A power systems engineering consultancy company

DIgSILENT Pacific

Overview of Grid integration of Renewables in Australia

On target for Paris agreement?

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This presentation

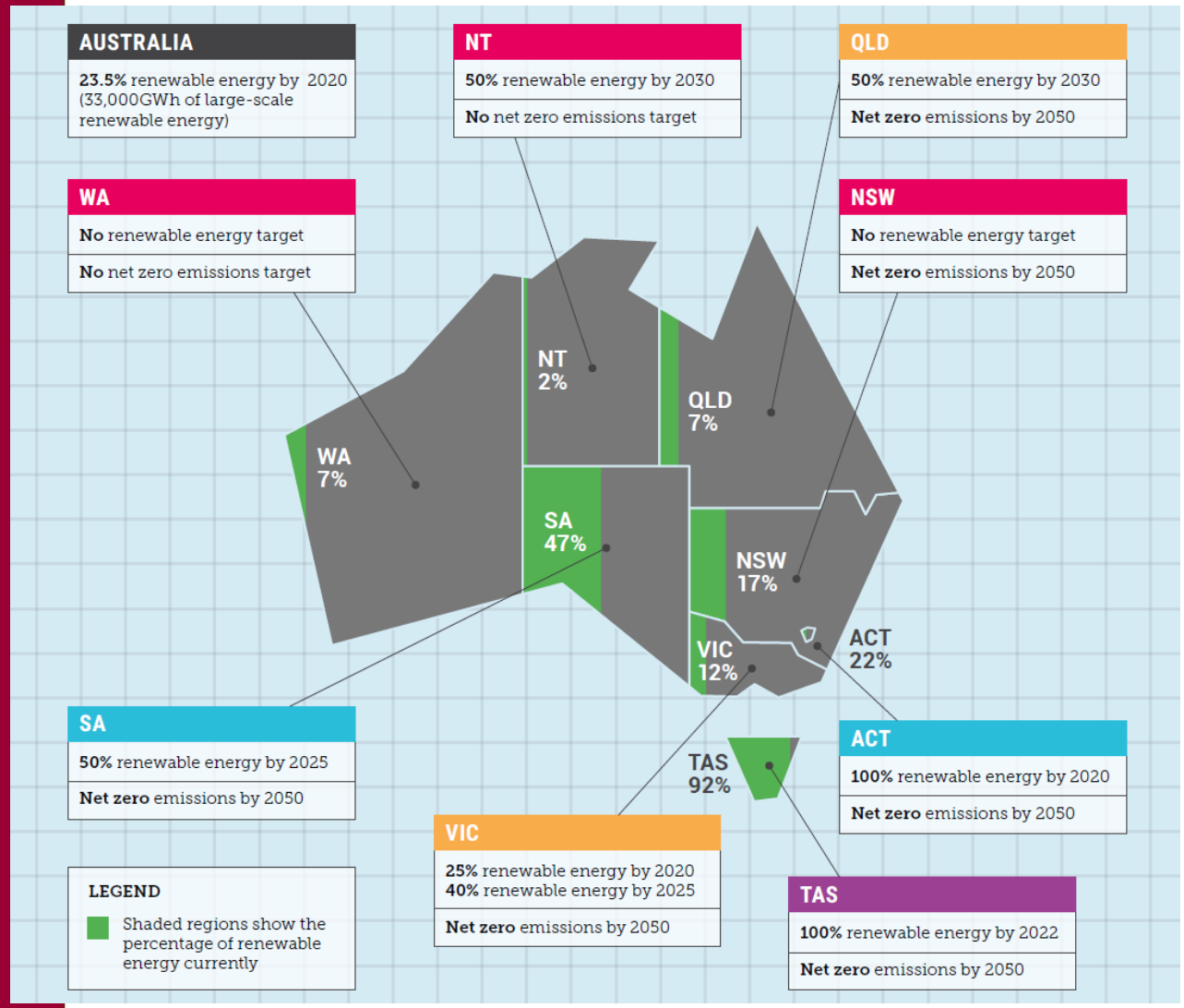
- Context – Ambitious State targets at odds with divided Federal government
- Currently
  - Very high wind penetration in South Australia and still growing
  - A solar gold rush
- Outlook – It's getting harder to connect renewables
- Paris agreement – not achieving the targets yet…

The Australian context

Australian government record

- Carbon pricing scheme introduced 2010; axed in 2014
- Ratified the Paris Accord in November 2016, 26 per cent reduction from 2005 levels by 2030.
- Renewable energy trading scheme extended to 2030, but with lower limits
- Federal government initiates Independent review of into the Future Security of the National Electricity Market
  - Rejects key recommendation for a Clean Energy Target
- Federal government coalition room approves National Energy Guarantee
  - Prime Minister announces he won't legislate the NEG's stated emission targets, drawn from Paris Agreement
- Prime Minister is replaced, and NEG policy withdrawn – September 2018

State and Territory policies

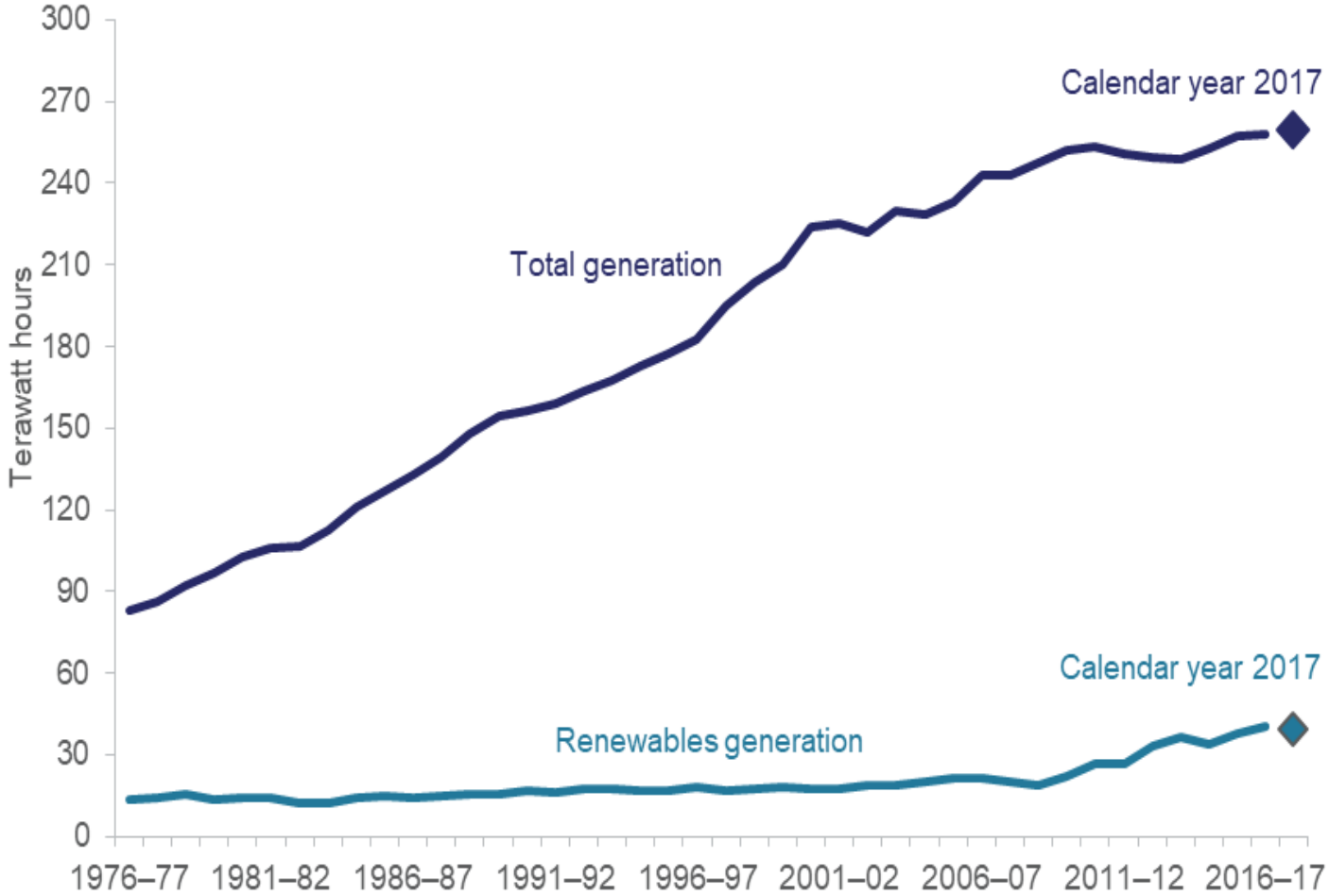


- QLD: 50% by 2030
- VIC: 40% by 2025
- SA: 50% by 2025
- WA: no targets
- TAS: 100% by 2022
- NT: 50% by 2030
- ACT 100% by 2020
- QLD, NSW, VIC, TAS, SA net zero emissions by 2050

Source: Climate Council of Australia, 'Renewables ready: States leading the way' 2017

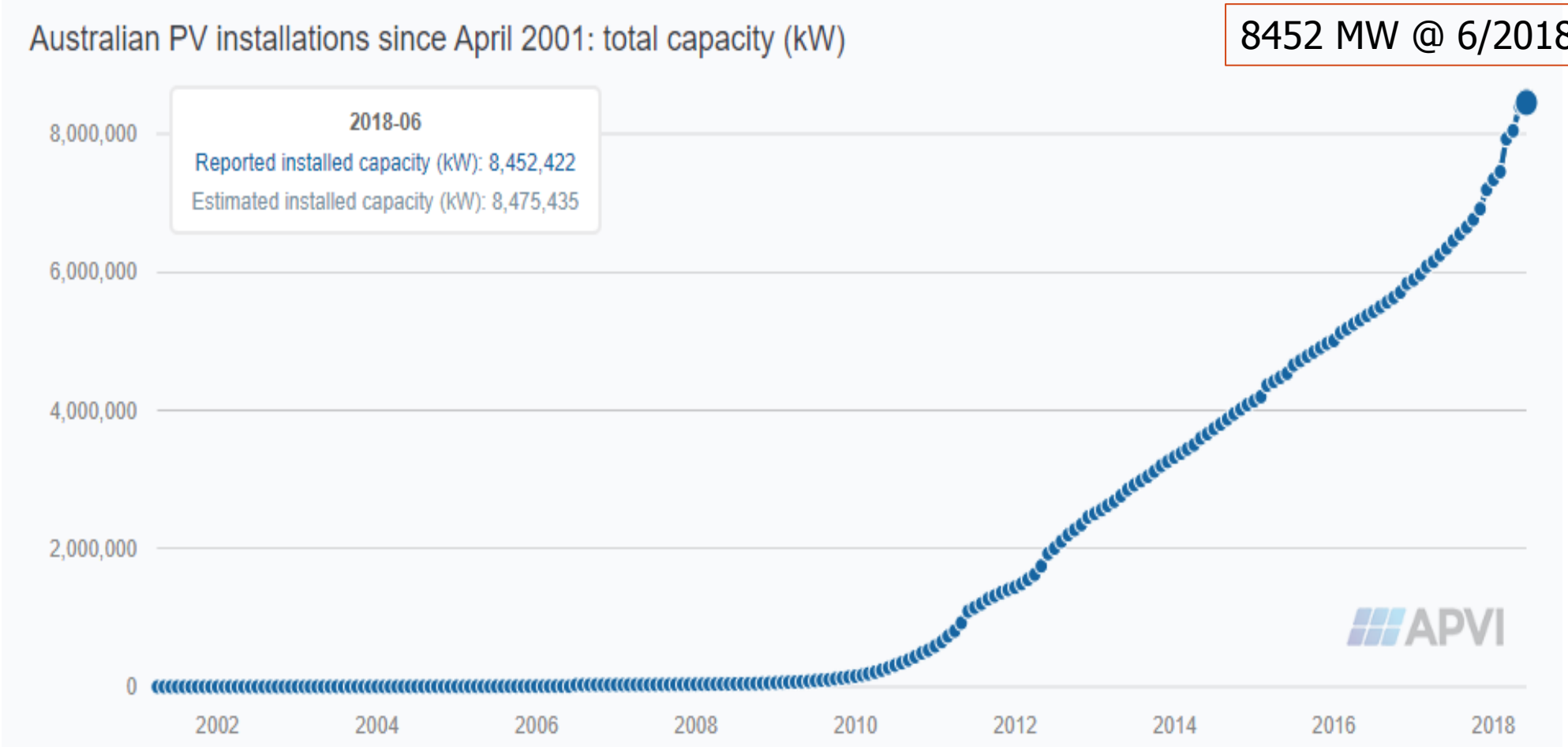
The current picture

Australia: Total renewable generation



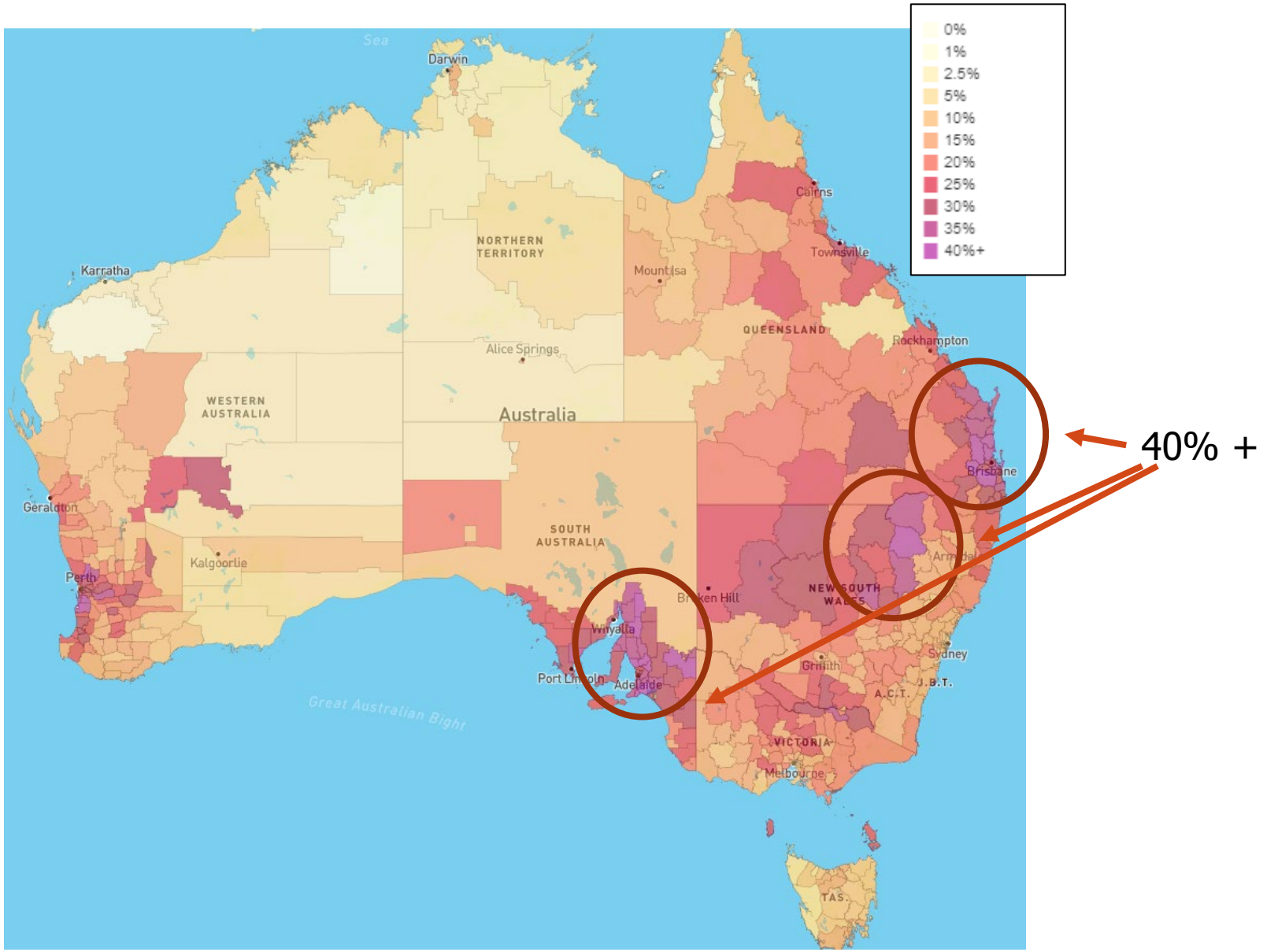
Source: Australian energy update report 2018, Dept of the Environment and Energy August 2018

Solar installations



Australian PV Institute (AVPI) Solar Map, funded by the Australian Renewable Energy Agency

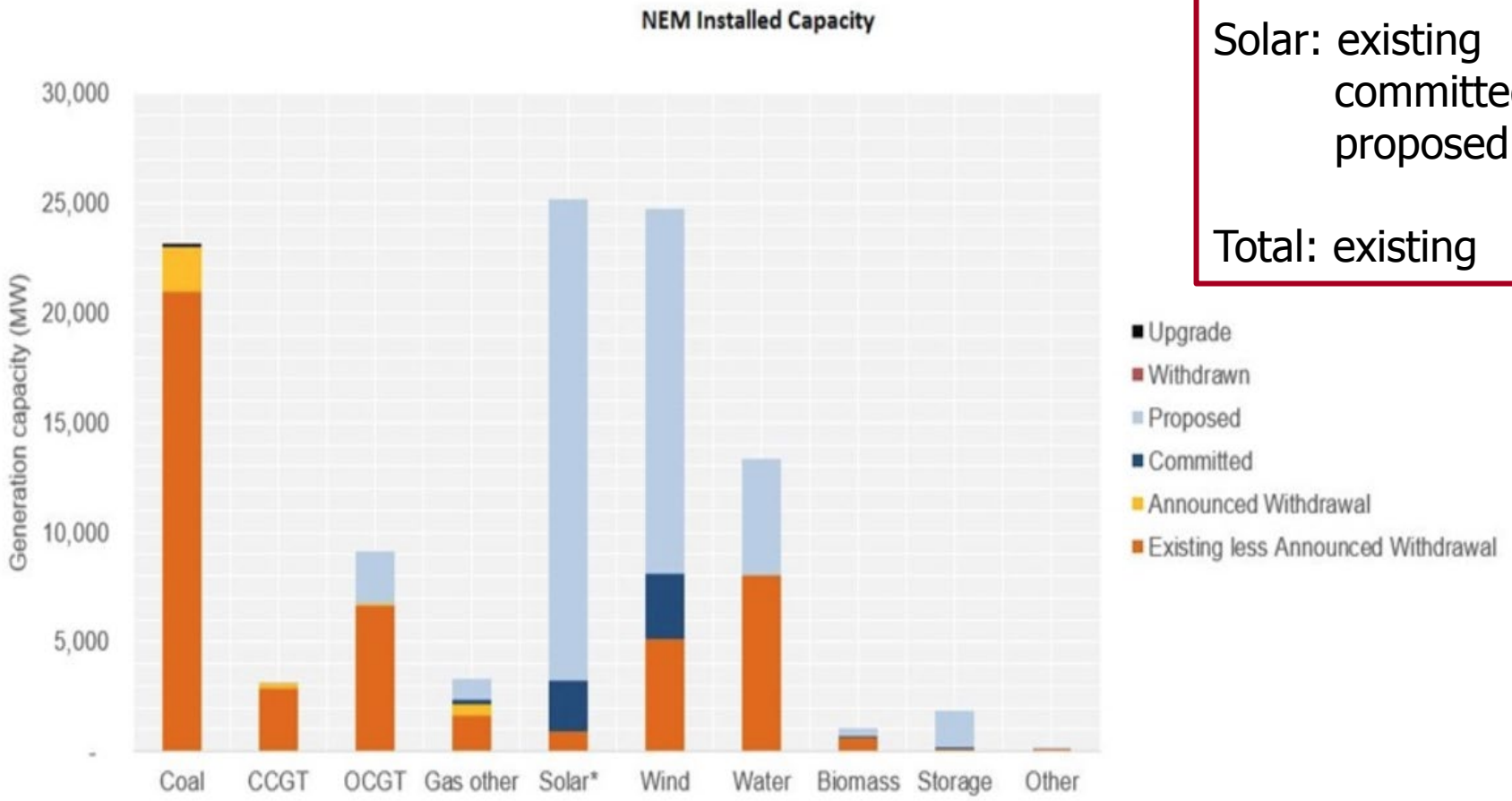
Solar PV residential % by Local Government area



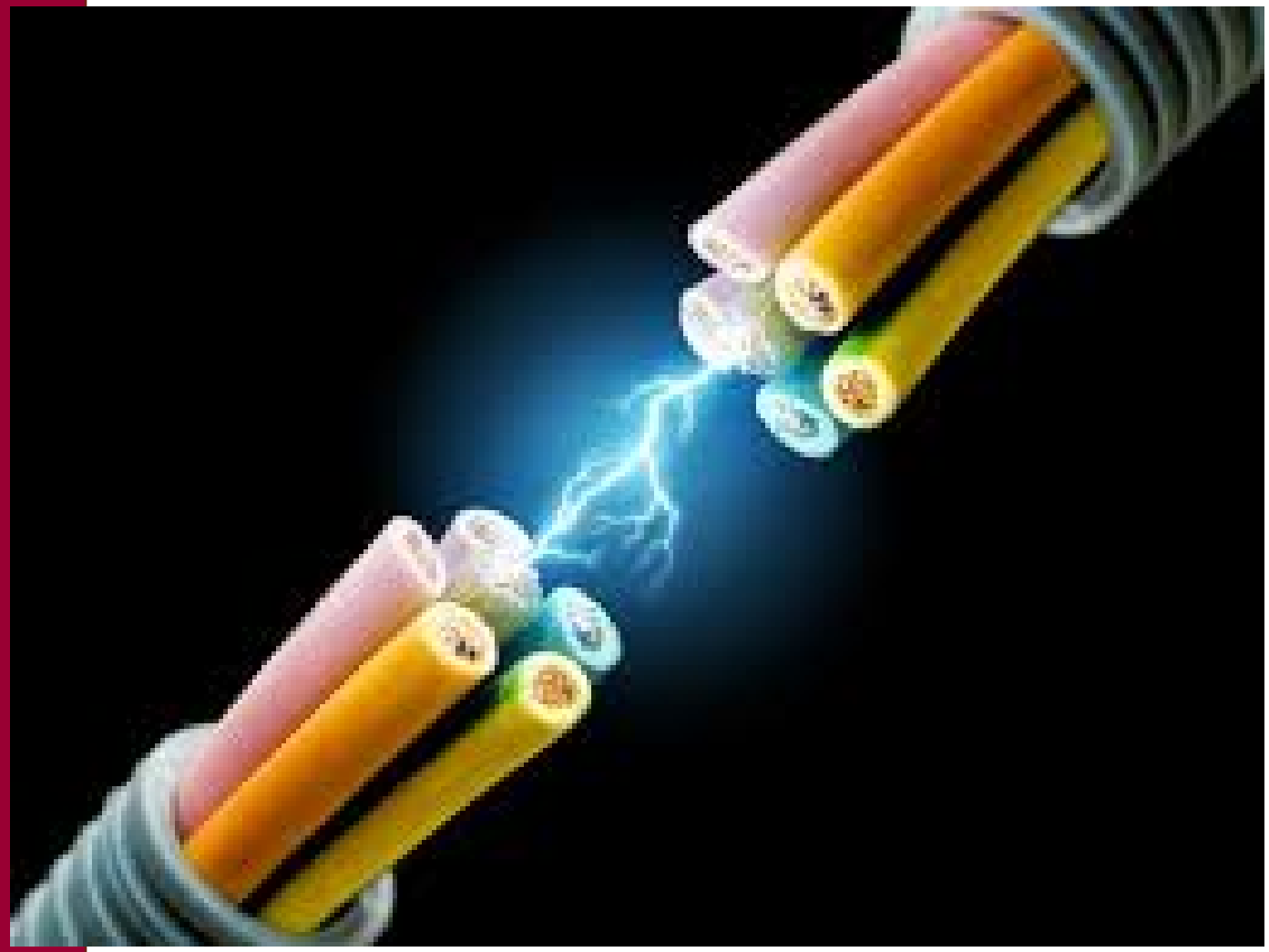
Source: Australian PV institute, Solar Map

NEM – grid scale generation only

Wind:	existing	5 115 MW
	committed	2 992 MW
	proposed	16 643 MW
Solar:	existing	960 MW
	committed	2 315 MW
	proposed	21 899 MW
Total:	existing	49 990 MW



Source AEMO: Generator information page (at July 1 2018)



Outlook

It’s getting harder to connect

Concerns about high penetration levels

- SA renewable generation > load
  - Inertia and frequency control
  - Operation of load shedding schemes
- SA Blackout 2016
  - Concerns about multiple fault ride through
  - Interconnector overloads
  - Active power reduction during power system voltage dips
- High penetration
  - Congestion
  - System strength issues
  - Modelling using EMT software

Regulatory framework changes

- New Technical Standards – largely targeting inverter-based generation
  - Multiple fault ride through conditions – many permutations
  - Much higher over-voltage requirements
- System strength impact assessment
  - Minimum short circuit level set, where all plant is stable, at defined nodes
  - Assess stability of new generators at this level
  - If not stable then must mitigate (eg synchronous condenser)
- Modelling
  - Modelling with PSCAD™ now required as well as PSS/e™
  - Benchmarking between them
- Testing and commissioning has become more onerous too

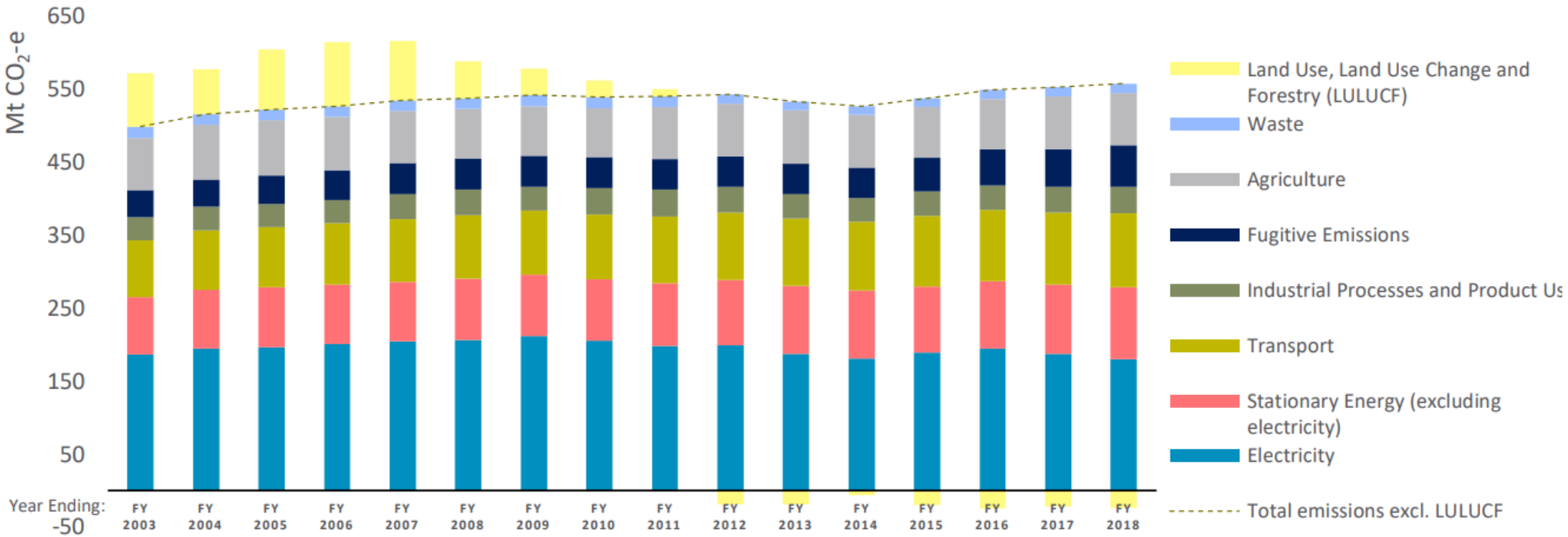
Connection is becoming more complex and slower

Technical standards

- Ride through 15 faults in 5 minutes
- Overvoltages at the connection point:
  - 120-125% for 2 s
  - 115 - 120% for 20s
  - 110 – 115% for 20 minutes
- Continuous uninterrupted operation – interpreted to mean active power should be maintained for voltages in the range 90 – 110%
- Strict requirements for reactive power injection during faults and over-voltages

Where does that leave us for the Paris accord?

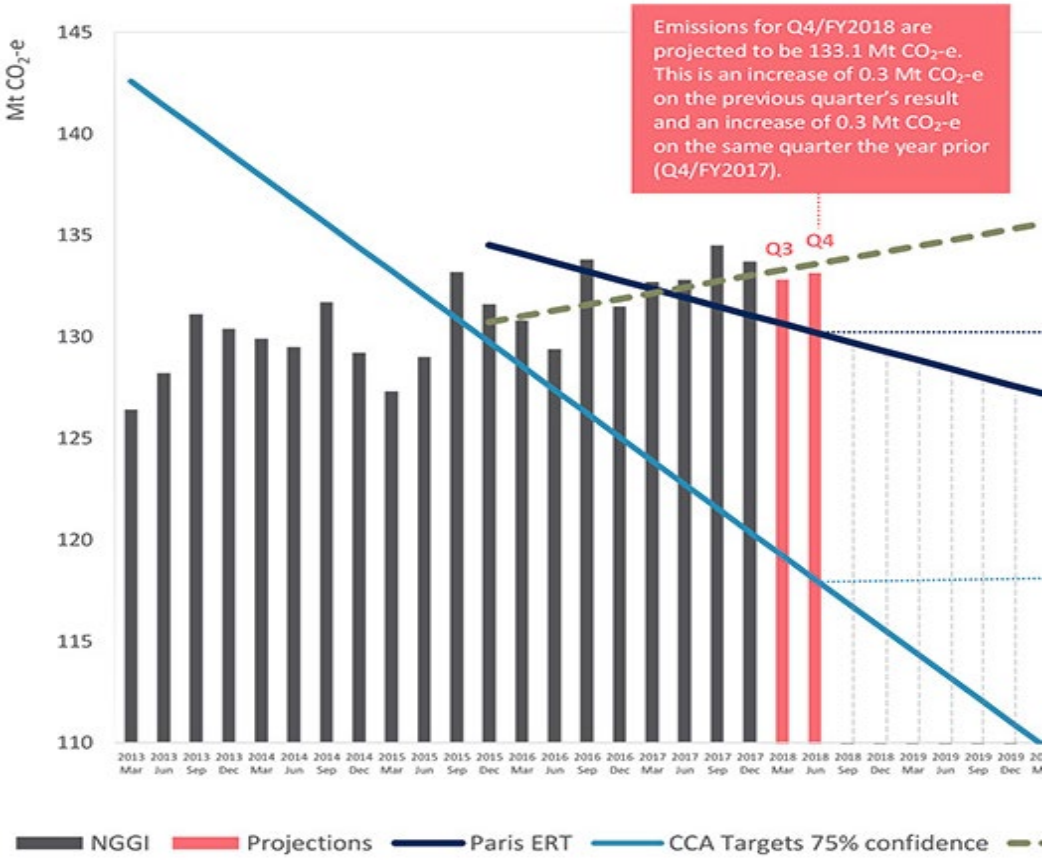
Electricity contribution to green-house emission large



* This graph includes both published Government NGGI data and Ndevr Environmental projections for Q3/FY2018 and Q4/2018.

Source: NDEVR environmental

Progress against targets (excl. land use)



- Overall emissions seem to be increasing still
- If projected solar and wind generation is not slowed by new regulation or government policy, there is still a good chance Australia will be able to meet its Paris targets.

Source: NDEVR environmental

Summary

- Despite federal government inaction on energy policy there is considerable enthusiasm for investment in wind and solar generation in Australia.
- Residents have embraced rooftop solar generation.
- There are many grid-scale solar and wind projects in progress.

- If progress is not slowed by complex and expensive regulation or government policy, there is still a chance that Australia will meet or exceed its Paris emission reduction targets.

References

- Climate Council of Australia 'Renewables Ready: States leading the Charge' 2017 https://www.climatecouncil.org.au/uploads/9a3734e825745466795l0bdc99d57847.pdf
- Department of Environment and Energy 'Australian Energy Update Report 2018' August 2018 https://www.energy.gov.au/publications/australian-energy-update-2018
- Australian PV Institute (AVPI), Solar Map, funded by the Australian Renewable Energy Agency, accessed from http://pv-map.apvi.org.au/analyses
- AVPI, Solar Map http://pv-map.apvi.org.au/historical#5/-26.706/134.121
- Australian Energy Market Operator 'Generator Information Page' https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Generation-information
- Australian Energy Market Commission 'Generator technical performance standards' https://www.aemc.gov.au/rule-changes/generator-technical-performance-standards
- NDEVR Environmental http://ndevr.com.au/environmental/tracking-2-degrees-fy18-q4

Questions and discussion?