

UQEI

UQ Energy Initiative

It's All About Energy – Event 1: Session 3. 18th August, 2017



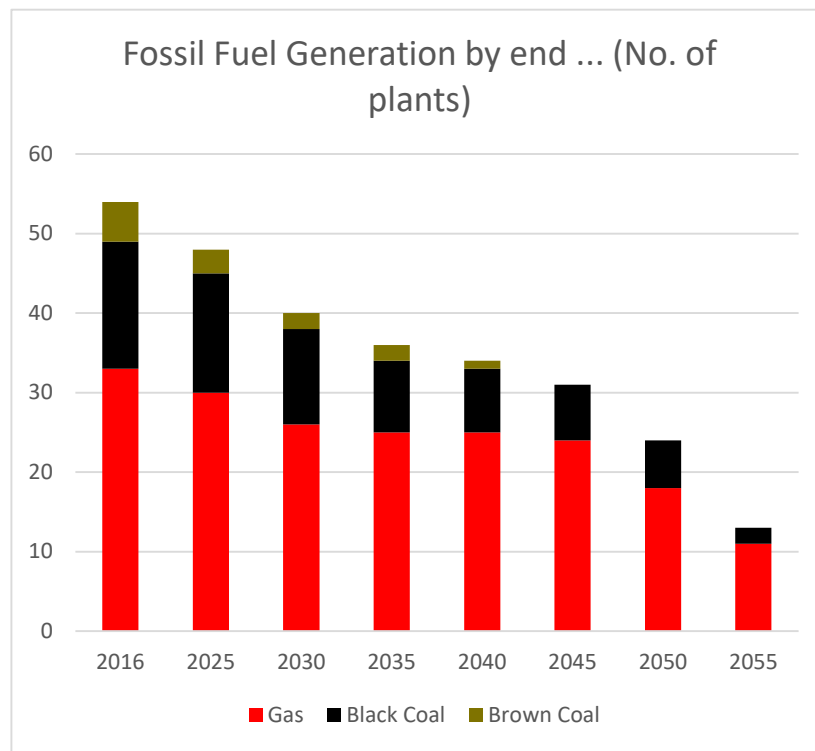
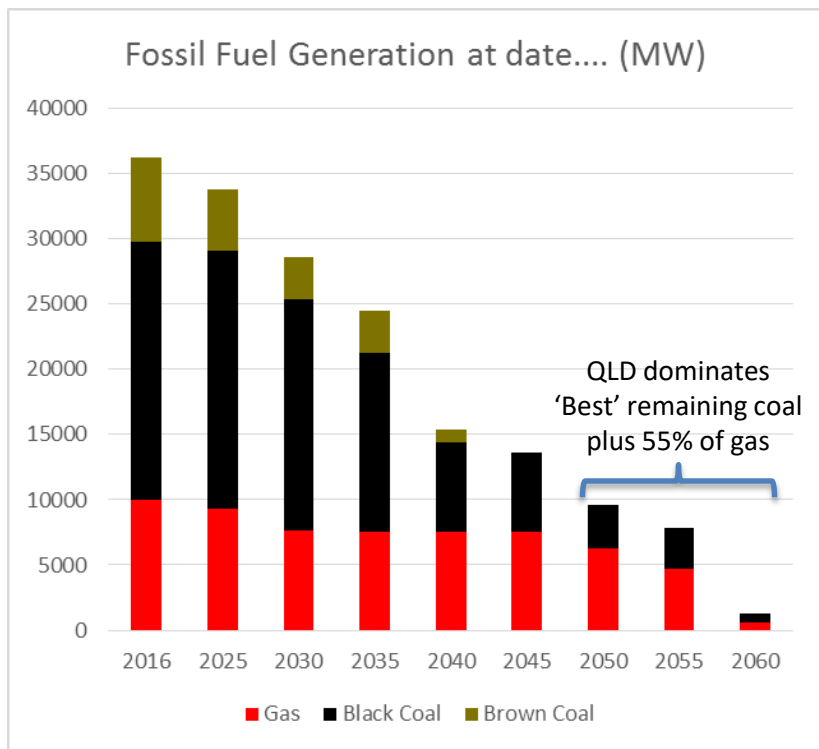
THE UNIVERSITY
OF QUEENSLAND
AUSTRALIA

Session 3: Security and Reliability without Coal ?

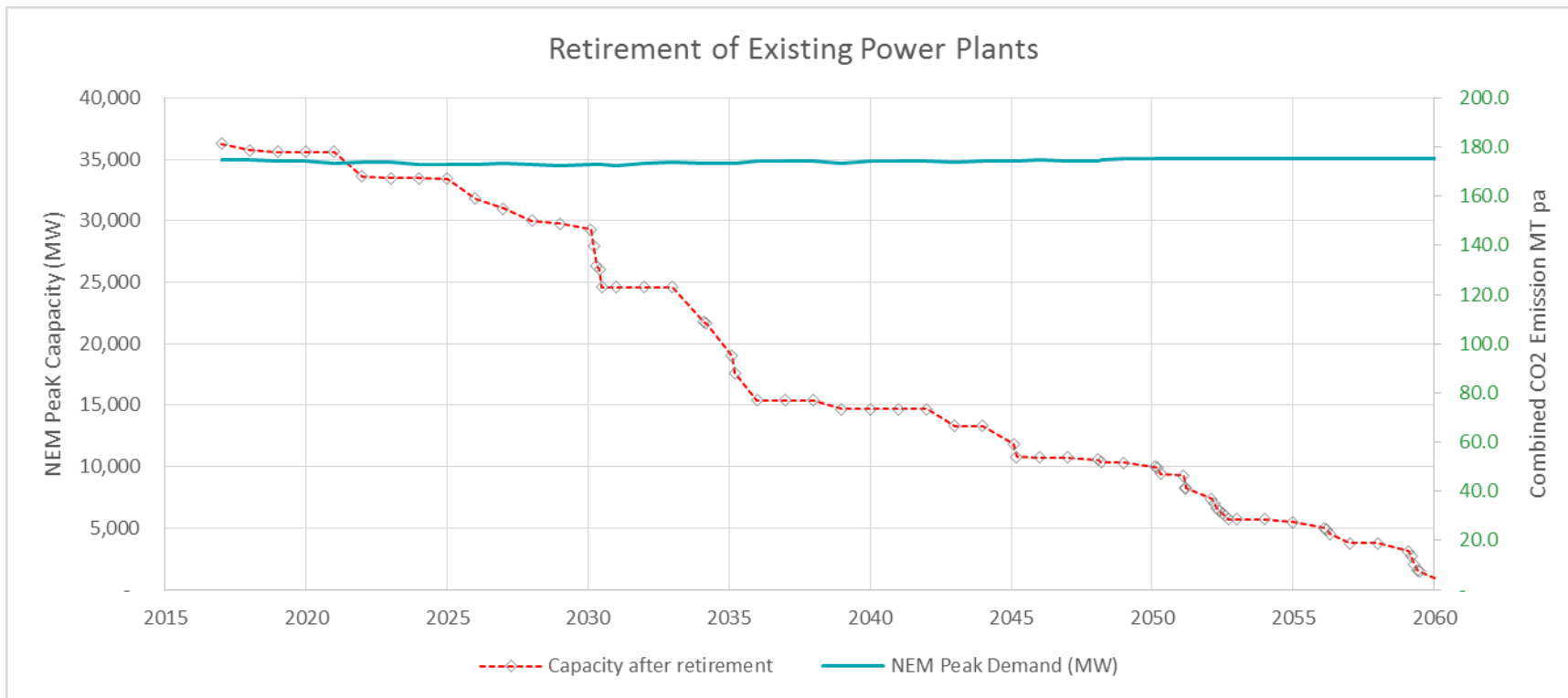
This Session

- Some introductions ...
- *The current power plant mix, age and retirements – choices to be made.*
- *Is there a clever combination? Enhanced grid connectivity + Pumped Hydro Storage + Maximum use of flexible gas.*
- *And now for something completely different ... Small Modular Reactors - a new nuclear option?*

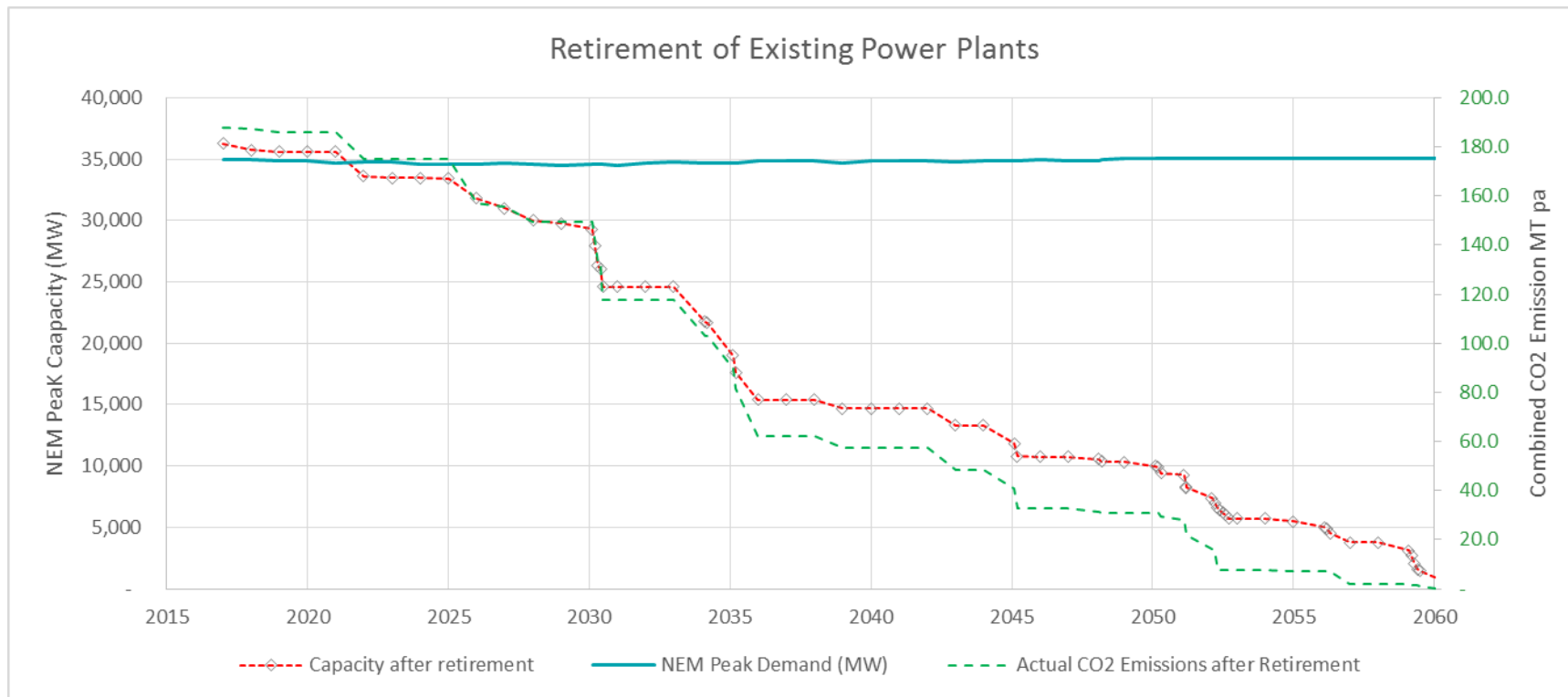
We have a mixed and ageing fleet – everything retires eventually



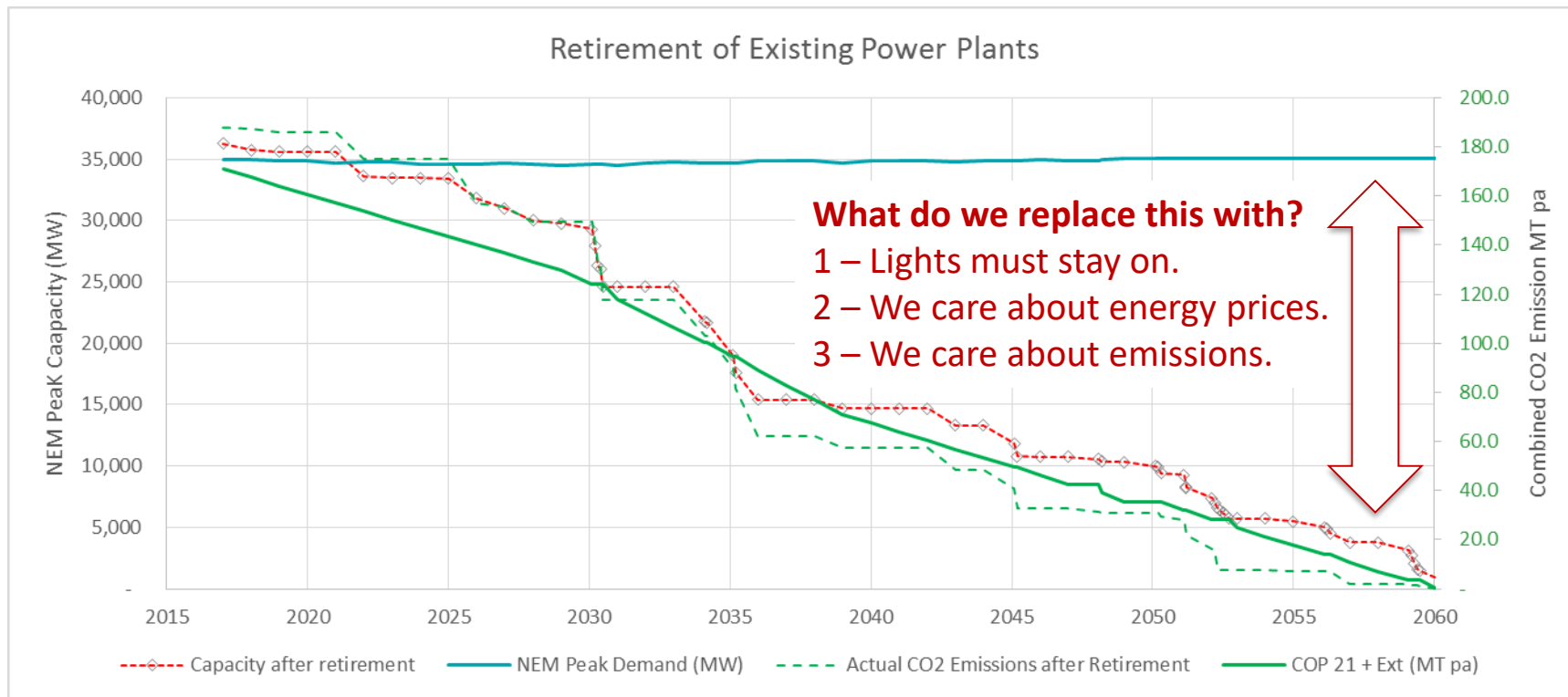
Retirement - leads to replacement choices & emissions consequences



Retirement - reducing NEM emissions



Retirement – reducing NEM emissions but ... what about the lights ?



So ...

Is there a clever combination of replacement options ?

Professor Simon Bartlett, University of Queensland

Hydro & pumped storage: an obvious “dancing partner” for wind and solar

- **Reliable and Secure**

- ✓ *Stable*: high synchronous inertia and fast frequency response
- ✓ *Flexible*: dispatch and load following capability
- ✓ *Back-up Storage*: large scale for excess solar

- **Affordable**

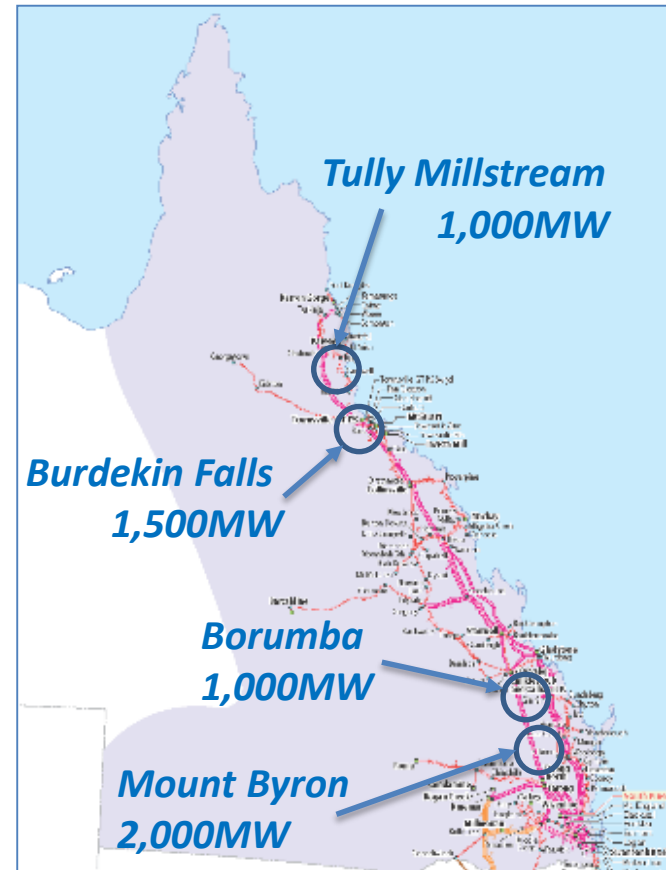
- ✓ *Cheap*: 1/10th the cost of battery storage (in \$/MWh)
- ✓ *Long Lasting*: 10 x the life of batteries
- ✓ *Low Cost*: lowest cost delivery of new ancillary services

- **Clean – Low CO₂**

- ✓ *But not zero impact*

There could be *significant* hydro / pumped storage sites in Queensland (5.5 GW)

- ✓ *Rigorous screening*: by SECQ 1980's
- ✓ *Large capacity*: energy storage
- ✓ *Low cost, high response*: high hydraulic head
- ✓ *Reserved sites*: for future development
- ✓ *Low Impact*: (not zero)
- ✓ *Existing dams*: or off-stream reservoirs
- ✓ *Infrastructure*: close by

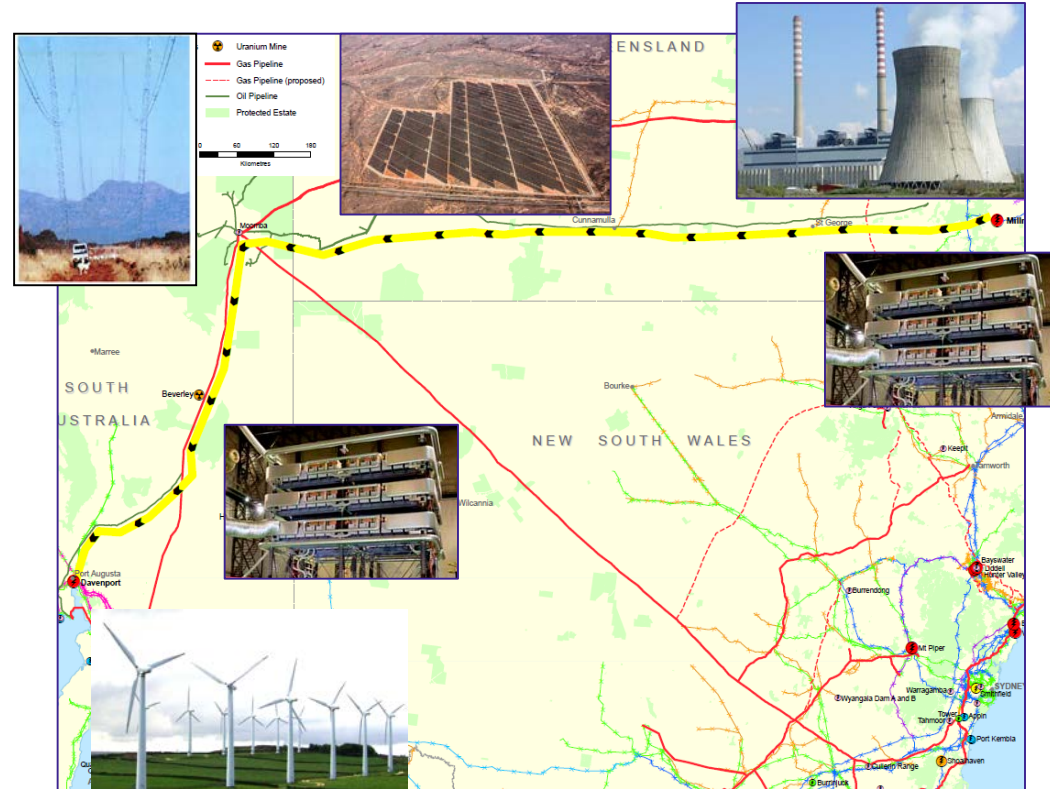


ARC-Mesh – key enabler

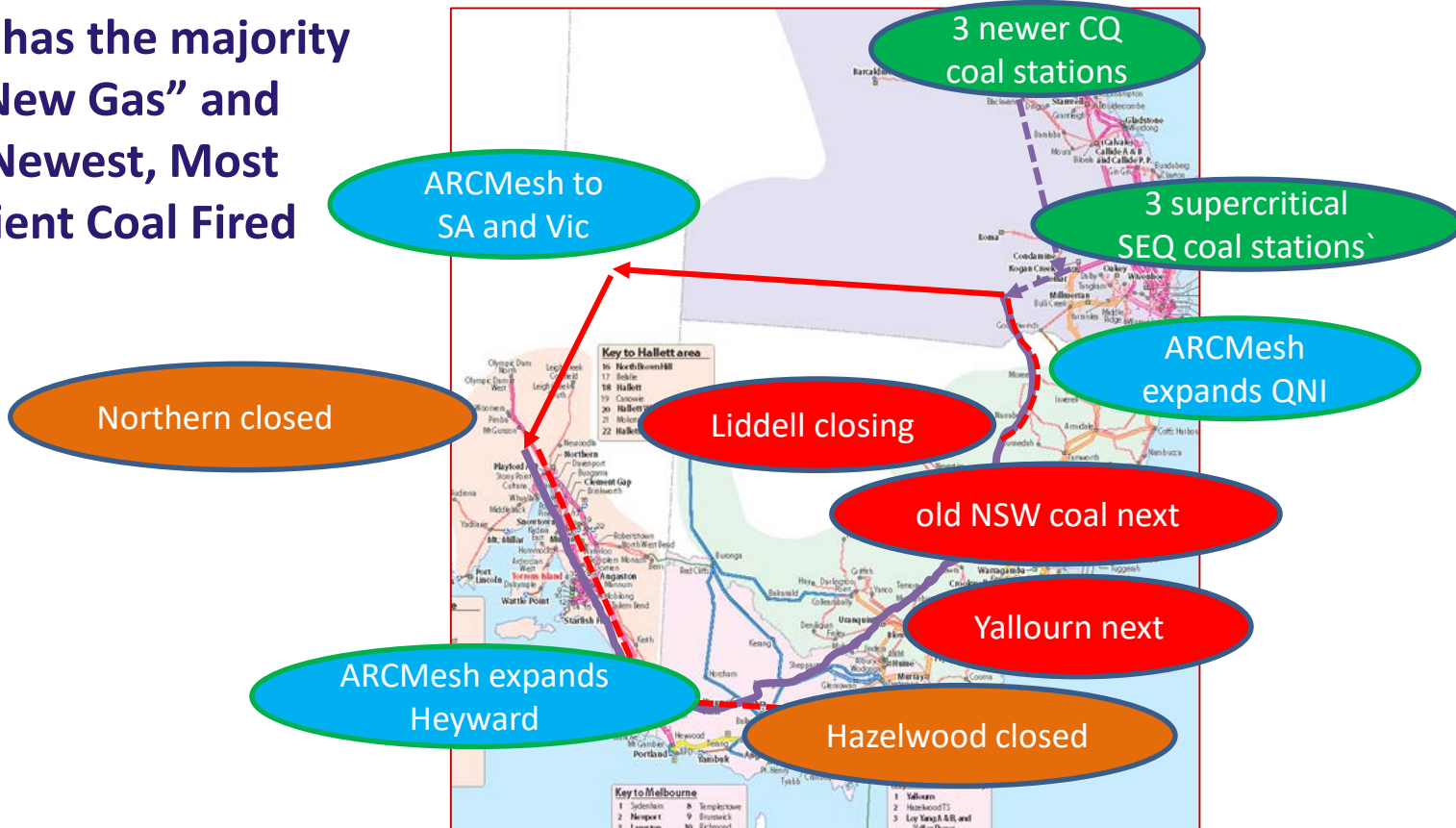
*Australian Renewable Connector
- Meshing the NEM*

- ✓ **Interconnector:** privately funded
- ✓ **Modern Tech:** HVDC VSC
- ✓ **Low Cost:** innovative line design
- ✓ **Price Stability:** in SA and Qld
- ✓ **Security:** for SA power system
- ✓ **Low env. impact:** (not zero)
- ✓ **Quick:** short construction time

feasibility study underway by ARC-Mesh

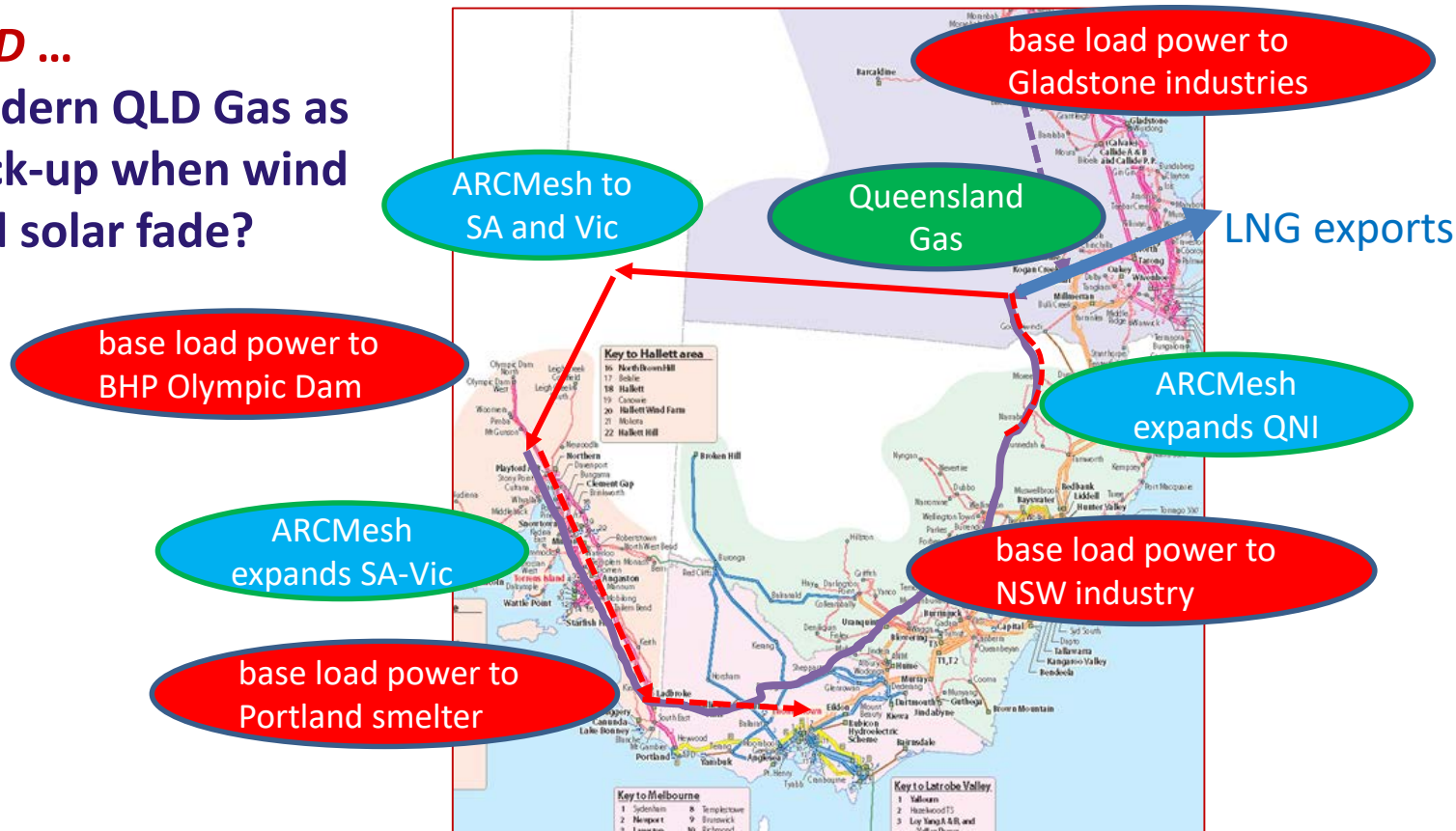


QLD has the majority of “New Gas” and the Newest, Most Efficient Coal Fired

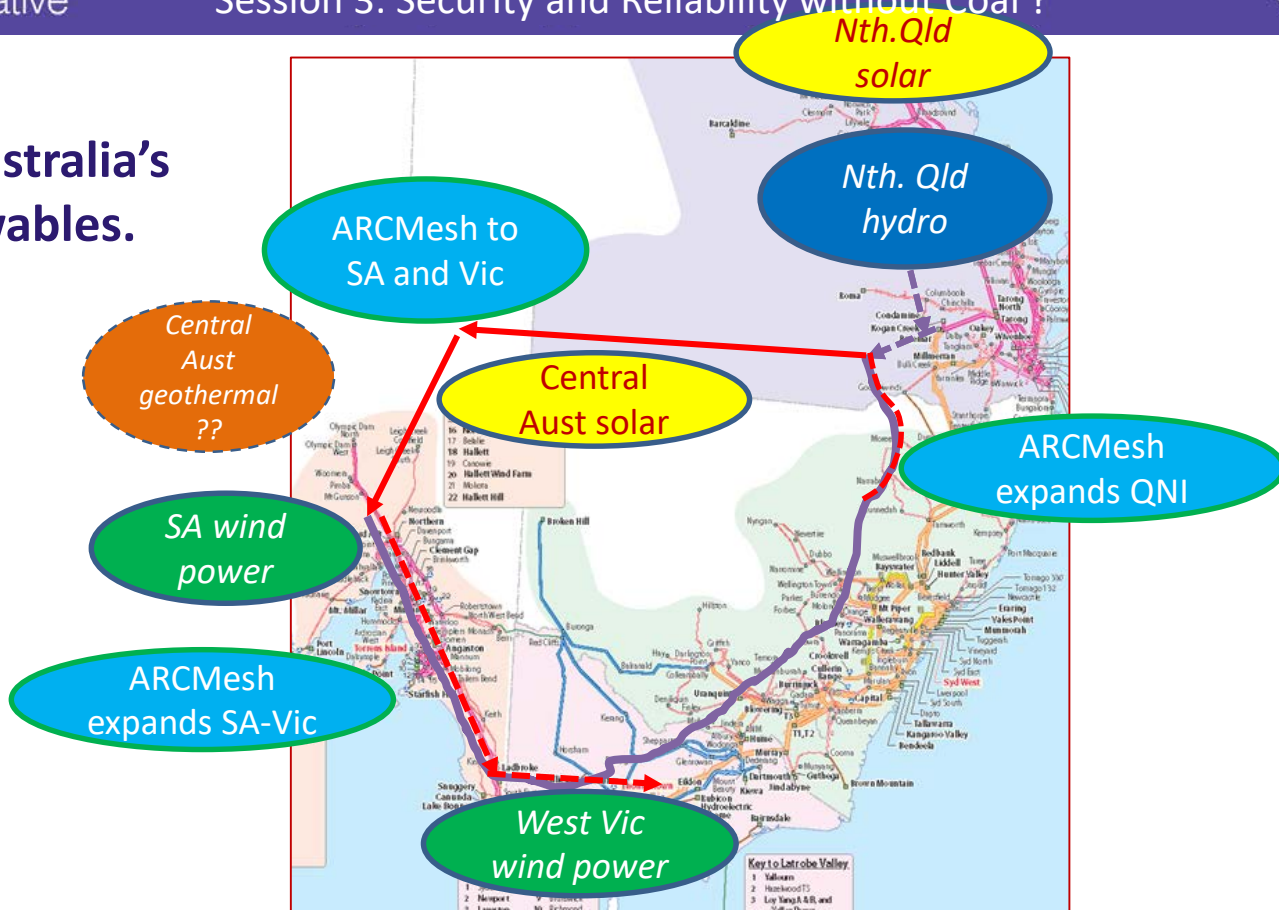


AND ...

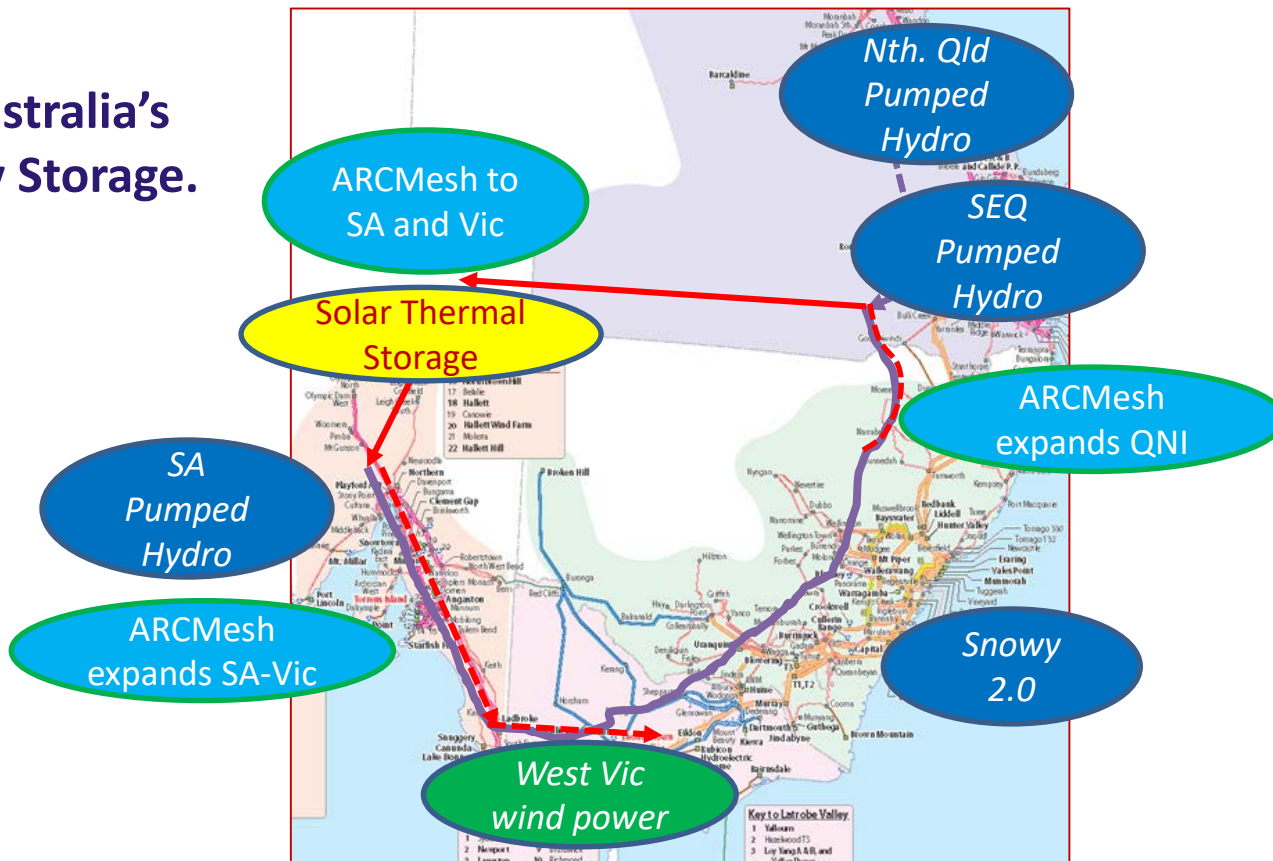
**Modern QLD Gas as
Back-up when wind
and solar fade?**



AND ...
**Develop Australia's
Best Renewables.**



AND ...
**Develop Australia's
Best Energy Storage.**



A Smart Combination for Replacements ? ... It's an 'AND' not an 'OR' solution

- Newest, most efficient coal in fleet to ~2050 (Queensland)

plus

- Best use of modern flexible gas (mostly in Queensland)

plus

- *ARC Mesh – turn the NEM spine into a proper grid ... the key enabler*

plus

- Develop best renewables

plus

- Develop best energy storage (hydro)

And now for something completely different ...

Small Modular Reactors - a new nuclear option?

*Dr. Adi Paterson,
CEO, Australian Nuclear Science and Technology Organisation*

TBC