is amount of autothermal reforming with carbon capture in RE-

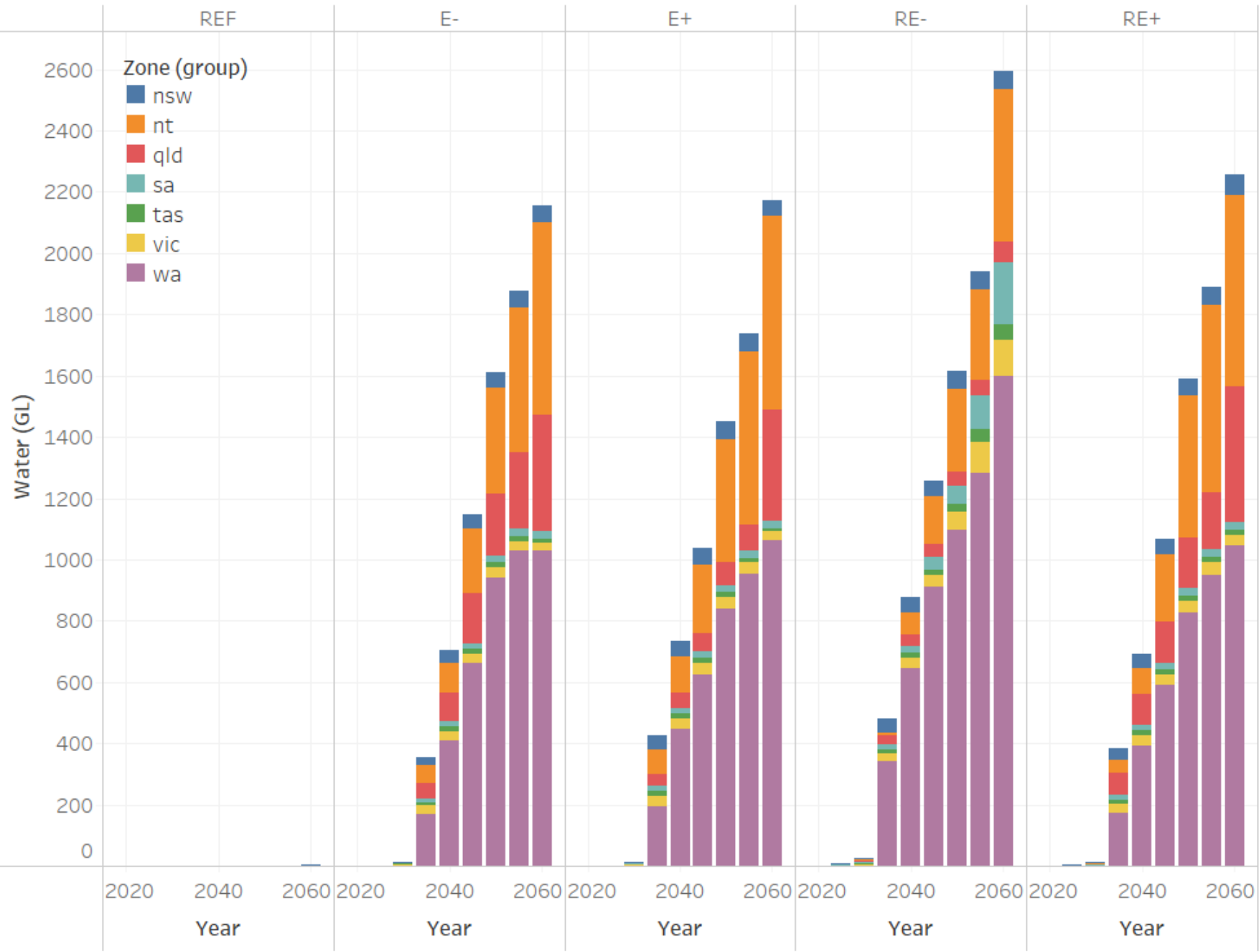
Water demand (GL) by water source



Water demand (GL) by scenario and source

- Highest for RE-
- Fresh water demand is small and stays constant
- Steep increase in desalinated water

H2 Water demand by state



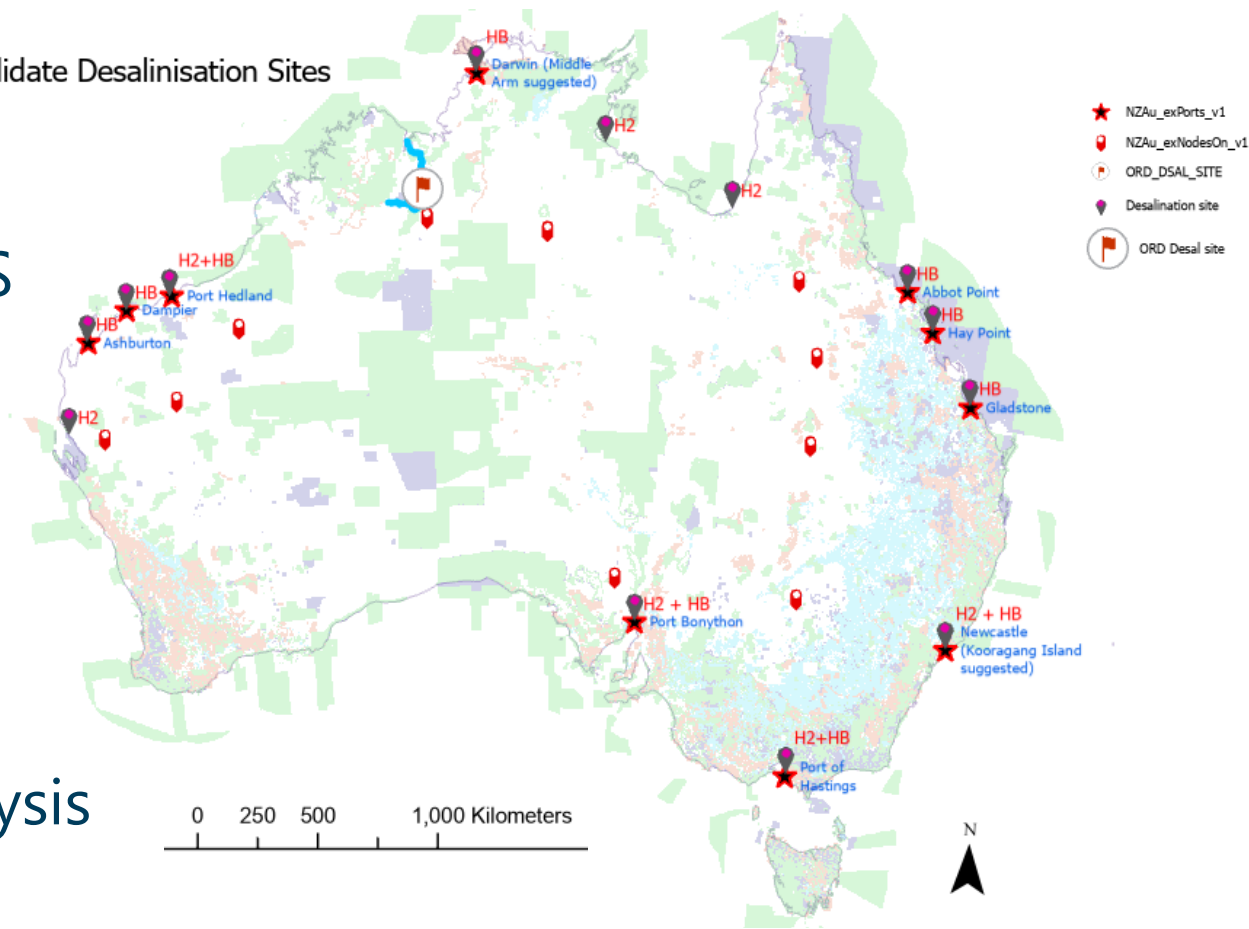
H₂ water demand by scenario and state

- WA has largest H₂ water demand in all scenarios and all years
- WA water demand is particularly large in RE- as ATR wCC is located mainly in WA

Ongoing downscaling

- Inclusion of DAC and water used by CCS
- Number of desalination plants & characteristics
 - 1 GL world class plants
 - Reverse osmosis for Haber-Bosch
 - Reverse osmosis + EDI for electrolysis
 - PEM air cooled electrolyzers
- Siting of desalination plants and water pipelines
- Potential siting of treatment plant on Ord river
- Wastewater and brine handling

Candidate Desalination Sites



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