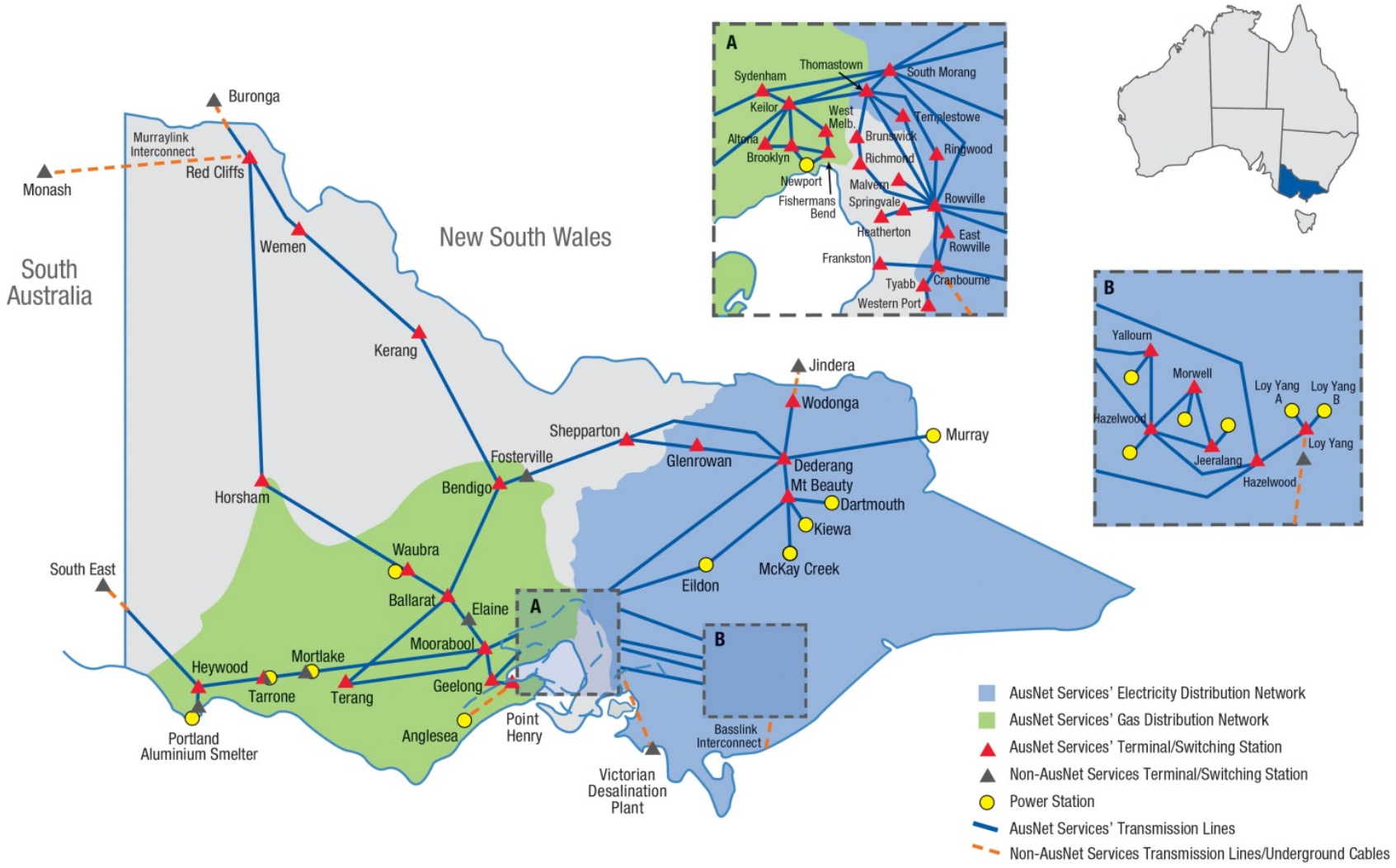
ENA Great Expectations: The Interactive Grid

Evolution of transmission networks in a distributed energy world

March 2019

Jacqui Bridge, AusNet Services

AusNet Services – What We Do



Electricity Transmission

- 6,571km of transmission lines
- 13,000 towers

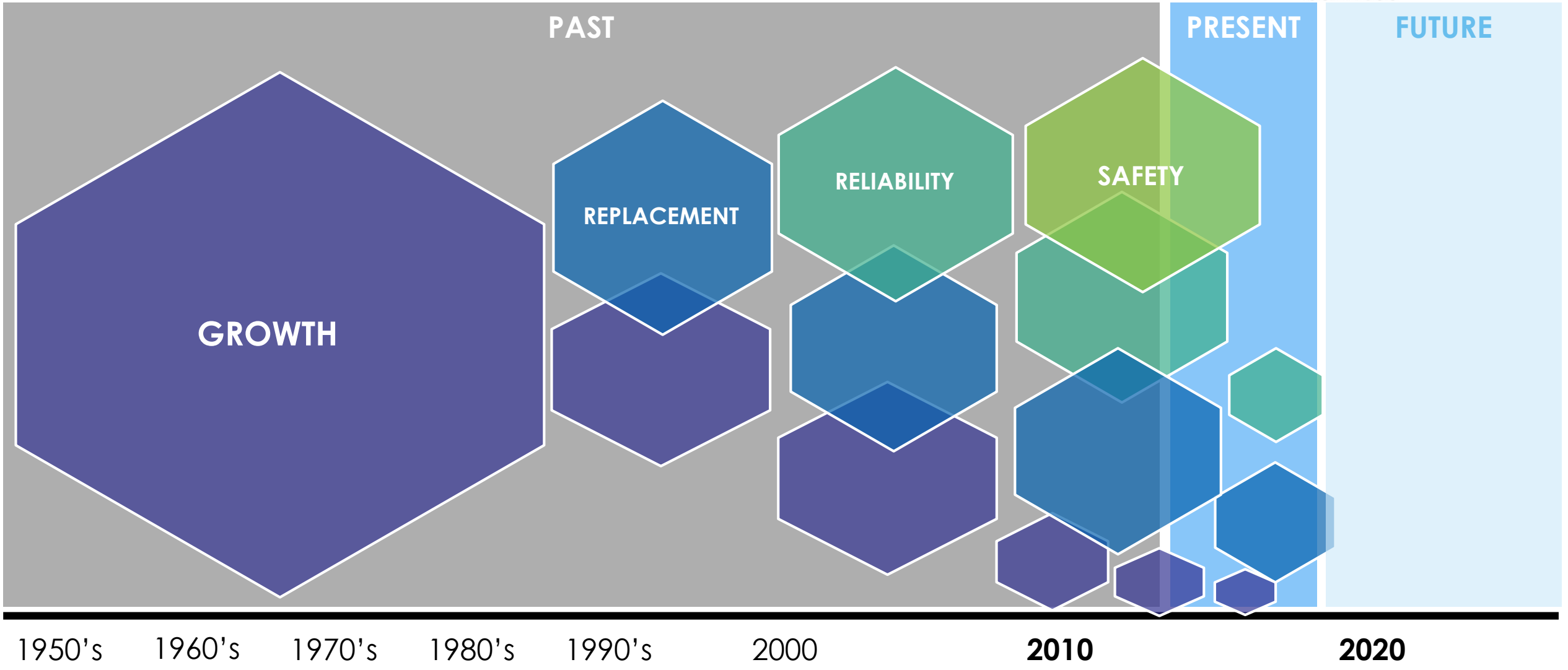
Electricity distribution

- 51,933km of electricity distribution network
- 705,186 customers

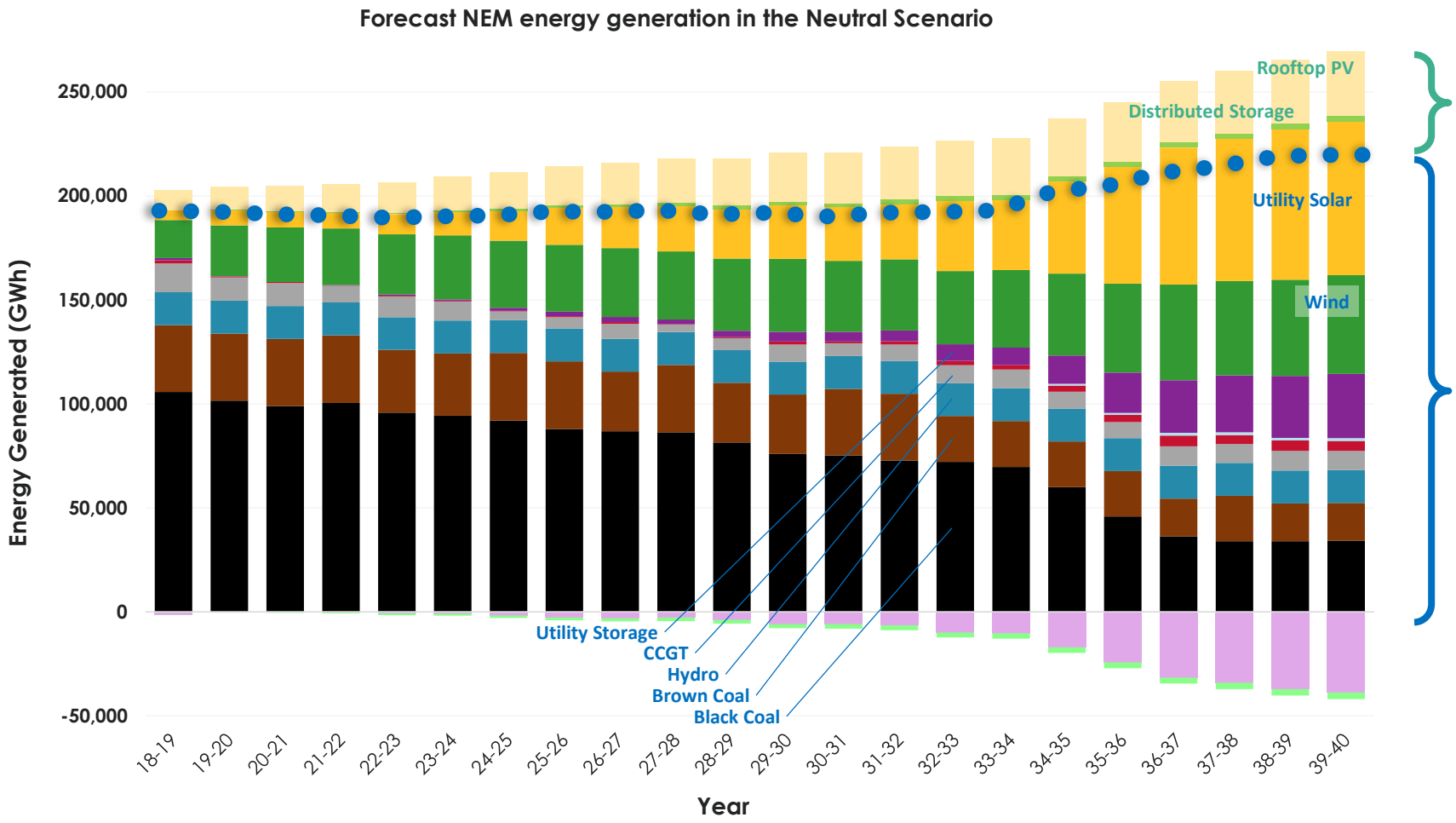
Gas distribution

- 11,109km of gas distribution network
- 676,035 customers

The transmission network has been evolving...



Our generation is shifting to renewables and increasingly connecting across both transmission and distribution networks



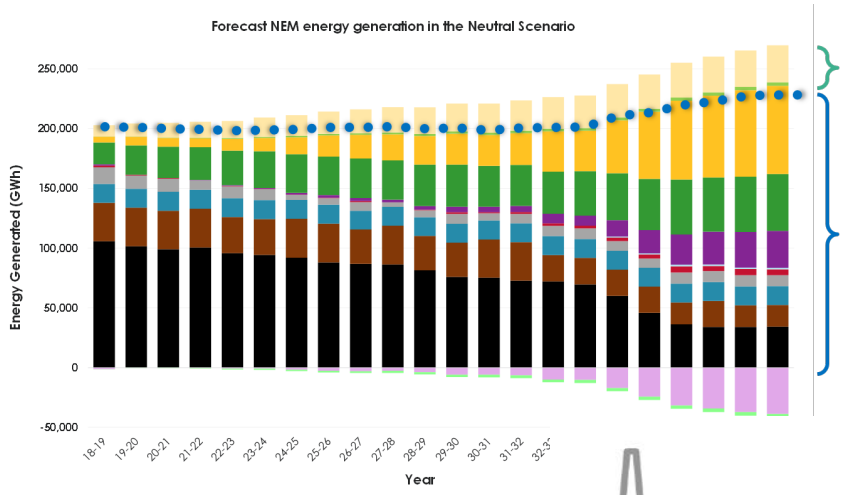
Increasing renewables generation connecting to Distribution Networks

Renewables replacing thermal generation in Transmission Networks

Source: AEMO, Integrated System Plan 2018, Figure 13: Forecast NEM Generation in Neutral Scenario

The Changes Ahead

Connecting renewables generation; changing functions; and increasing system resilience

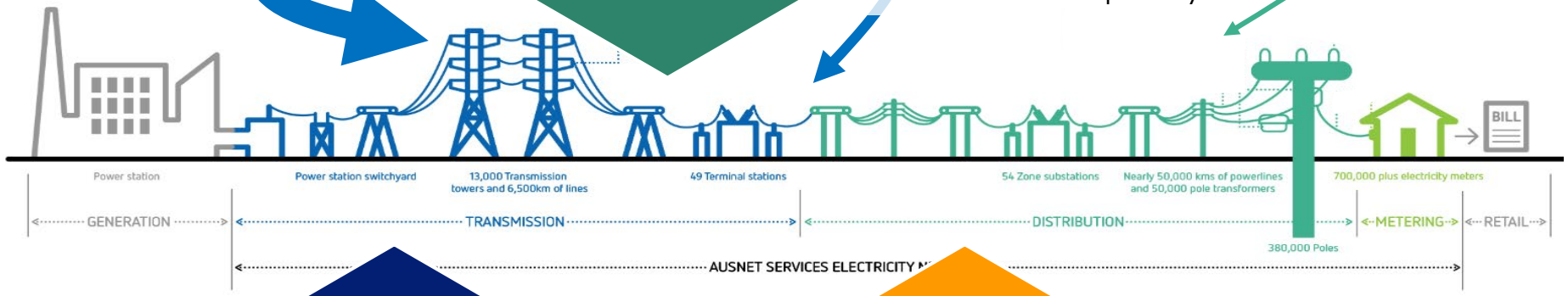


Increasing renewables generation connecting to Distribution Networks

Renewables replacing thermal generation in Transmission Networks

RESILIENCE

Resilience to the unexpected
Balance between native supply and interconnector capacity



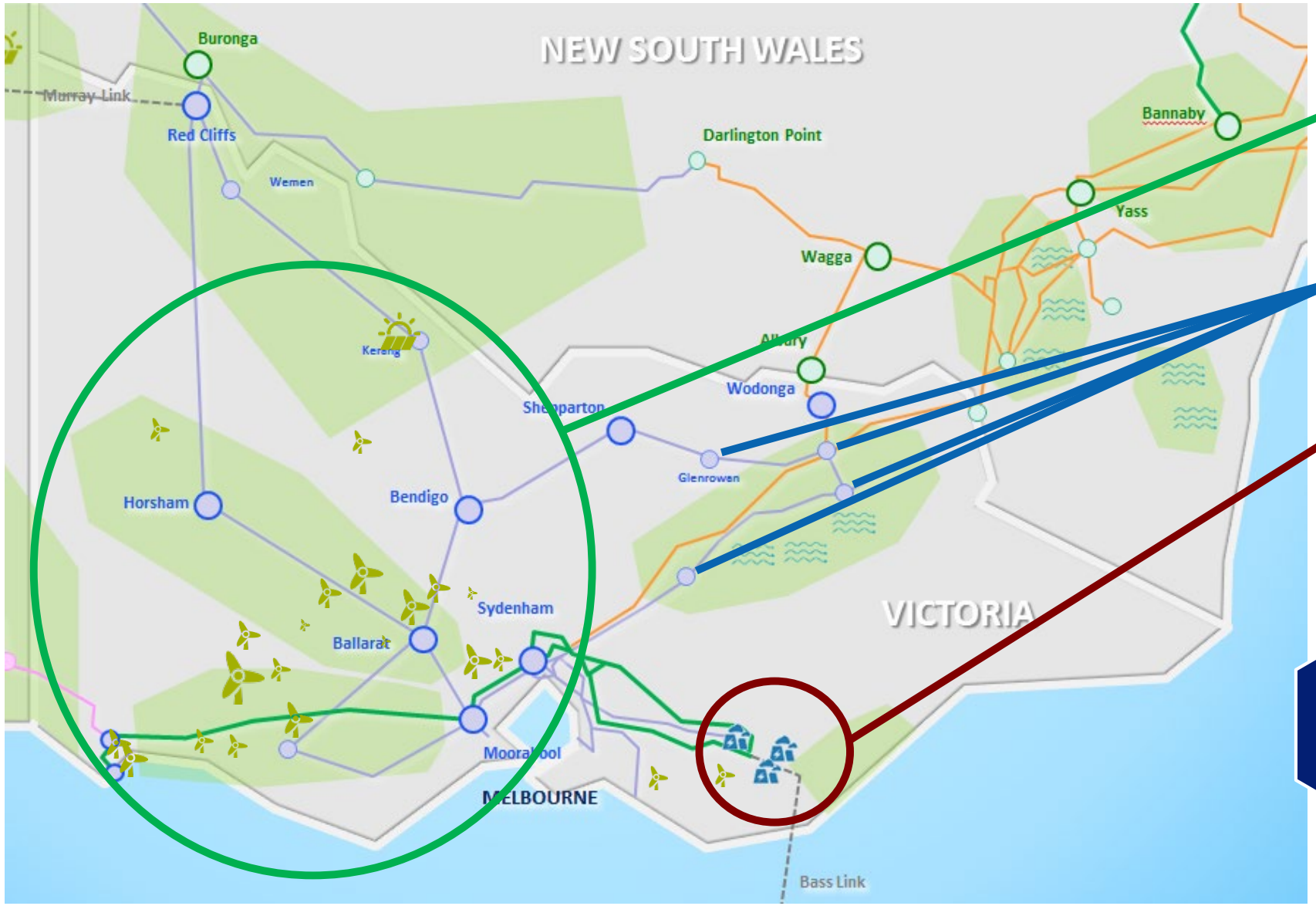
LOCATION

Capacity and Location of network to support new generation sources

FUNCTION

Direction of energy flow, impacting assets, control systems and protection

Planning for Distributed Energy Resources in Transmission



In 2019

Installed	1,600 MW large scale
Committed	>1,600 MW
Proposed	>7,000 MW

In future

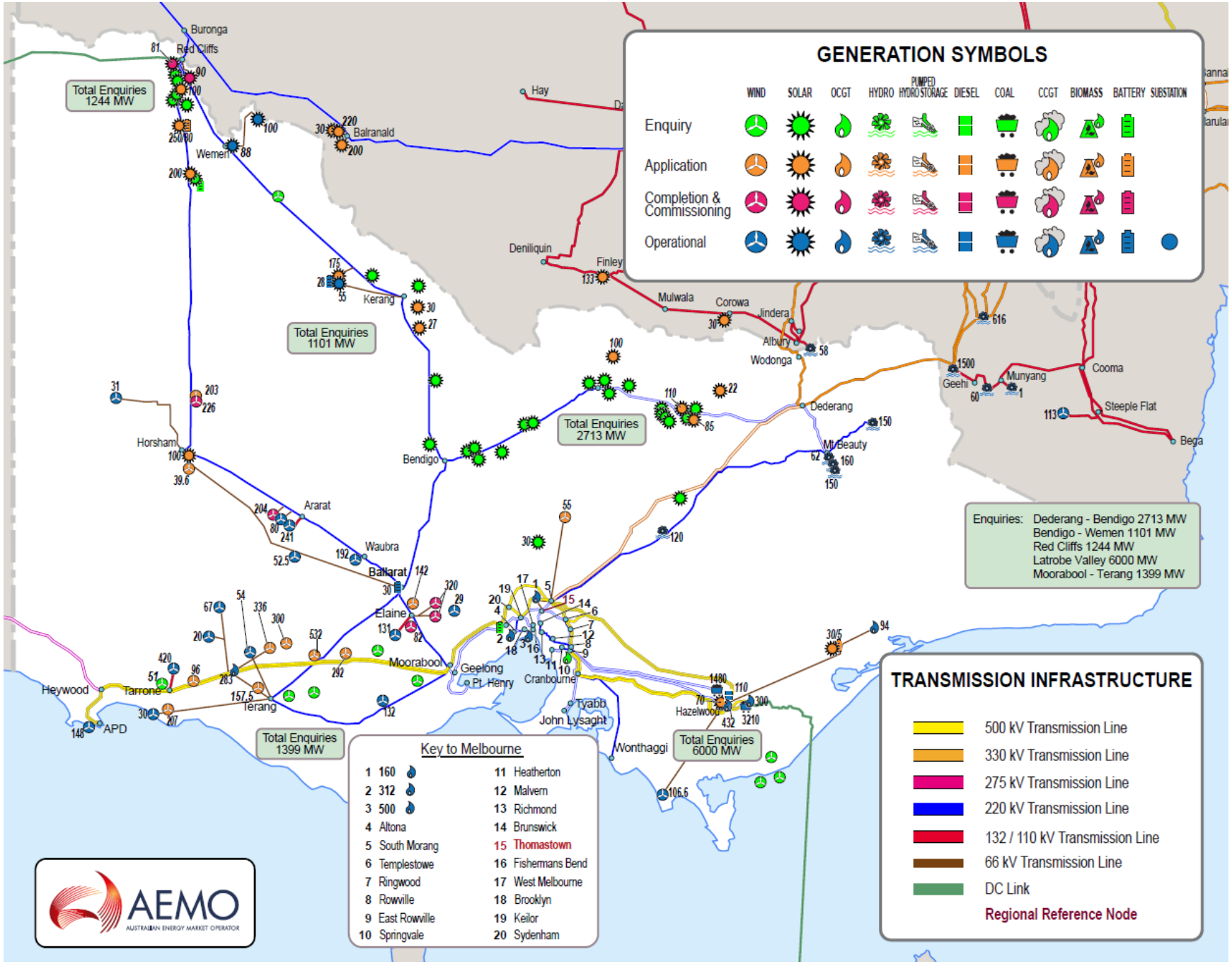
Aggregated DER connects to transmission network at more than 50 Transmission Sub-stations

Until 2016

> 7,000 MW thermal generation capacity

LOCATION
Capacity & Location

FUNCTION
Direction of Flow



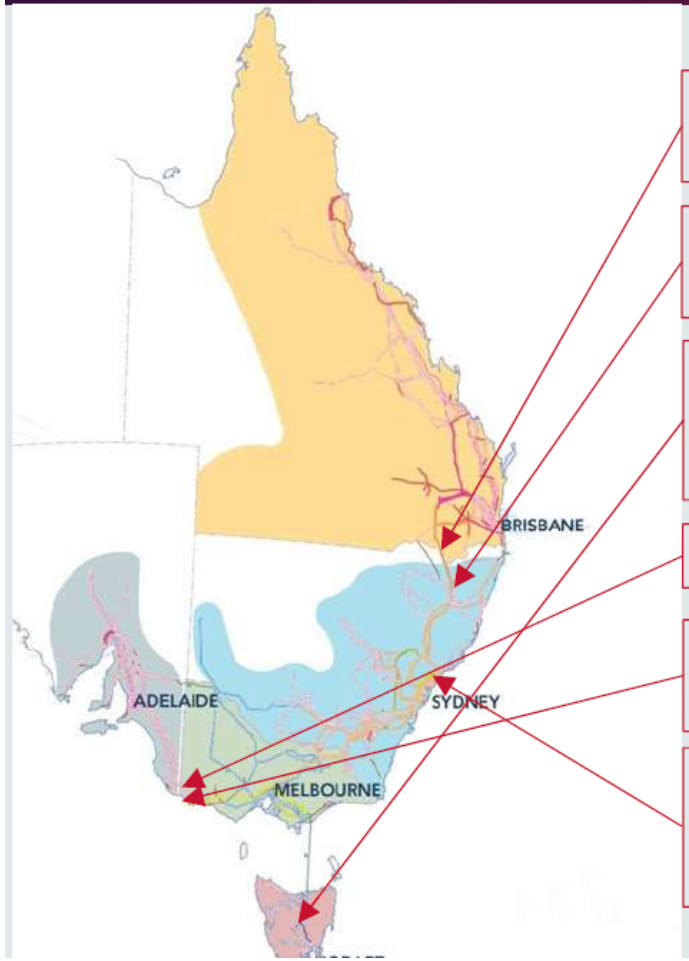
https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Network-connections/NEM-generation-maps

AusNet services

Large scale generation becomes increasingly distributed

Case Study
QLD and SA Separation event - 25 August 2018

1. Event - Sequence



1. Lightning strikes QNI 13:11:39
   QNI separates Qld and NSW at 13:11:41
2. Tamworth – Armidale trips at Armidale end only 13:11:41 (no impact)
3. Tasmania Adaptive UFLS-2 scheme disconnects 81MW of contracted industrial load 13:11:46.0
4. SA separated from VIC at Heywood 13:11:46.9
5. Automatic UFLS disconnects one Alcoa Potline of 282MW 13:11:47.6
6. Automatic UFLS disconnects two Tomago potlines (622MW) and 93.3MW of customer load in NSW 13:11:47.8

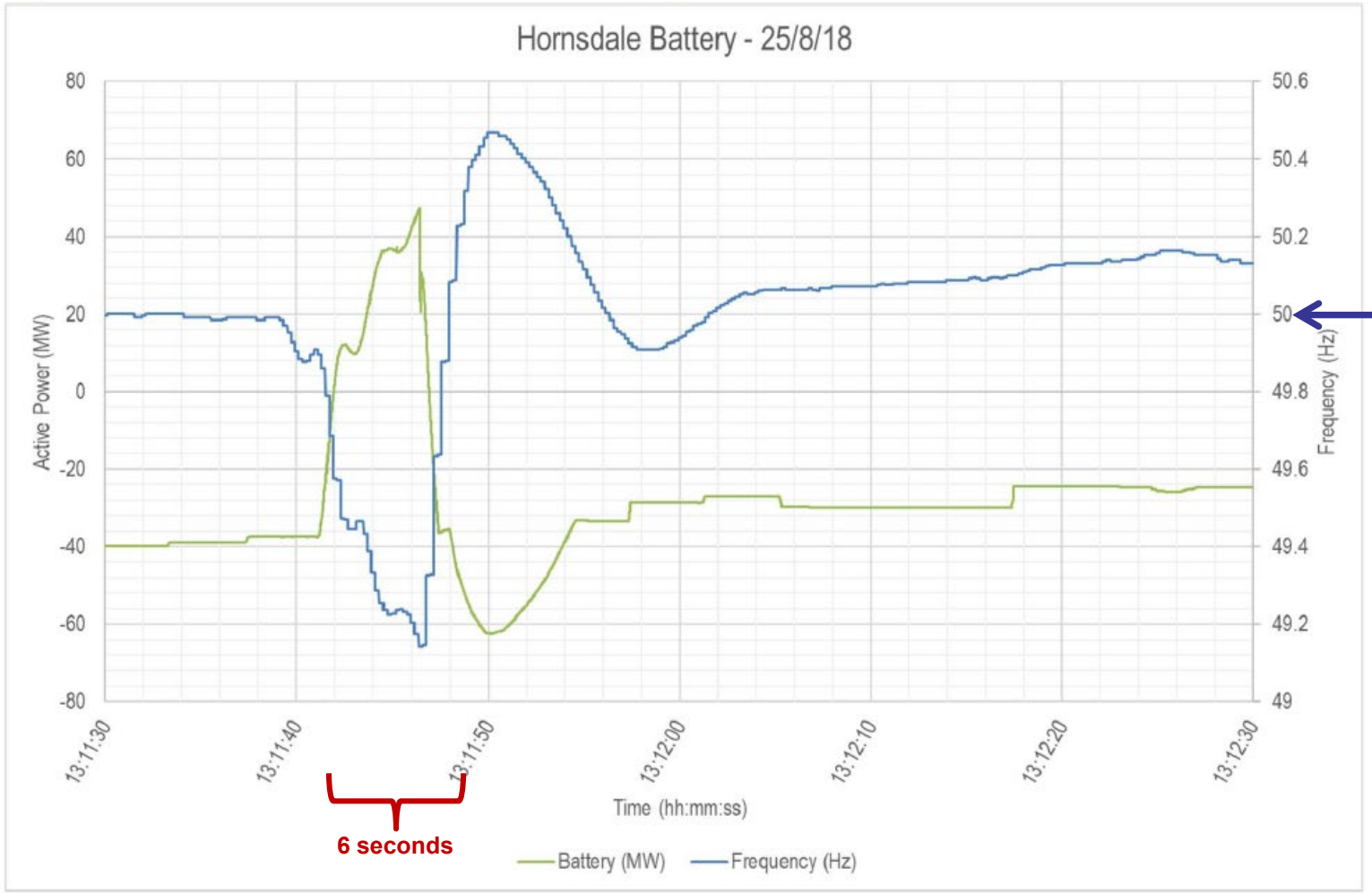
- **QNI separates**
- **Frequency drops in southern NEM**
- **Under frequency load shedding schemes activate**
  - TAS
  - VIC (Alcoa)
  - NSW (Tomago)
- **SA generation increases to VIC**
- **SA-VIC separates**
- **EAPT – Emergency APD Portland Tripping scheme**

FUNCTION
Direction of Flow

Source: Presentation and Final Report – Queensland and South Australia system separation on 25 August 2018, 10 January 2019, AEMO

Case Study
QLD and SA Separation event, 25 August 2018 – Battery Response

Figure 41 SA transmission-connected battery response – short-term



RESILIENCE
To unexpected

FUNCTION
Direction of Flow

Source: Final Report – Queensland and South Australia system separation on 25 August 2018, 10 January 2019, AEMO

Case Study

Load shedding event in Victoria 24 & 25 January 2019

WEATHER & DEMAND :

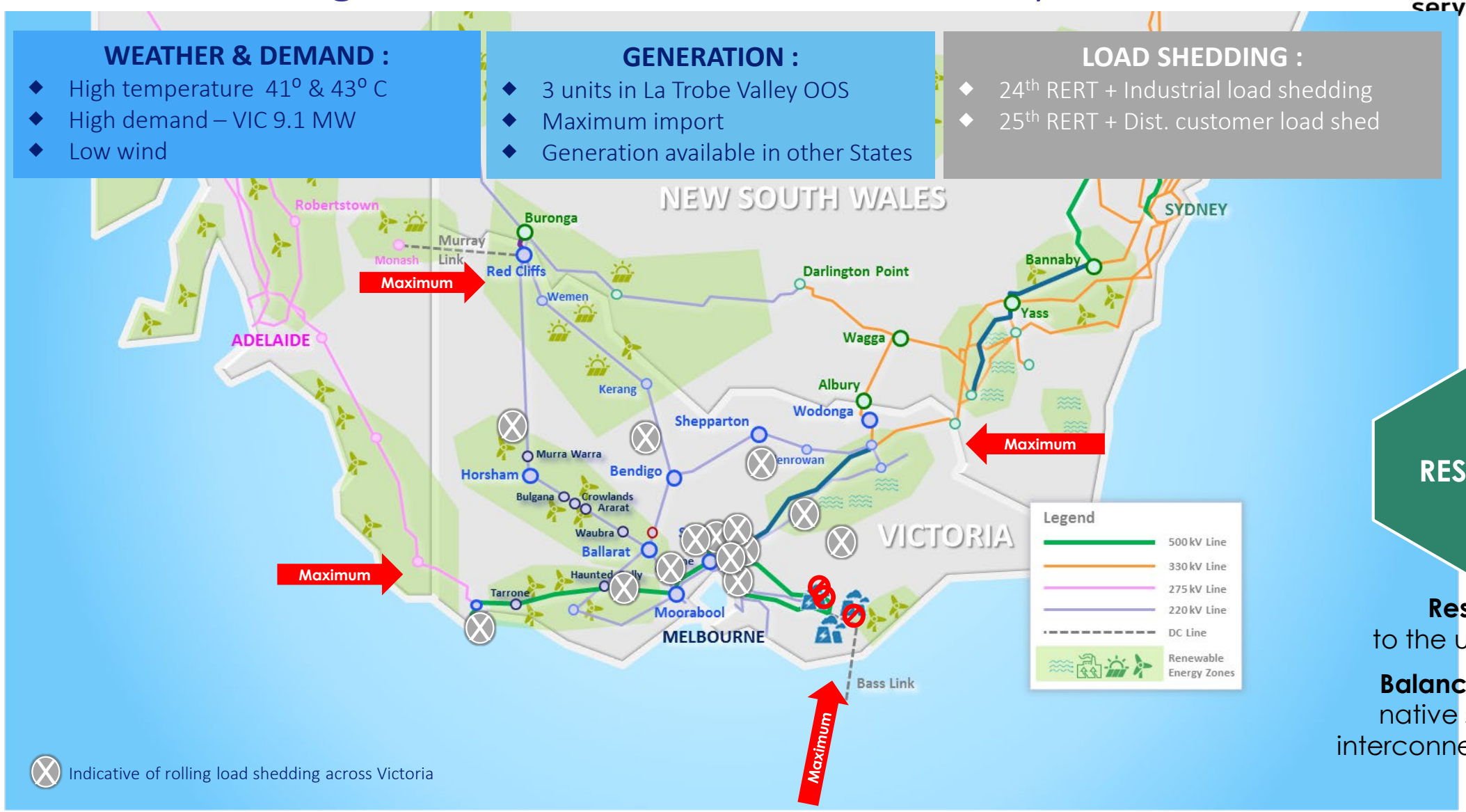
- High temperature 41° & 43° C
- High demand – VIC 9.1 MW
- Low wind

GENERATION :

- 3 units in La Trobe Valley OOS
- Maximum import
- Generation available in other States

LOAD SHEDDING :

- 24th RERT + Industrial load shedding
- 25th RERT + Dist. customer load shed



⊗ Indicative of rolling load shedding across Victoria

RESILENCE

Resilience
to the unexpected

Balance between
native supply and interconnector capacity

Accelerating towards transformation…