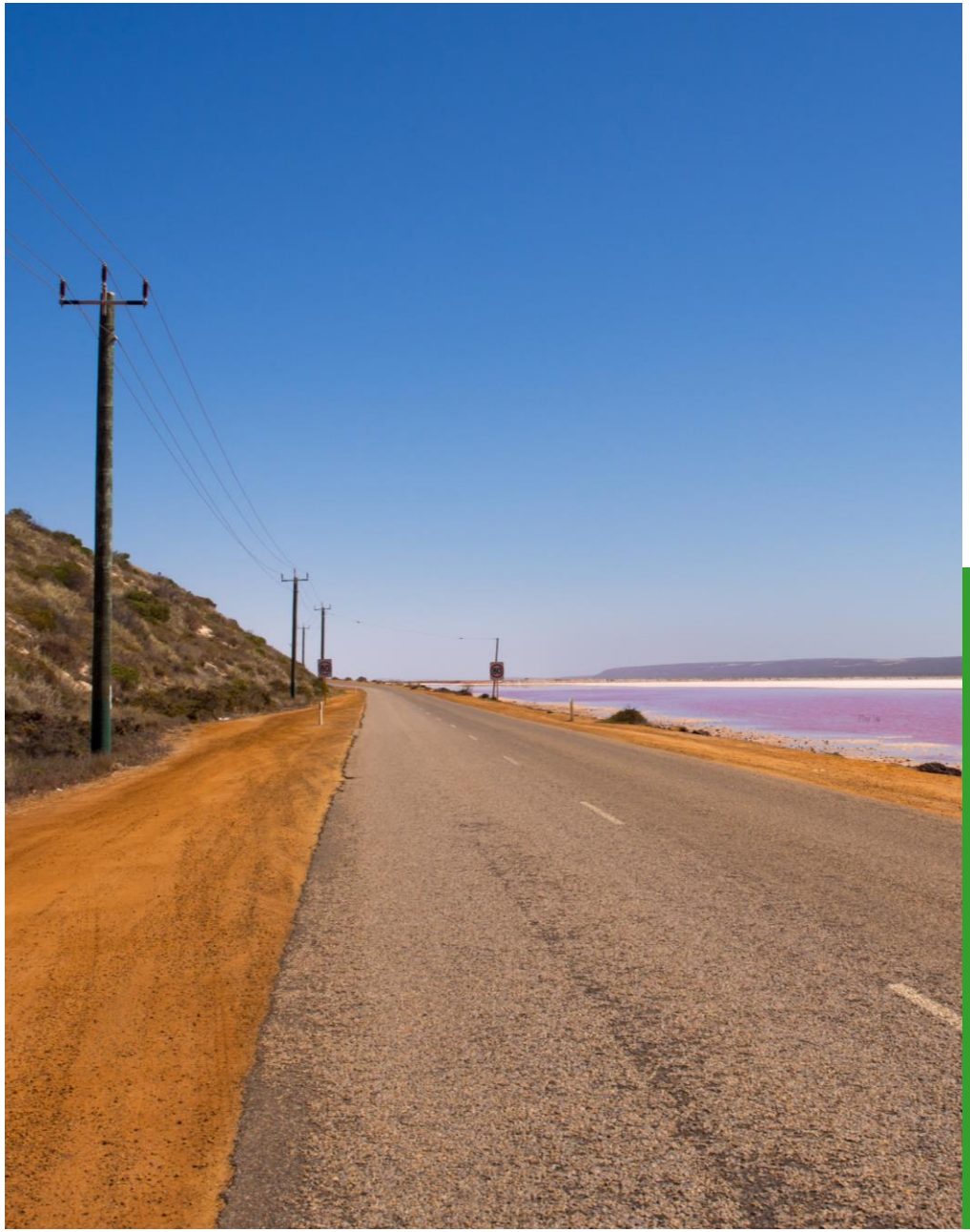

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2021 LT PASA: RELIABILITY ASSESSMENT

14 April 2021

Contents

- WEM Rules context
- Approach overview
- EUE Assessment
- Availability Class requirements
- Draft results

WEM Rules context – scope of Reliability Assessment

WEM Rule 4.5.9: Planning Criterion

a) Forecast peak component: 10% POE peak + Min Freq Keeping (MFK) + Reserve Margin (RM) + Intermittent Load allowance

b) Reliability component: Capacity sufficient to limit Expected Unserved Energy (EUE) to 0.002% of expected demand

Reserve Capacity Target (RCT) = Max(a, b)

WEM Rule 4.5.12: Availability Class requirements

b) Min Availability Class 1 requirement:
- All Availability Class 2 capacity dispatched to minimise peak demand
- Outage evaluation criteria satisfied (capacity margin)
- Planning Criterion satisfied (i.e. EUE < 0.002% of annual expected demand)

c) Max Availability Class 2 requirement:
- RCT minus Availability Class 1 requirement

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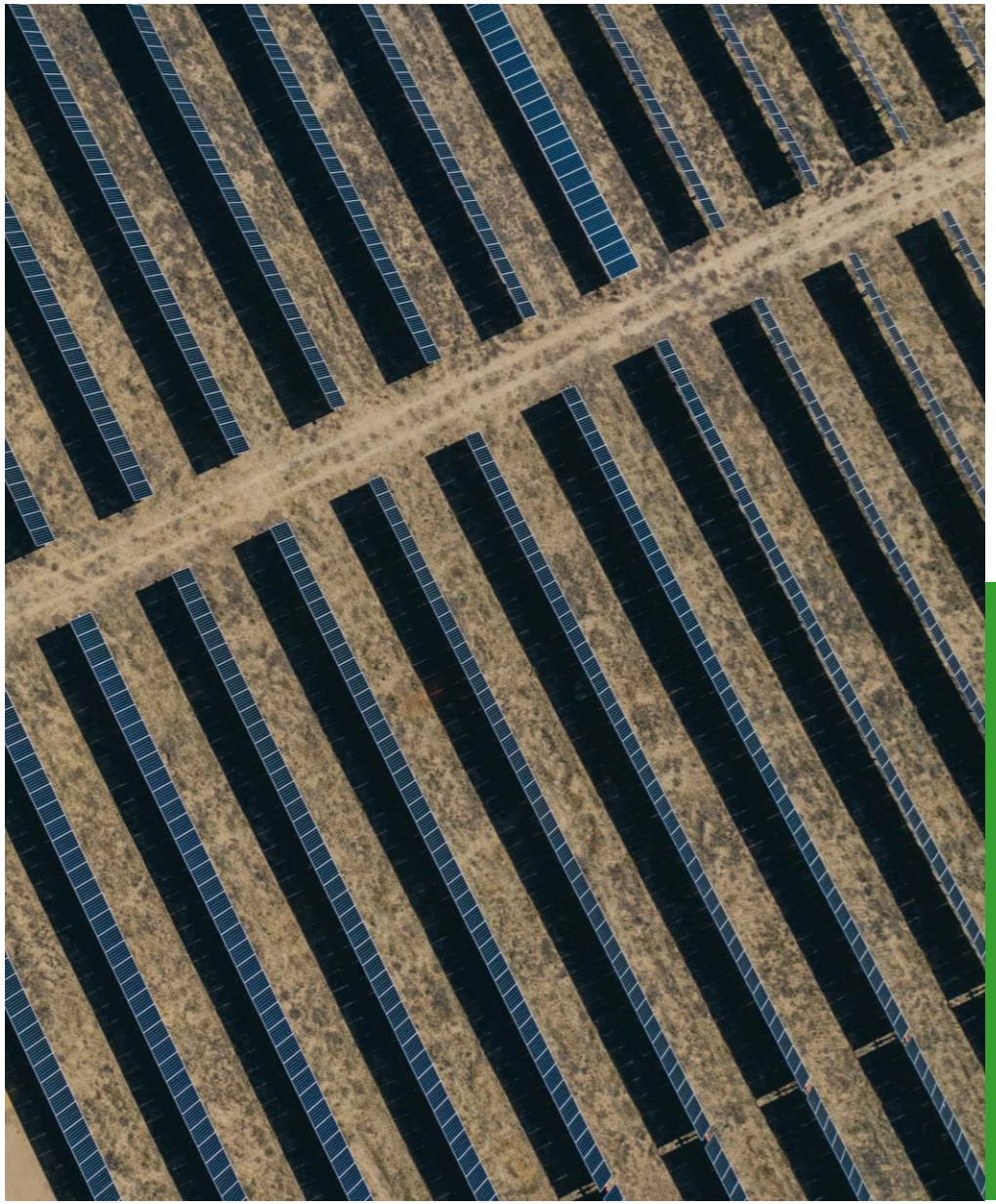

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APPROACH

Simulating Unserved Energy - overview

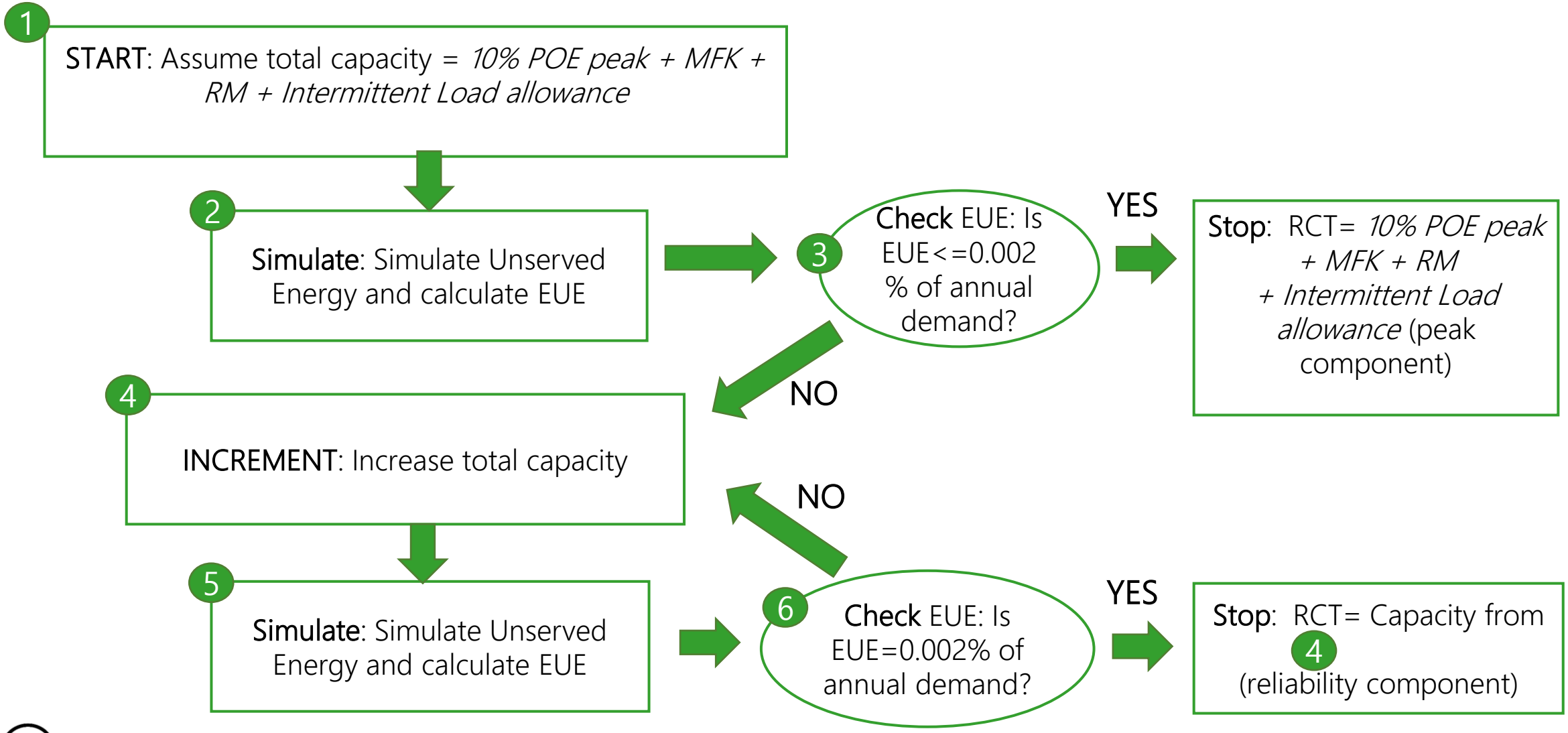
Key modelling output is estimate of Unserved Energy, simulated using bespoke model (CAPSIM)

1. Forecast load for each hour for each year of LT PASA horizon
   - Five sets of hourly traces calculated using five different historical load shapes (load scenarios)
2. Calculate Unconstrained Available Capacity
   - Equals total capacity less Planned Outages less randomly simulated Forced Outages. Scaled to reflect RCT in each Capacity Year.

Apply SCED constraints

3. Calculate Constrained Available Capacity
   - Equals Unconstrained Available Capacity less SCED curtailments
4. Calculate Unserved Energy for each year of LT PASA horizon
   - Hourly Unserved Energy equals 3 minus 1
   - Annual Unserved Energy equals sum of hourly estimates
   - 2 3 Is simulated 50 times (random forced outage seeds) per load scenario (1) -> 250 estimates of Unserved Energy
5. Calculate Expected Unserved Energy
   - Average 250 Annual Unserved Energy estimates

EUE Assessment (4.5.9)



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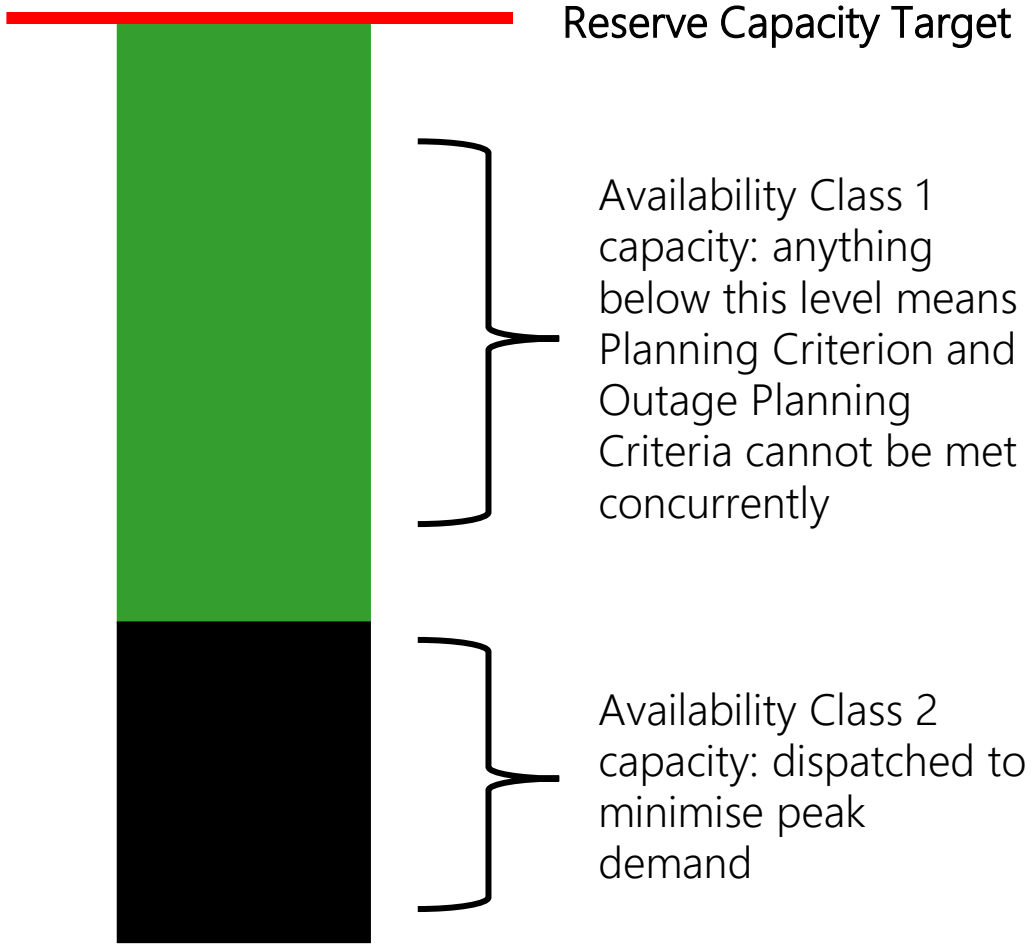
Availability Class Requirements (4.5.12)

- Availability Class 1 requirement is minimum level of capacity at which:
  - All Availability Class 2 capacity dispatched to minimise peak demand
  - Outage evaluation criteria satisfied (capacity margin)
  - Planning Criterion satisfied (i.e. EUE < 0.002% of annual expected demand)
- Availability Class 2 capacity is difference between RCT and Availability Class 1 capacity
- Determination of Availability Class 1 capacity also requires simulation of Unserved Energy, but with some differences to the Reliability Assessment approach



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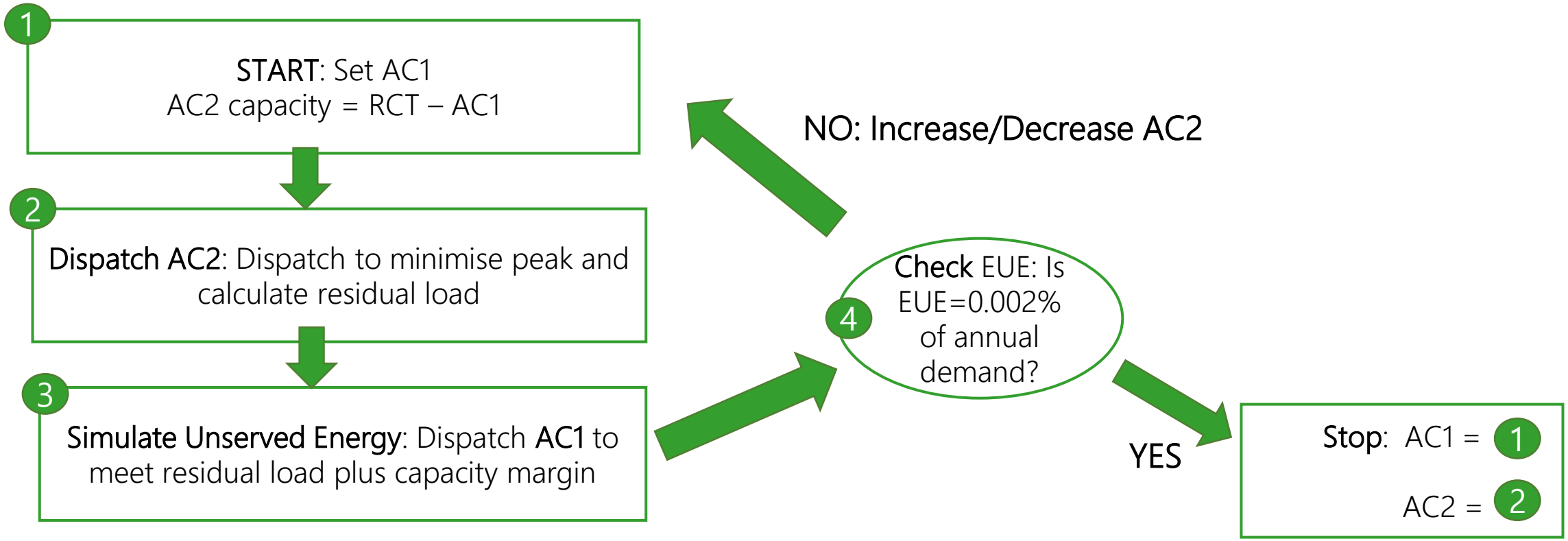
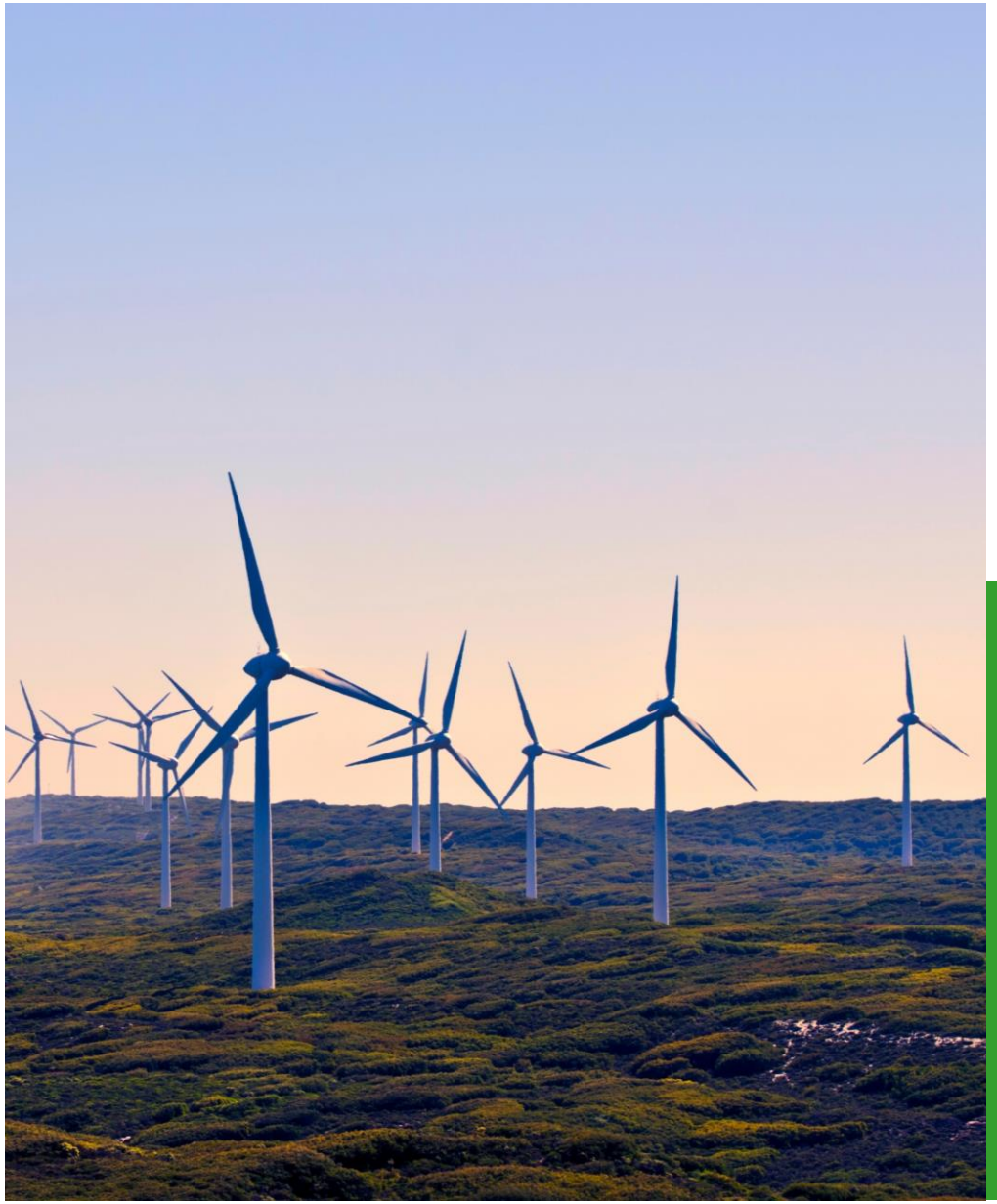
Availability Class requirements





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DRAFT RESULTS

EUE Assessment – Summary

- Reserve capacity target set by peak component in all years
- % EUE significantly below 0.002% threshold, but higher than LT PASA 2020 due to more planned outages and effect of SCED curtailment

Capacity Year	RCT = peak component	EUE (MWh)	EUE as % of Demand	EUE (MWh) - 2020
2021-22	4,297	1.54	0.0000092%	0.00
2022-23	4,285	2.45	0.0000148%	0.00
2023-24	4,304	0.47	0.0000029%	0.15
2024-25	4,334	8.07	0.0000495%	2.22
2025-26	4,338	5.06	0.0000311%	0.00
2026-27	4,361	3.33	0.0000206%	0.00
2027-28	4,375	9.45	0.0000586%	1.06
2028-29	4,385	5.54	0.0000344%	1.45
2029-30	4,388	21.40	0.0001330%	1.92
2030-31	4,409	8.98	0.0000557%	

Unserved energy mainly occurs during evening peaks in winter

Month/Hour	17:00	18:00	19:00	20:00
January	0.00	0.00	0.00	0.00
February	0.19	2.69	1.57	0.99
March	0.92	7.30	3.18	0.00
April	0.00	0.00	0.00	0.00
May	0.00	0.00	0.00	0.00
June	3.11	11.95	0.00	0.00
July	0.51	7.53	0.43	0.00
August	0.00	8.30	0.67	0.26
September	0.00	8.69	7.00	0.00
October	0.00	0.00	0.00	0.00
November	0.00	0.00	0.00	0.00
December	0.00	0.59	0.41	0.00

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Unserved energy varies by load scenario

- Half of EUE is driven by the 2018-19 reference year. High winter loads -> increased risk of UE

Month/R	2015	2016	2017	2018	2019
January	0.00	0.00	0.00	0.00	0.00
February	0.10	0.00	0.00	0.92	4.42
March	1.89	0.17	7.70	1.64	0.00
April	0.00	0.00	0.00	0.00	0.00
May	0.00	0.00	0.00	0.00	0.00
June	0.00	0.00	0.00	15.06	0.00
July	0.00	7.81	0.00	0.65	0.00
August	0.00	7.95	0.11	0.71	0.46
Septemb	0.00	0.23	0.00	15.47	0.00
October	0.00	0.00	0.00	0.00	0.00
Novemb	0.00	0.00	0.00	0.00	0.00
Decembe	0.00	0.00	0.00	0.00	1.00
Total	1.99	16.16	7.81	34.45	5.89

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Questions

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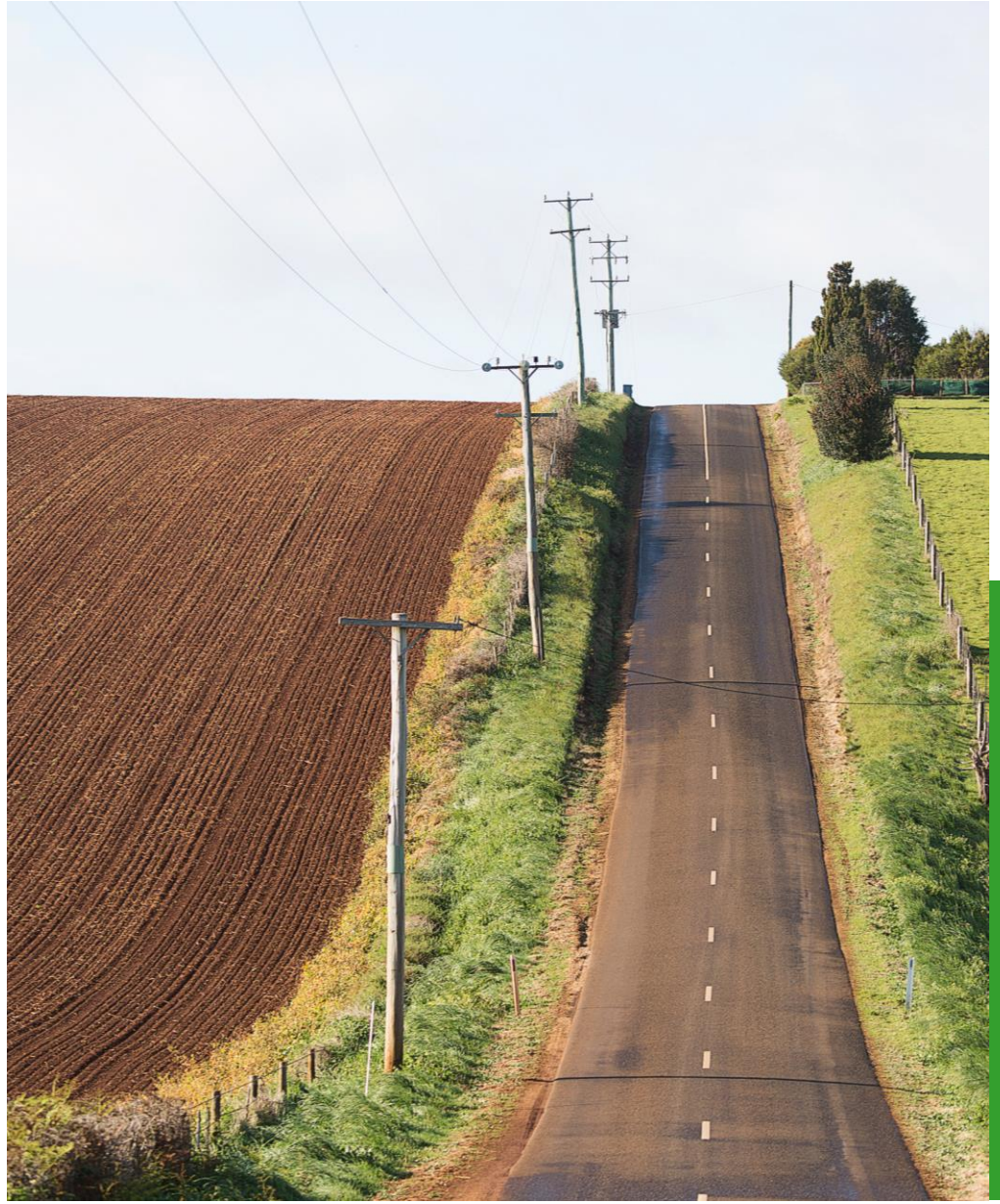

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APPENDIX

1 Load Forecast

- Based on AEMO's 50% POE and annual expected demand forecast
- To convert AEMO's load forecasts into hourly load traces, we need to model how that load will be spread out over the year and when the peaks will occur.
- Five load shape scenarios (reference years) based on historical Capacity Years (2015-16 – 2019-20)
- Model underlying demand and DER, combine to get operational load shape and timing.
  - Underlying demand shape and DER capacity factors based on reference year.
- Scale shape and timing to AEMO's operational forecasts

❷ Unconstrained Available Capacity

Total generating capacity in hour h, scaled to RCT.

LESS

Total Planned Outages in hour h

Based on participant submitted long-duration outages

LESS

Total Forced Outages in hour h

Simulated based on historical 36 month forced outage rates

Thermal capacity = Capacity Credits assigned

Intermittent capacity based on historical or participant provided profile (for each reference year)

Storage capacity equals storage's max hourly generation capability from 4-8pm; 0 Otherwise.

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3 Constrained Available Capacity

- CAPSIM optimises the Constrained Available Capacity subject to the following constraints
  - SCED constraints must be met
  - Constrained Available Capacity >= hourly Load Forecast (1)
  - Constrained Available Capacity >= Unconstrained Available Capacity (2)
- Stochastic simulation of forced outages and multiple load scenarios means that ~2M+ hourly optimisation solves are required per year
  - Not practicable to solve
  - Optimisation solves are unnecessary in periods where Unserved Energy is unlikely
  - A threshold of 400 MW is used to limit the number of solves

4 5 Unserved Energy and Expected Unserved Energy

4 Calculate Unserved Energy for each year of LT PASA horizon

Annual Unserved Energy equals sum of hourly estimates

2 3 Is simulated 50 times (random forced outage seeds) per load scenario (1) -> 250 estimates of Unserved Energy

5 Calculate Expected Unserved Energy (EUE)

Average 250 Annual Unserved Energy estimates

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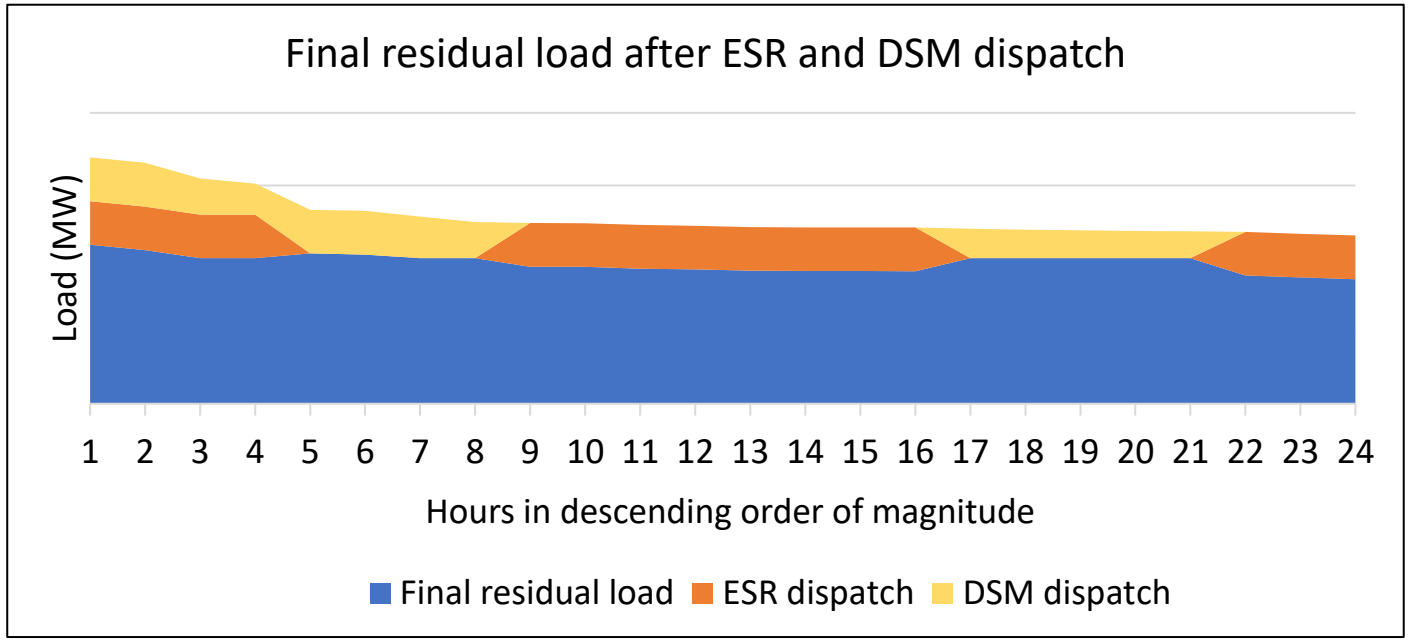
Availability Class Requirements

Dispatch Availability Class 2 (AC2) capacity dispatched to minimise peak demand first. Load forecast is based on average load scenario.

- Assume all ESR will generate in accordance with RCOQ from 4-8pm (modelling assumption)
- Dispatch DSM to minimise the peak of the residual (after ESR is accounted for) load curve
  - Heuristic uses iterative process to dispatch all DSM (subject to constraints on availability) while minimising peak load.
- Final residual load curve is used in simulation of Unserved Energy with AC1 capacity



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