SYSTEM RESTART STANDARD

APRIL 2016

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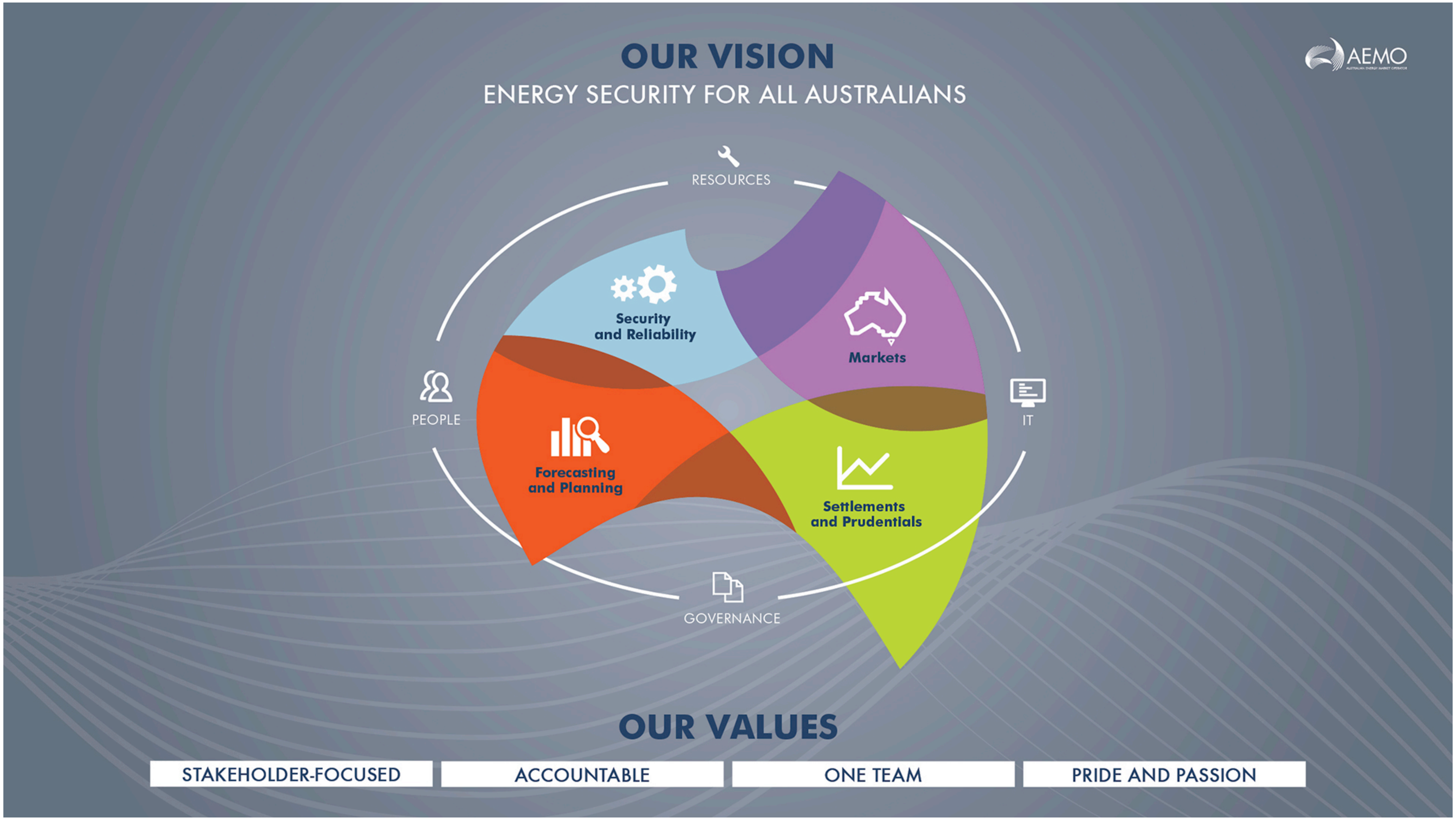
PRESENTATION OUTLINE

- AEMO’s role in SRAS
- SRAS procurement
- System characteristics relevant to system restoration
  - o Maximum and minimum loads
  - o Available generation
  - o Fuel types
  - o Trip to House Load (TTHL) SRAS source
- System Restart Standard
  - o Sub-networks
  - o Sensitive loads

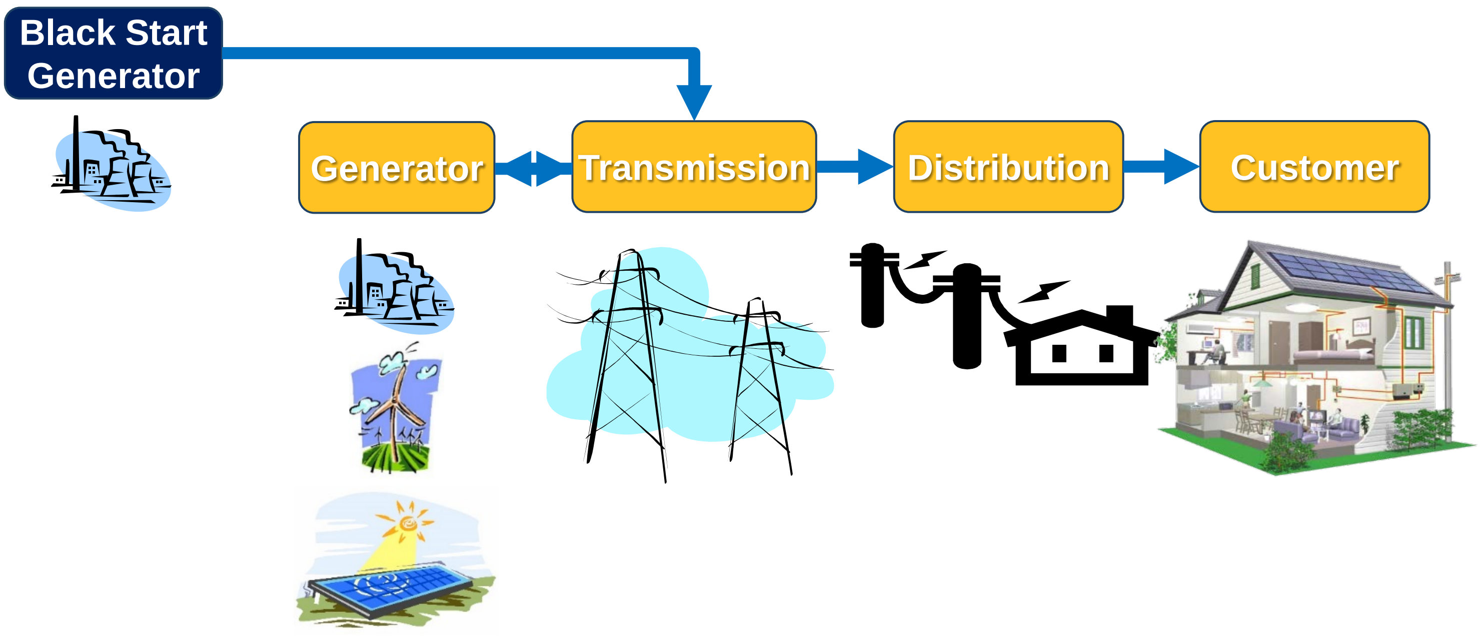
ABOUT AEMO – WHO WE ARE



AEMO'S ROLE IN SRAS

WHAT	HOW
Acquire System Restart Ancillary Services to meet the System Restart Standard at the lowest cost (**the SRAS Procurement Objective**)	Procurement process
Develop and publish the SRAS guideline	Industry consultation 12 Months
Determine electrical sub-network boundaries	Industry consultation 12 Months
Witness SRAS provider demonstrating relevant plant's SRAS capability to AEMO's satisfaction	Consultation with generator and TNSP
Prepare and amend system restart plan for managing and coordinating system restoration activities	Consultation with TNSP jurisdiction and generators
System Restart training	Training to TNSP, Generator, Distributor

SRAS PROCUREMENT – WHAT WE ARE BUYING



NEW APPROACH IN SRAS PROCUREMENT

- AEMO developed detailed models of power system components involved during restoration, including the SRAS generator and the network to be restored

- AEMO verified system restart procedures by power system modelling and simulation

- AEMO used models to improve and develop restoration paths where necessary

SRAS GENERATOR PROCUREMENT OVERVIEW

- Collect data from SRAS applicants and TNSPs
- Create models and simulate cranking paths
- Determine if service capable of meeting SRS (combined or alone)
- Rank by price accounting for availability

BASELINE ASSUMPTIONS IN SRAS GENERATOR PROCUREMENT

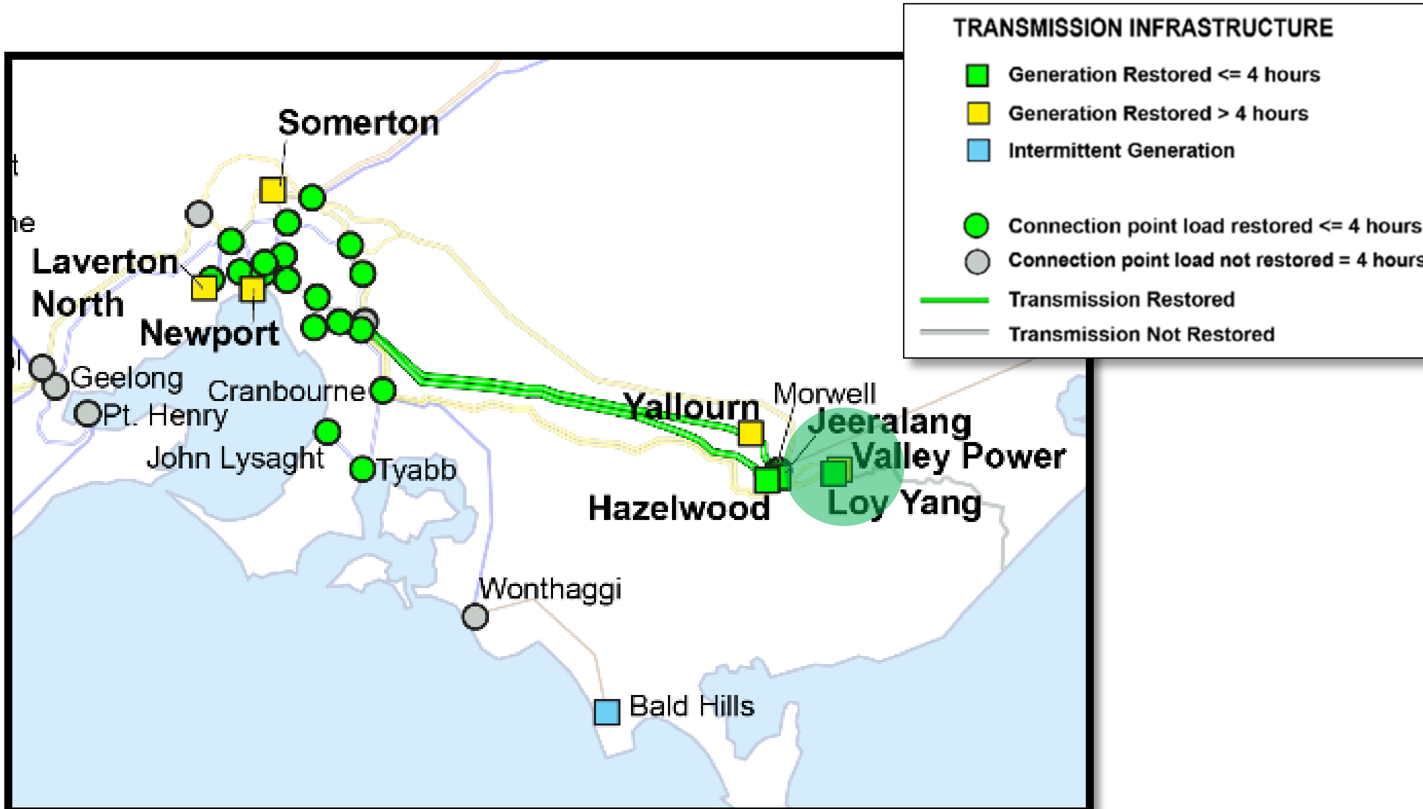
- The entire sub-network under consideration is blacked out
- No contribution from adjoining interconnectors
- All generation and transmission equipment is intact and able to be operated
- Power of direction is not exercised
  - SRAS generators must energise auxiliaries of all other power stations required to meet SRS, including those with potential self-start capability
- Non-SRAS generation capability based on data provided by respective Generators
- Only predictable loads are energised on restart paths
  - Connection points with high solar PV are avoided

2015 SRAS PROCURMENT SUMMARY

Electrical sub-network	Contracts Submitted EOI	Contracts Procured	Procured Generating Units	SRS met?
New South Wales	9	2	10	✓
QLD North	4	2	6	✓
QLD South	5	1	4	✓
South Australia	6	2	3	✓
Tasmania	6	1	3	✓
Victoria	8	2	7	✓
Totals	**38**	**10**	**33**	

- No single point of failure

OPTIMAL NUMBER OF SRAS SOURCES

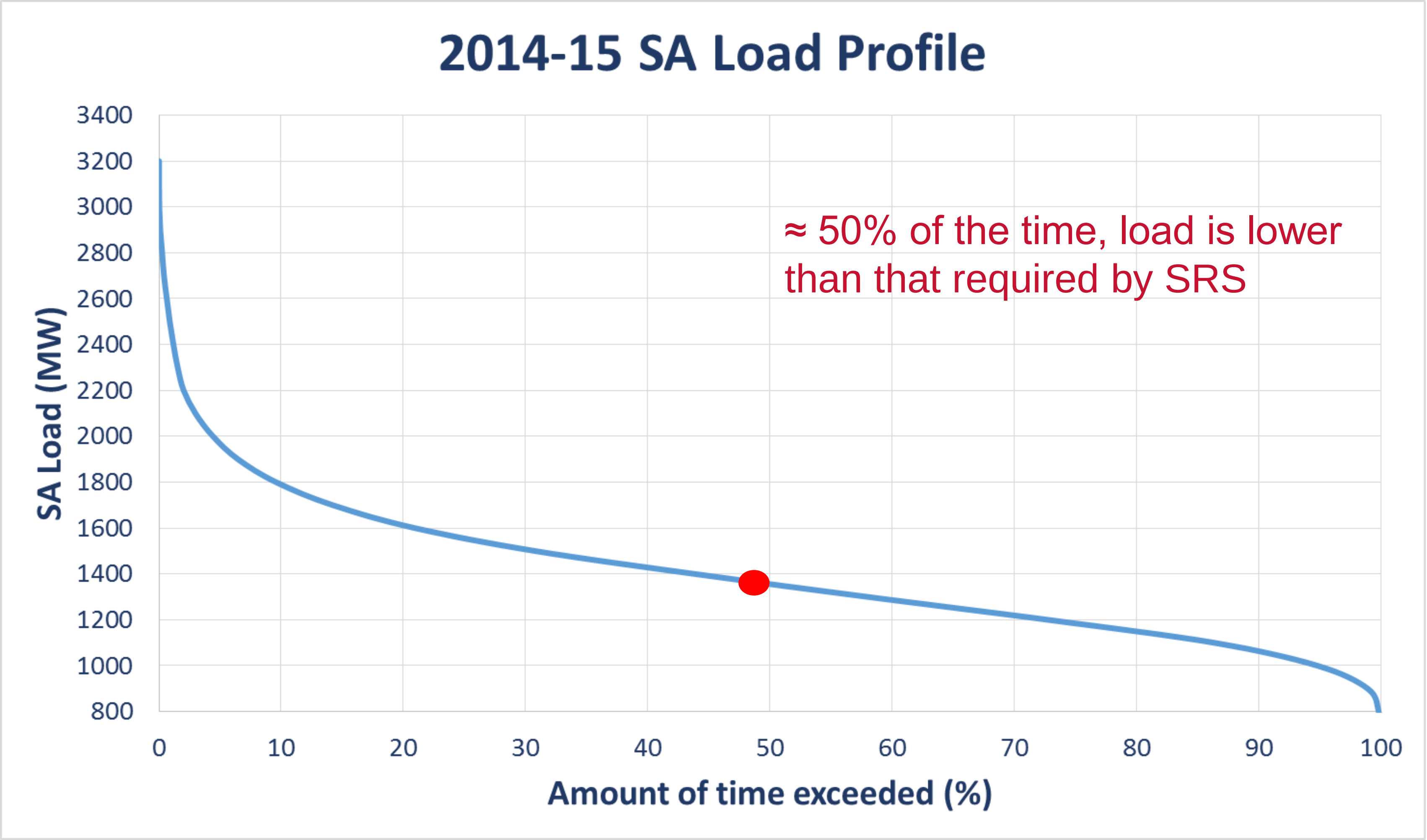


- Four SRAS capable power stations (comprising 13 generating units) exist in the highlighted area
- **Procuring more than two services (comprising 7 generating units) does not add any value in terms of MW restoration or time**

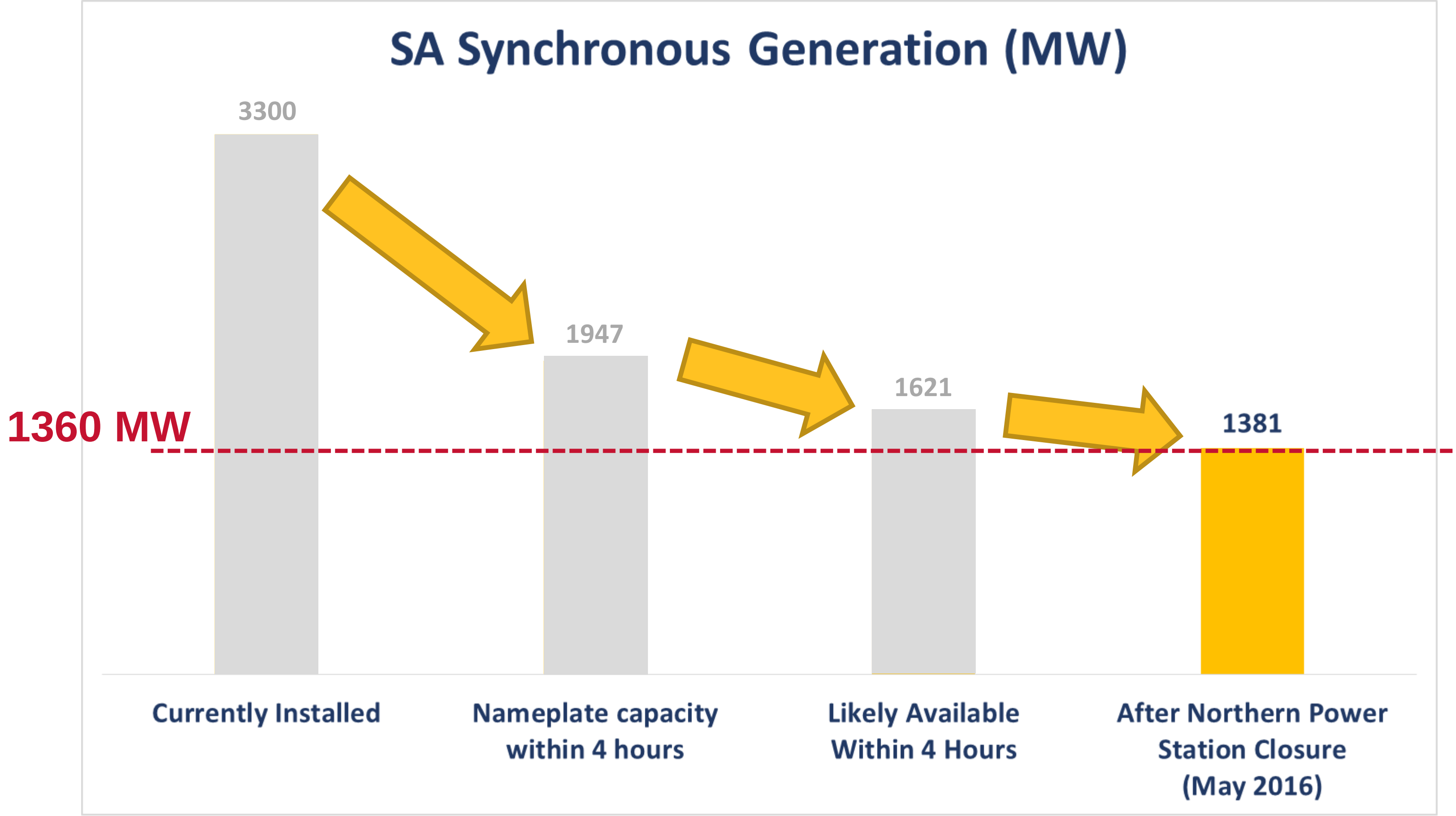
SYSTEM CHARACTERISTICS RELEVANT TO SYSTEM RESTORATION

- In all states except QLD, SRS requirements (40% of peak demand) is greater than the minimum demand

SOUTH AUSTRALIAN HISTORICAL DEMAND VARIATIONS

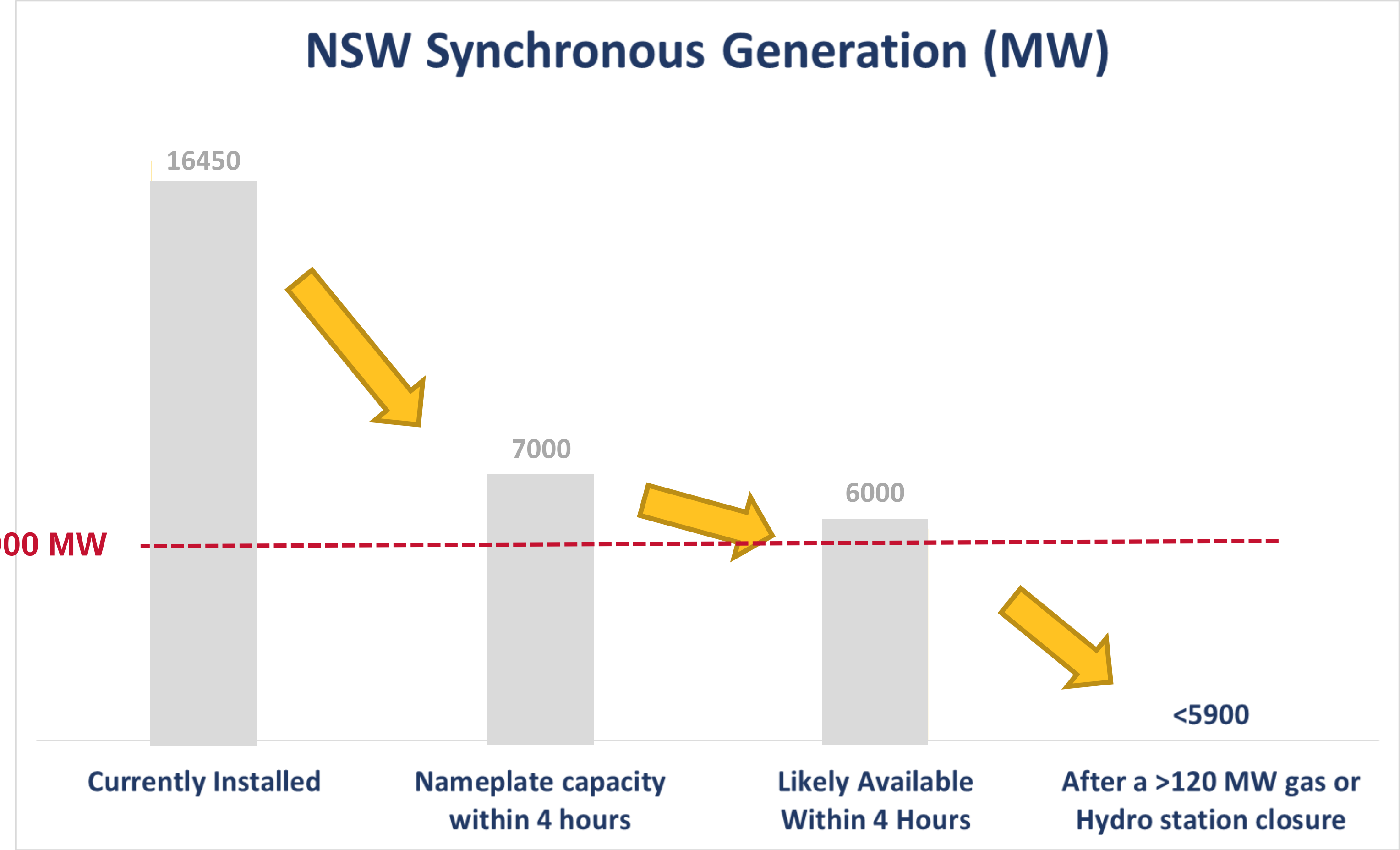


PRACTICALITY OF 40% SRS TARGET (SA EXAMPLE)



- 21 MW margin between SRS requirements and available generation
- Very little restorable synchronous generation
- Vast majority of transmission network needs to be energised

PRACTICALITY OF 40% SRS TARGET (NSW EXAMPLE)



≈100 MW margin between SRS requirements and available generation

FUEL TYPE CONSIDERATIONS

- The following technologies are used as SRAS sources:
  - Gas
  - Hydro
  - Conventional coal fired
  - Trip-To-House-Load (TTHL)

- The following technologies cannot be currently used as SRAS sources
  - Wind
  - Solar PV

  WHY?

  - Source intermittency
  - Reasonably strong network required for stable operation

TTHL SRAS SOURCE CAPABILITY

- Some of the procured TTHL units are essential services, i.e. no alternative exists
- Highly unlikely for multiple units to fail
  - o Each generating unit at a power station has an independent TTHL facility, multiple units within each SRAS contract
- Less susceptible to fuel scarcity compared to gas and hydro units
- Successful practical experiences of NEM TTHL units during actual network islanding events
- Contracts in place – Deliberate effort to monitor, maintain and test equipment regularly.

SUB-NETWORKS

- Number of SRAS units needed to meet current SRS are the same irrespective of boundaries
- AEMO modelling and analysis concludes determination of sub-networks should be based on location of capable generators

SENSITIVE LOADS

- AEMO prioritise sensitive loads in the System Restart Plan

- Fastest and most capable generators are used for energising sensitive loads

- Sensitive loads have traditionally been provided with their minimum load requirements. Have minimum requirements changed ?

- Restoring several hundred MW of load requires 3-5 times installed generation capacity:
  - e.g. approximately 2 GW of nearby synchronous generation is needed to restore a single 500 MW load

- The need for a strong power system to do so.

CAN SENSITIVE LOADS BE RESTORED WITH CURRENTLY AVAILABLE GENERATION?

Restoring a minimum of 750 MW of load requires installation of 1-2 GW of new nearby fast-start synchronous generation

THANK YOU:

QUESTIONS