ROBINSON BOWMAKER PAUL

2022 LONG TERM PASA: RELIABILITY ASSESSMENT

13 April 2022

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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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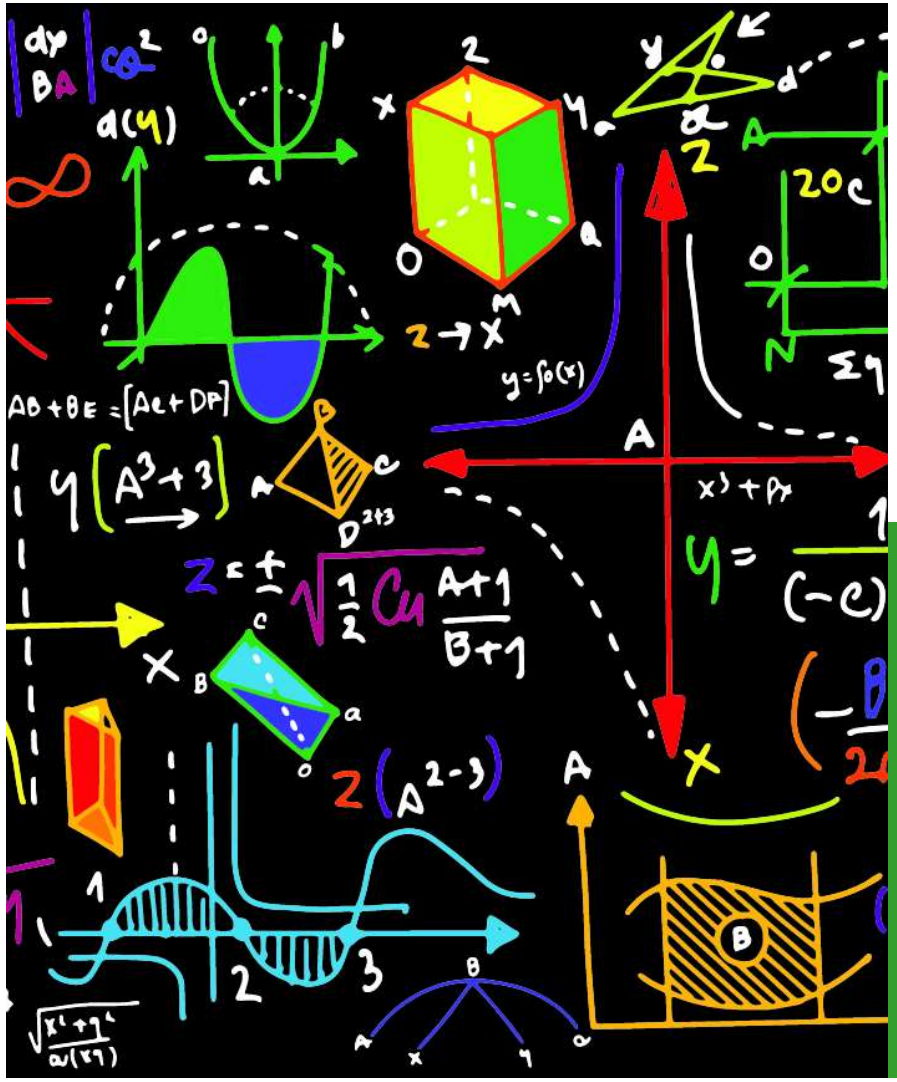

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APPROACH

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

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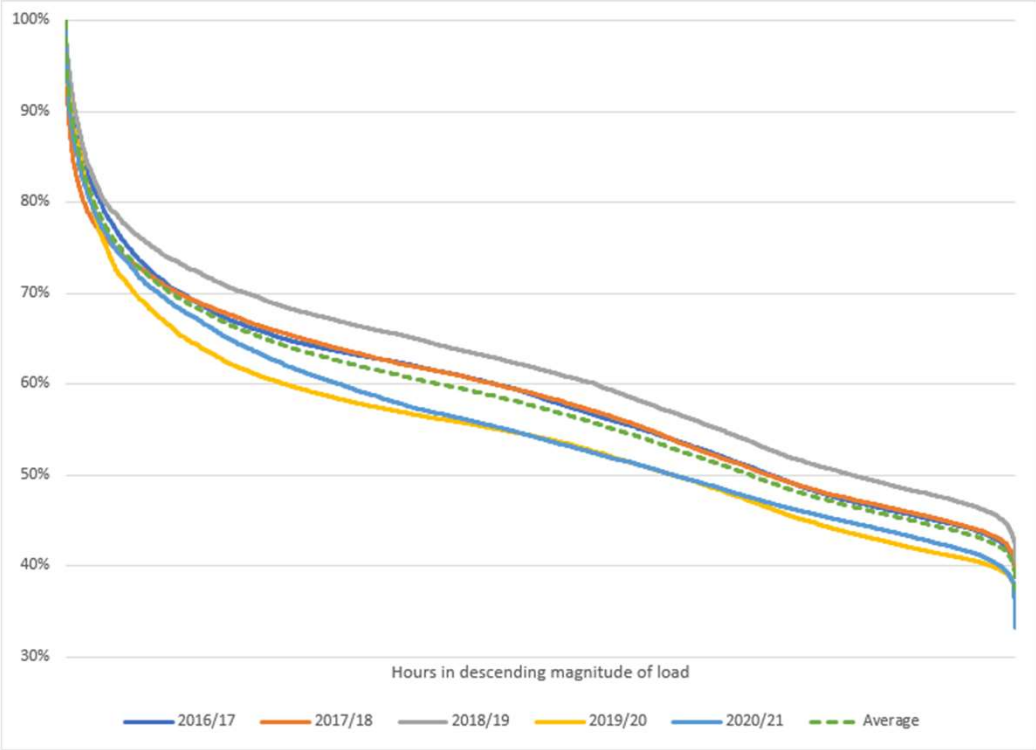
❶ Load Forecast

- Based on AEMO's peak (MW) and annual consumption (MWh) forecast. Three scenarios modelled:
  - 50% POE peak and expected consumption
  - 10% POE peak and expected consumption
  - 10% POE peak and high consumption
- 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 (2016-17 – 2020-21)
- Model underlying demand and DER, combine to get operational load shape and timing.
- Scale shape and timing to AEMO's operational forecasts



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2 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 4:30-8:30pm; 0 Otherwise.

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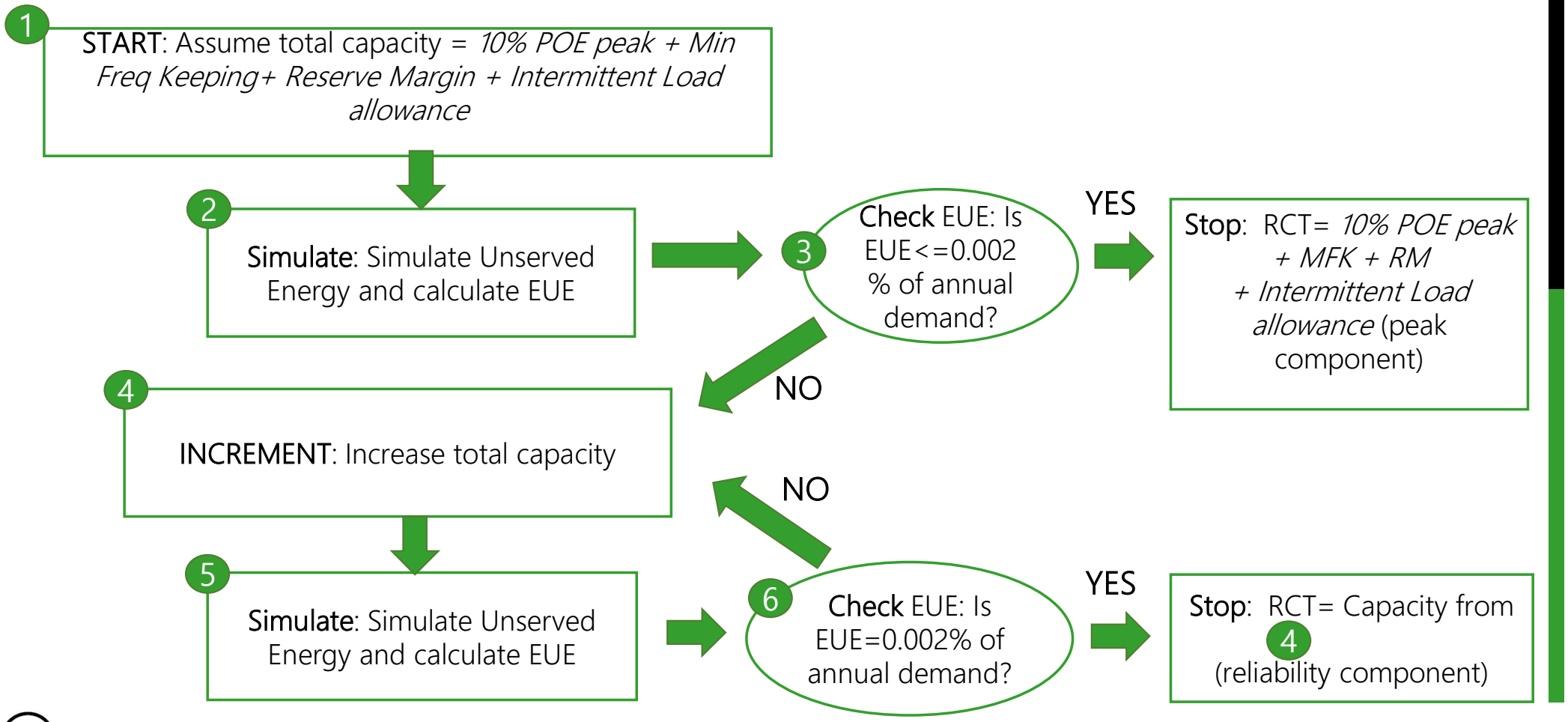
3 Constrained Available Capacity

- CAPSIM optimises the Constrained Available Capacity subject to the following constraints
  - Network 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 Calculate Expected Unserved Energy



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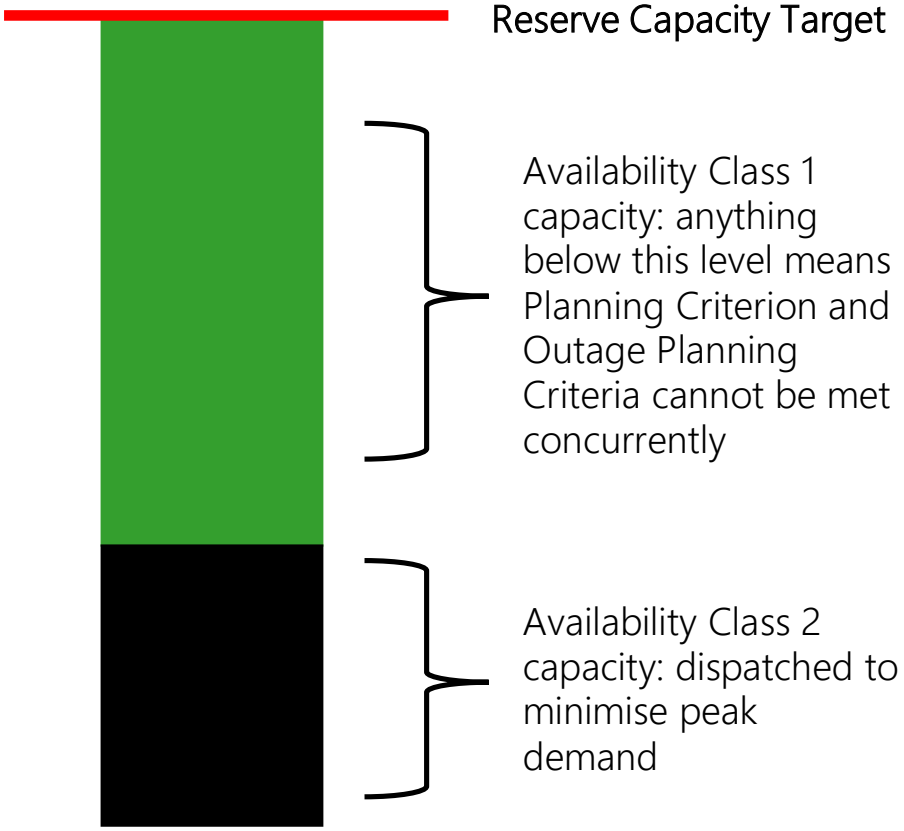
Availability Class Requirements (4.5.12)

- 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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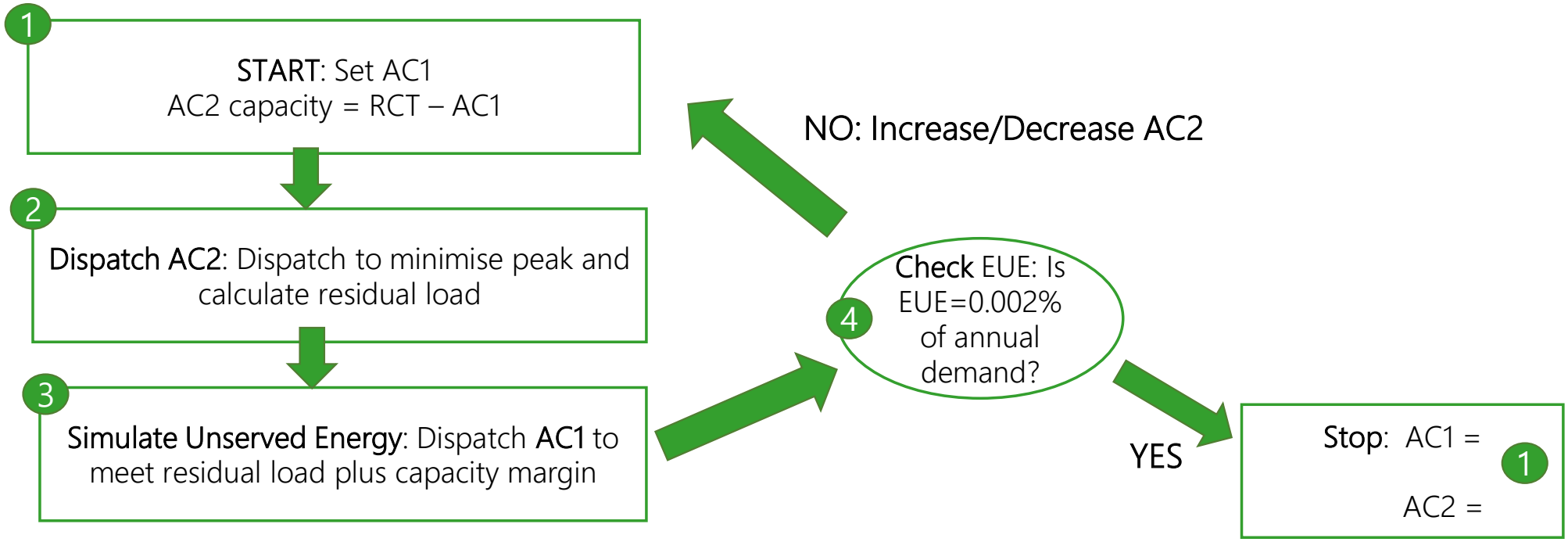
Availability Class requirements



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QUESTIONS

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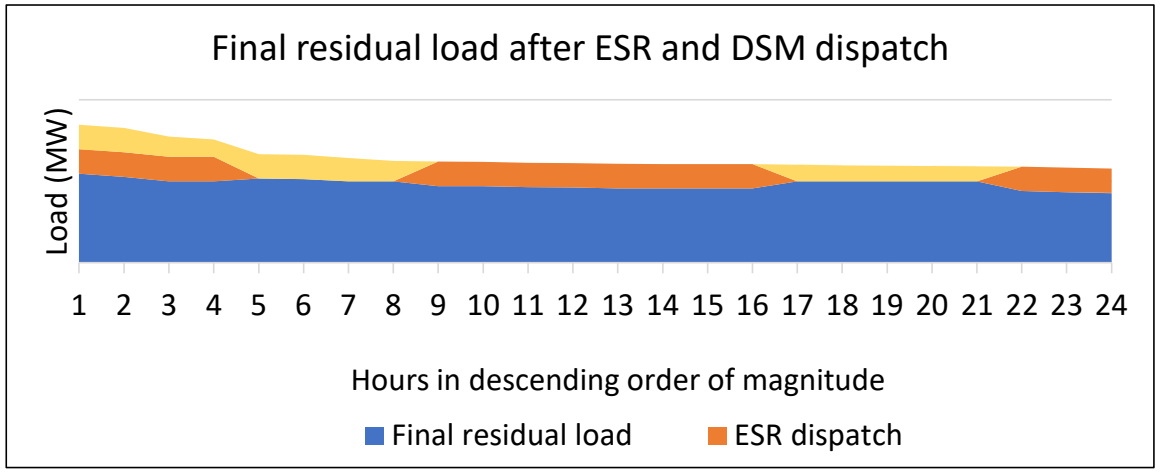
APPENDIX

Dispatch of Availability Class 2 Capacity

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 4:30-8:30pm (ESROIs)
- 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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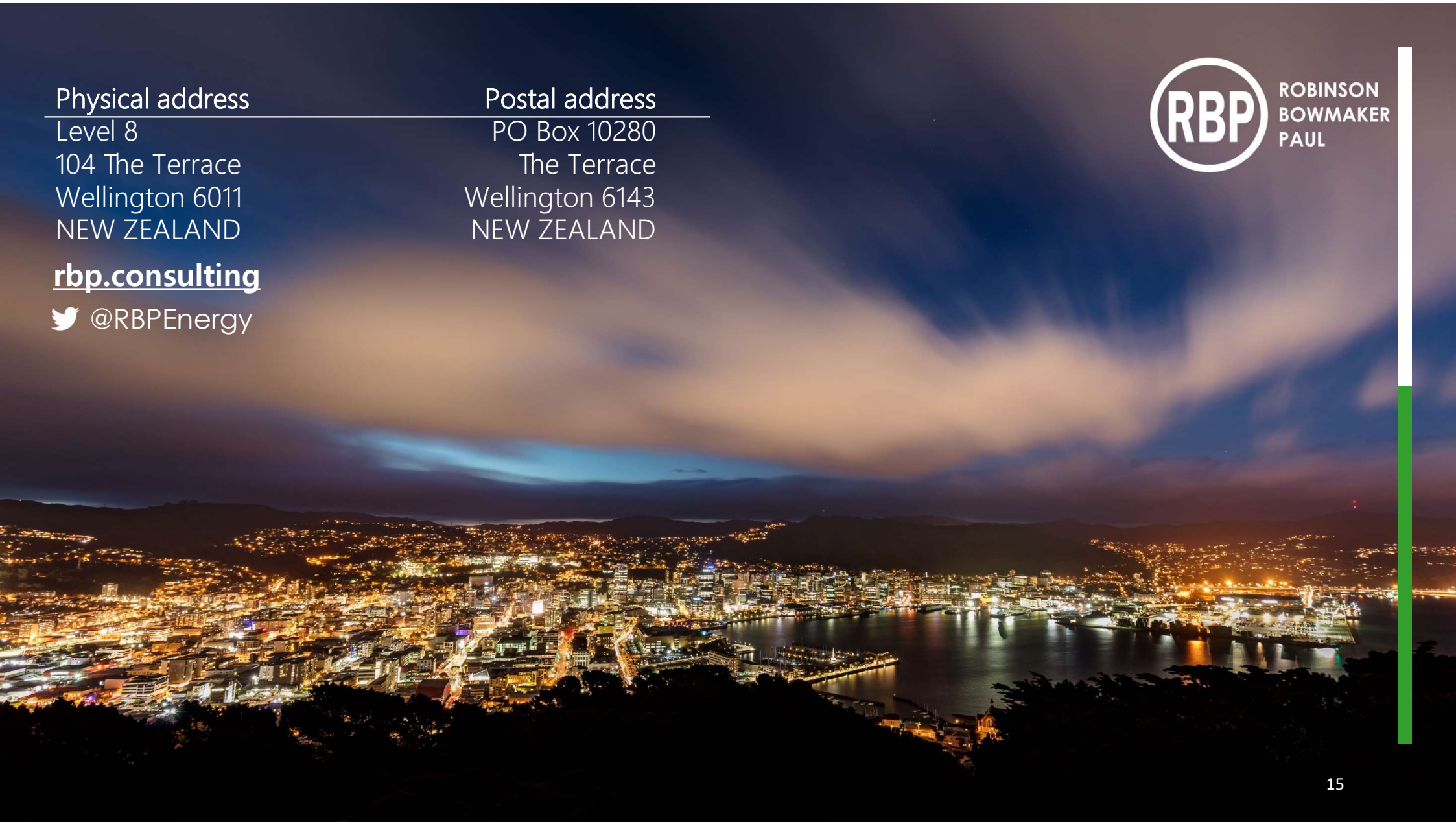

Physical address	Postal address
Level 8	PO Box 10280
104 The Terrace	The Terrace
Wellington 6011	Wellington 6143
NEW ZEALAND	NEW ZEALAND

rbp.consulting

@RBPEnergy

ROBINSON BOWMAKER PAUL