Draft 2022-23 Summer demand review

29 March 2023 FRG Meeting

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Purpose and agenda

The purpose of this presentation is to *inform* the FRG on the forecast accuracy of AEMO's 2022 Electricity Statement of Opportunities (ESOO) maximum and minimum demand forecasts for summer 2022-23 (November 2022 – March 2023).

Today's agenda includes:

- Explaining Probabilities of Exceedance (POEs)
- Results overview
- Unpacking how maximum demand is achieved
- Explaining each region's results for maximum and minimum demand

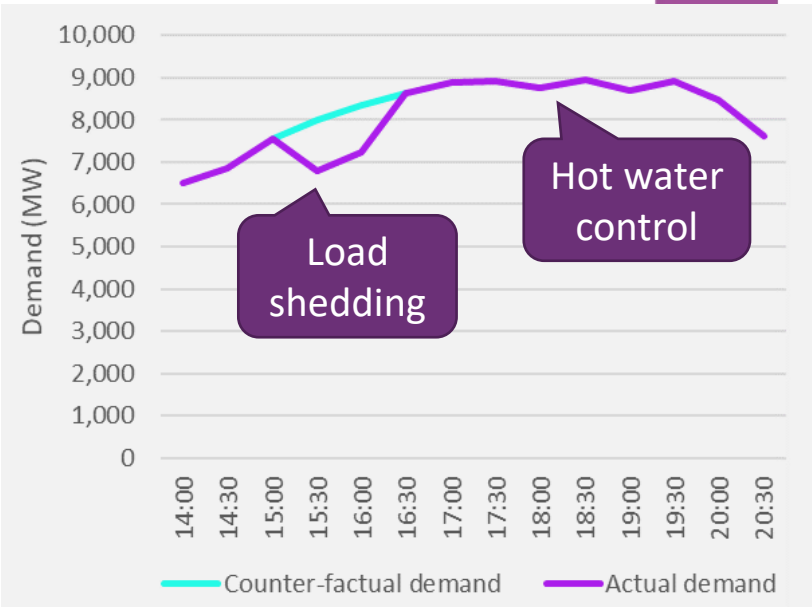
Timing	Relevant topic	Responsible
Aug 2022	2022 ESOO publication	AEMO, FRG
Nov 22-Feb 23	Forecast Accuracy Report/Forecast Improvement Plan (FIP) consultation	AEMO, Stakeholders
Today	**Summer 2022-23 demand review**	**AEMO**
Apr FRG	Forecasting Improvement Plan update	AEMO

Measuring maximum and minimum demand

AEMO's maximum and minimum demand forecasts represents forecast demand in the absence of:

- Directed load shedding
- Network outages
- Mandatory restriction schemes in effect
- Call for voluntary reduction in demand
- Demand side participation (DSP) including any under RERT

It does account for daily operation of load control, such as timer controlled hot water, or ripple controlled hot water/pool pump loads.



Any load shedding or atypical reduction in demand should be added back to the actual demand (counterfactual) when comparing with the forecast. For peak demand days, any such adjustments are accounted for and documented in the annual Forecast Accuracy Reports.

Note that "demand" refers to the "*as-generated*" definition (including generation aux load) and is *half-hourly* average values.

Time reference is NEM-time (AEST) unless otherwise noted.

Modelling maximum and minimum demand

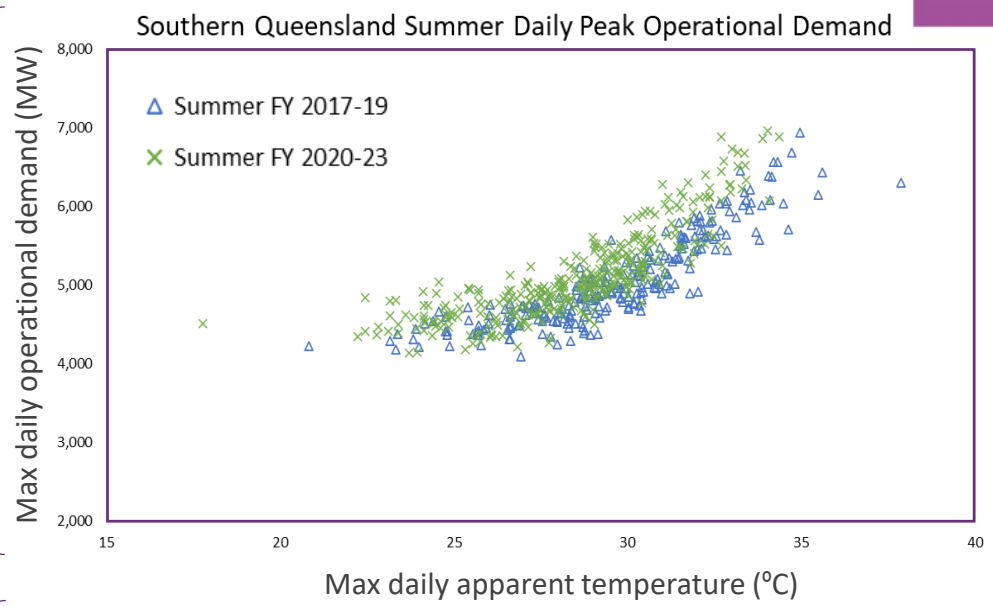
Maximum demand depends among other things on temperature*. The realised temperature outcomes differ from year to year.

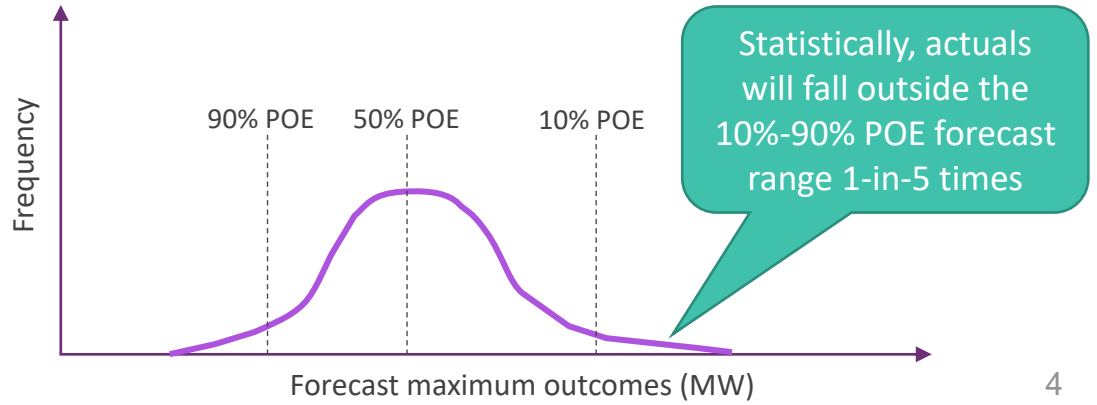
AEMO therefore applies a probabilistic forecast to account for difference in weather, among other things. This results in a forecast distribution of max (and min) demand outcomes.

AEMO publishes different points of the forecast distribution to stakeholders.

Typically, the 10%, 50% and 90% probability of exceedance (POE) values are provided. The 10% POE forecast represent a forecast value that only will be exceeded across the season with a probability of 10%.

* Minimum demand is temperature dependent too, typically occurring during weekends with high PV generation and mild weather, so without any significant cooling/heating load.





Overview of max/min demand results

Status as of 22 March 2023, compared with ESOO 2022 forecast

Region	Summer maximum	Summer minimum
Queensland	Just under 50% POE	Just below 90% POE
New South Wales	Just above 50% POE	Between 90% and 50% POE
Victoria	Between 90% and 50% POE	Between 90% and 50% POE
South Australia	Between 10% and 50% POE	Between 10% and 50% POE
Tasmania	Below 90% POE	Between 10% and 50% POE
Western Australia	Between 90% and 50% POE	TBA

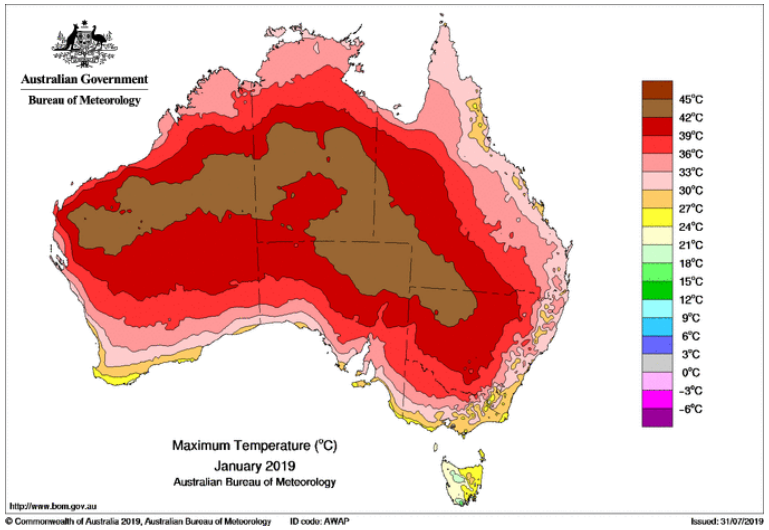
Note that green and red colours simply represent whether the forecast falls within the 10%-90% POE interval. Being red may not be due to input/model error, but due to more extreme drivers than usual.

Generally cooler in Eastern Australia

- Once again, a summer dominated by La Niña weather and relatively few, and less intense heat waves in the East, while Western Australia (around the SWIS) maintained more normal temperatures.
- The relativities between actuals and forecast outcomes reflect this.

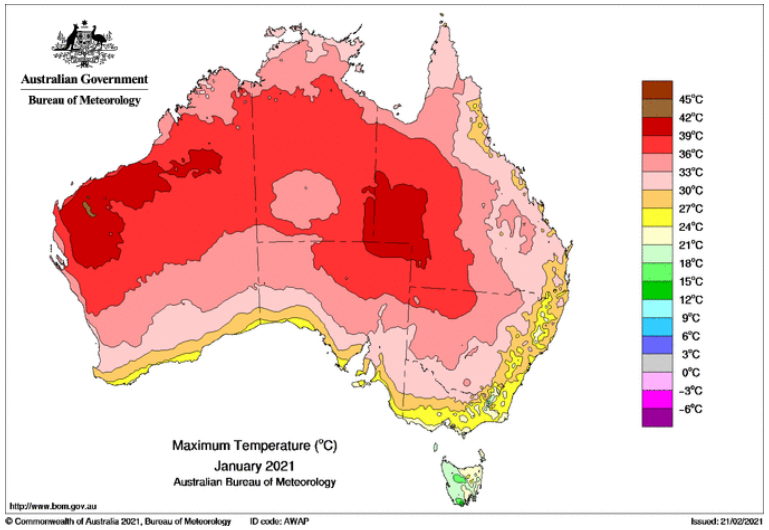
In March, eastern states have experienced higher temperatures atypical for late summer, as climate moved back into Neutral.

January 2019



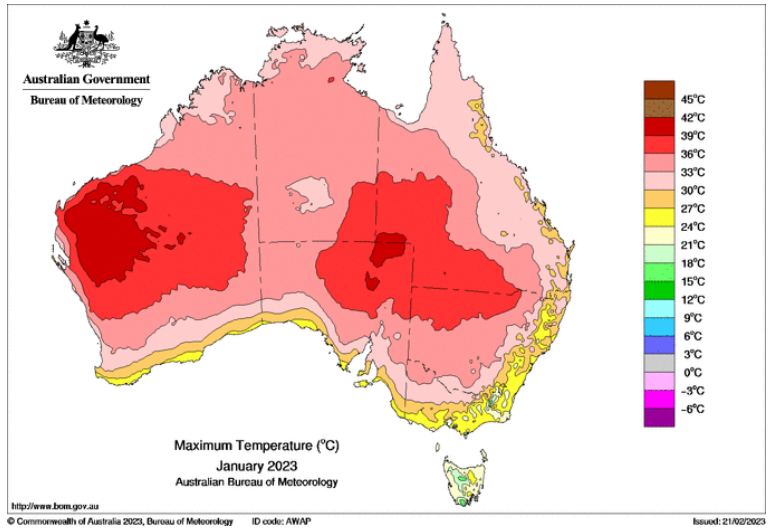
El Niño

January 2021



La Niña

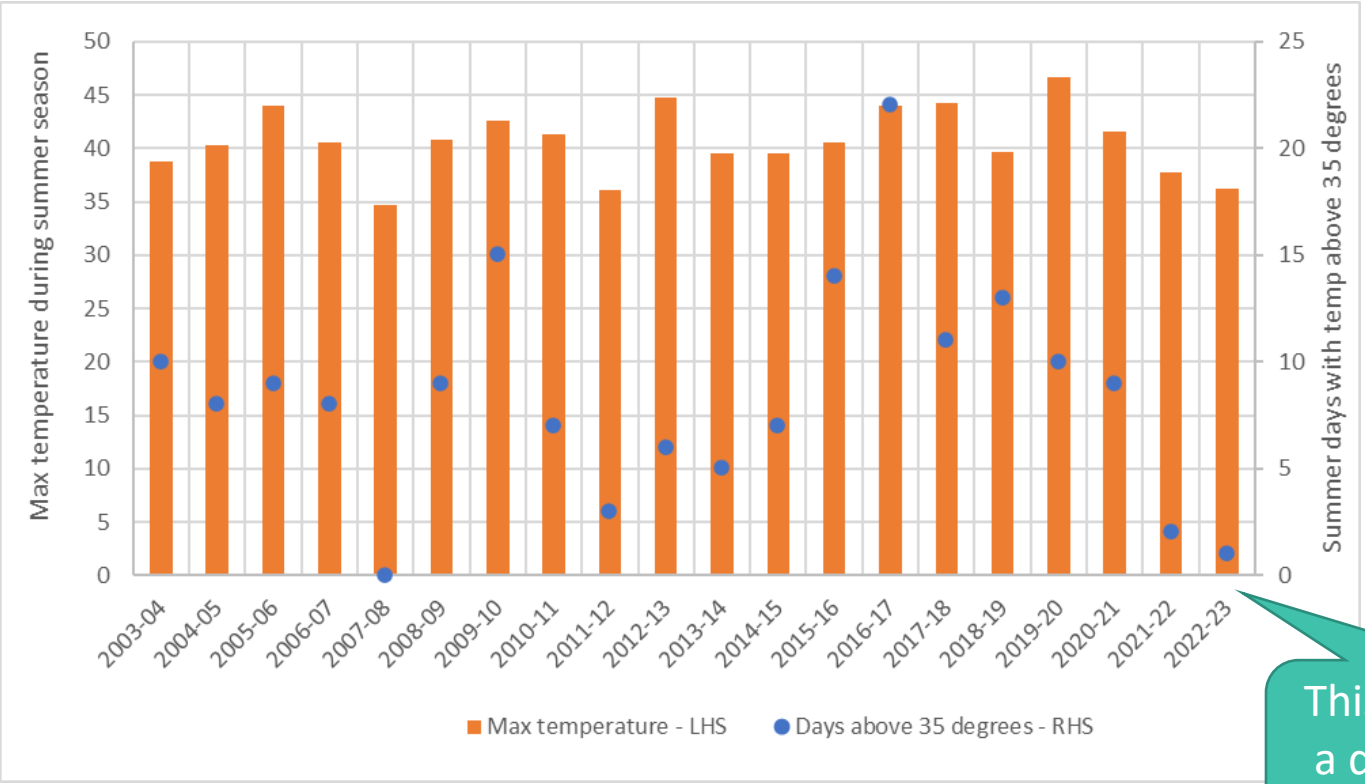
January 2023



La Niña

Example: NSW faced an unusual summer

Bankstown – Temperature outcomes 1 November till 28 February



This was on track for a demand outcome lower than 90% POE

To get a really high demand outcome…

…many planets have to align

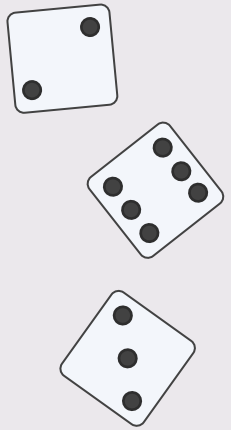
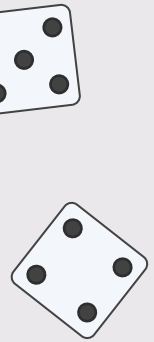
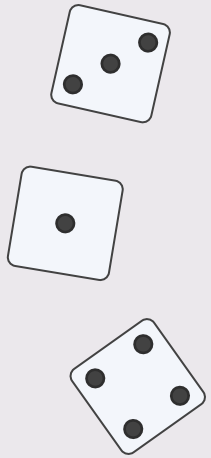
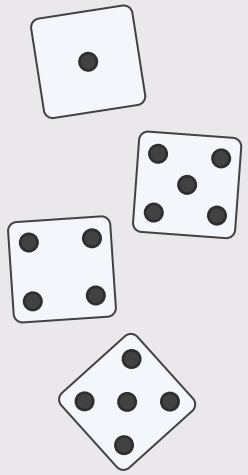
Things that must align for a high demand outcome…

- Hot weather days (cold for winter max)
- Extended heatwave giving little relief/cooling between days (cold snaps for winter max)
- High humidity (wind chill for winter max)
- PV generation lower than usual
- Weekday
- Outside holiday periods
- High aggregate random consumer demand

For each of these events, there is a chance they fall at a time that results in higher demand. One way to see it, is that we get to roll a die for each of these events, and the highest roll will be the max demand.

Some years we get many dice to roll, other years only one or two

Things that must align for a high demand outcome

Year	Historical year 1	Historical year 2	Historical year 3	Historical year 4	Historical year 5
Days with temp above 35 degrees	1	3	2	3	4
Dice rolls					
Top roll	2	6	5	4	5

Queensland

Max/min	10% POE	50% POE	90% POE	Actual
Max	10,553	10,118	9,769	DSP 10,070
Min	4,258	3,936	3,681	3,676

Factor	Check
Hot day	Yes
Extended period of hot weather	Partial
High humidity	Yes
Low PV outcome	TBA
Weekday	Yes
Non-holiday	Yes
Consumer behaviour	?

2022 Forecast Improvement Plan:
Humidity will be considered in the 2023 ESOO forecast

- Maximum demand (Friday 17 March) reached just under the 50% POE forecast (likely to be just over when correcting for DSP). Compared to the other high demand day (3 February), it was slightly warmer and there wasn't the late afternoon change that for some time reduced temperatures and humidity).
- It was a new all-time high Queensland demand outcome – and still just around 50% POE. The forecast range still seems reasonable given the events on 3 February:
  - At morning and midday temperatures and dew points were tracking well above day-ahead forecast and underlying demand 550 MW above day-ahead forecast. Pre-dispatch forecast for the late afternoon exceeded AEMO's 10% POE forecast!
  - The combination of stronger and earlier sea breeze, emerging cloud cover, and storms dropped temperatures and dew point and resulted in a much lower outcome in the end.
- Minimum demand outcome (Sunday 6 November) was lower than the 90%POE forecast, but not a lot. As the annual minimum is typically set at another season, it is not a significant concern, but will be taken into account for the 2023 ESOO forecast.

Dew point temp. (°C)	How it feels
>24	Oppressive, uncomfortable for most, possible heat stress issues
20-24	Muggy, quite uncomfortable
15-20	Starting to feel muggy, though still comfortable for most
10-15	Comfortable
5-10	Dry
<5	Very dry

Dew point description by BOM

New South Wales

Max/min	10% POE	50% POE	90% POE	Actual
Max	14,071	12,921	12,037	13,136
Min	4,915	4,746	4,449	4,481

Factor	Check
Hot day	Partial
Extended period of hot weather	No
High humidity	Yes
Low PV outcome	TBA
Weekday	Yes
Non-holiday	Yes
Consumer behaviour	?

- Generally mild summer with few hot days. Only one day with temperatures above 35°C till end of February.
- The maximum demand day (Monday 6 March) saw the record high March demand and above the 50% POE forecast for the full summer. Humidity was quite high.
- March was warmer than usual (with 18:00 on 6 March being the second warmest 18:00 in March since 2002) and the hot weather penetrated from the west all the way to the CBD.
- From an overall summer perspective, temperature outcome was close to average.
- Minimum demand was as expected on a Sunday (20 November) and fell within the forecast interval.

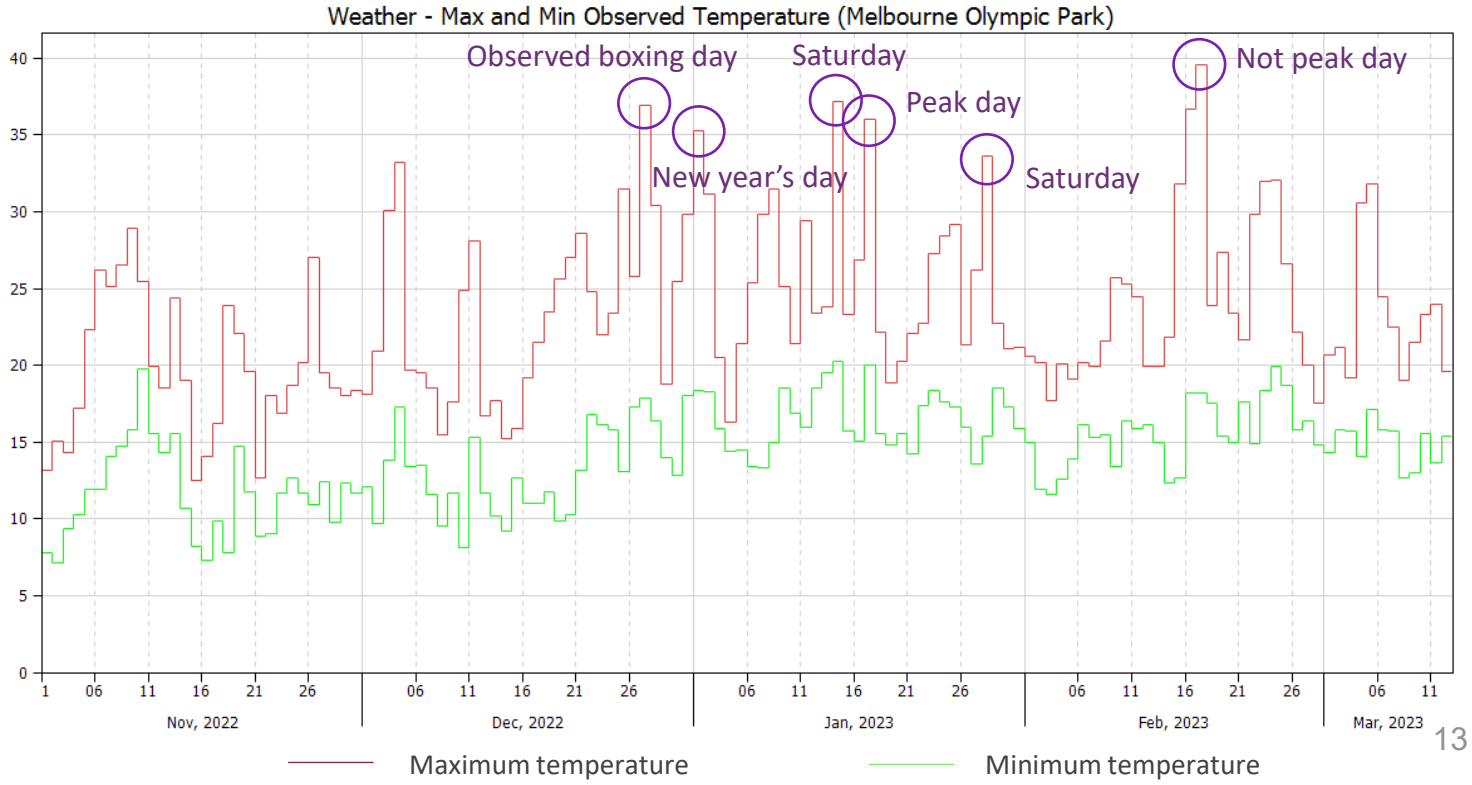
Temperature in Bankstown at 18:00			
Year	Count of Days >=26	Max	Max in March
2002	23	33.8	27.9
2003	21	37.5	26.9
2004	27	38.9	34.1
2005	32	35.9	26.4
2006	34	41.2	29.2
2007	19	37.6	31.4
2008	24	31.6	28.6
2009	39	37.3	25.9
2010	34	34.3	30.7
2011	30	39.4	28.2
2012	20	33.5	26.5
2013	38	39	28.1
2014	31	32	26.3
2015	36	37.5	27.5
2016	44	36.1	28.2
2017	34	41.2	29.7
2018	47	37.2	36.2
2019	46	33.6	29.1
2020	37	39.5	32.5
2021	24	32.9	32.6
2022	18	30	26.3
2023	17	35.8	35.8

Victoria

Max/min	10% POE	50% POE	90% POE	Actual
Max	10,474	9,386	8,569	DSP 8,988
Min	2,426	2,295	2,177	2,195

Factor	Check
Hot day	Partial
Extended period of hot weather	Partial
High humidity	Partial
Low PV outcome	TBA
Weekday	Yes
Non-holiday	Yes
Consumer behaviour	?

- Victoria generally had a mild summer, and coincidentally, most warmer days fell on weekends or holidays
- Max demand occurred on Tuesday 17 Jan. With a max of 36.5°C, that day was not as hot as 17 Feb, when temperature peaked at 39.6°C. But the latter day had an early cool change and temperature had dropped to 20.1°C at 18:00.
- With a dew-point exceeding 20, it was more humid than most other warm days as well.
- Minimum demand was as expected on a Sunday (18 Dec) and fell within the forecast interval.

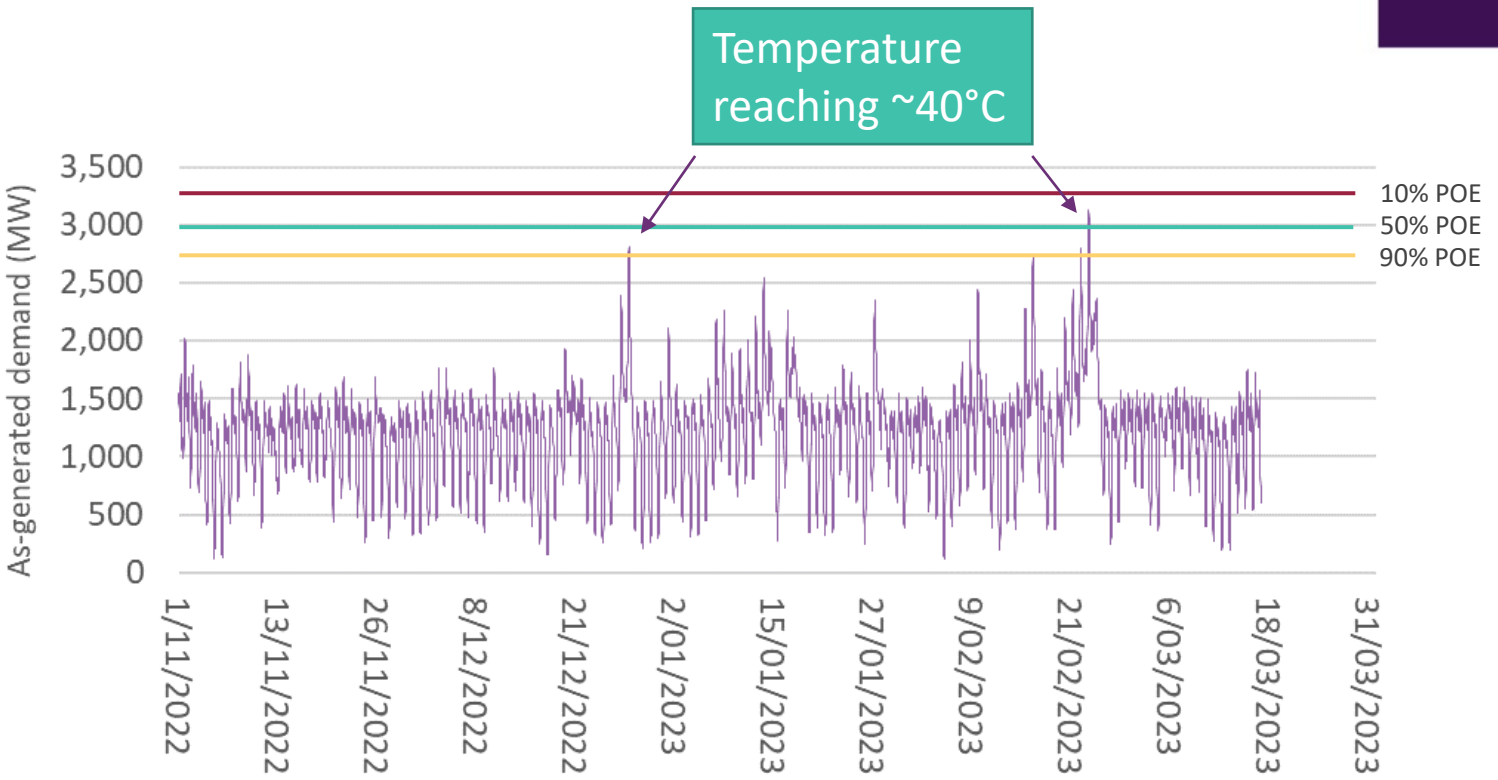


South Australia

Max/min	10% POE	50% POE	90% POE	Actual
Max	3,329	2,989	2,740	3,125
Min	125	84	38	117

Factor	Check
Hot day	Partial
Extended period of hot weather	Yes
High humidity	Yes
Low PV outcome	TBA
Weekday	Yes
Non-holiday	Yes
Consumer behaviour	?

- The maximum demand day (Thursday 23 February) saw the highest max demand outcome since 2014.
- Summer temperature were not extreme by Adelaide standard, only two days reached ~40°C. The max demand day was one of them and came following four days in a row with temperatures above 30°C.
- Min demand fell on a Sunday (5 February) in the higher end of the forecast range.



Tasmania

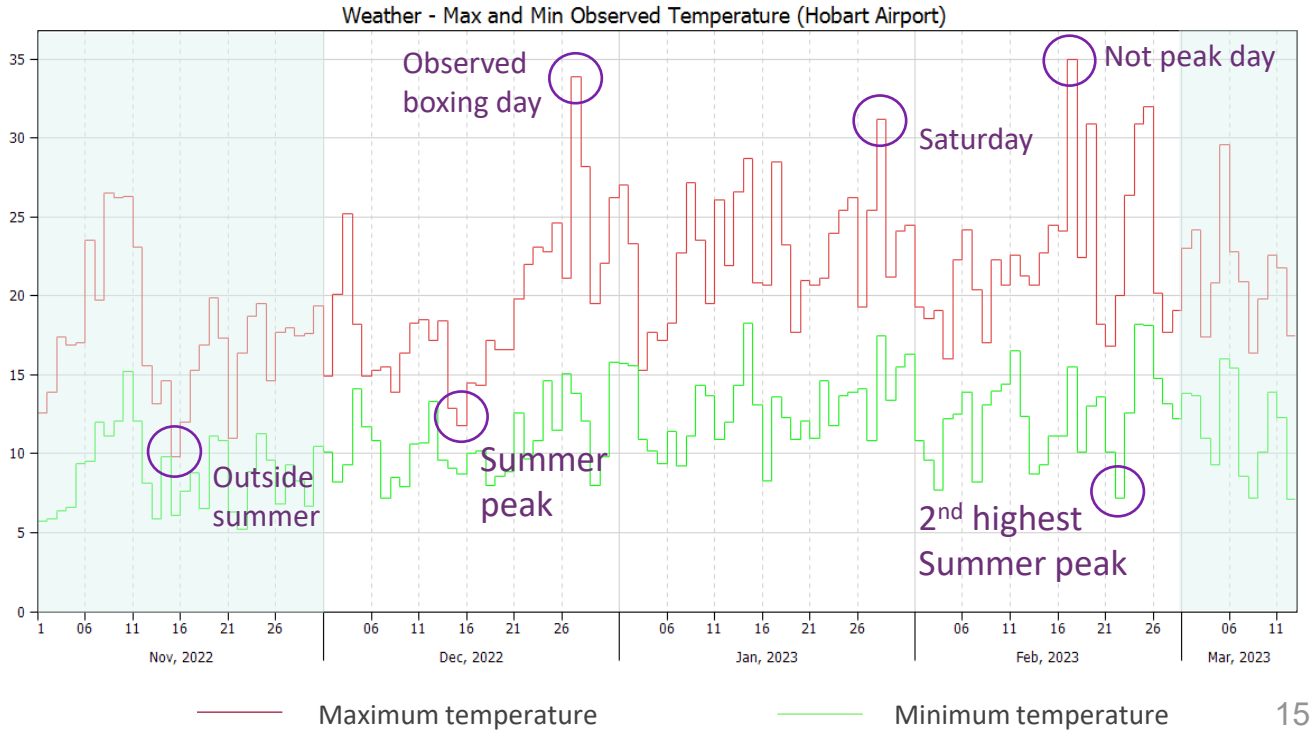
Max/min	10% POE	50% POE	90% POE	Actual
Max	1,507	1,476	1,442	1,392
Min	926	900	865	915

Factor	Check
Cold day	Partial
Extended period of cold weather	No
High humidity	n/a
Low PV outcome	TBA
Weekday	Yes
Non-holiday	Partial
Consumer behaviour	?

- Unlike the mainland, Tasmanian summer peaks are often set by cold spells increasing heating load rather than heat waves. Winter maximum demand is higher than summer.
- Weather is less impactful in Tasmania as large industrial load (LIL) is ~60% of consumption. Daily LIL contribution:

Date	15 Dec	27 Dec	28 Jan	17 Feb	22 Feb
LIL at time of peak	732 MW	623 MW	734 MW	723 MW	751 MW

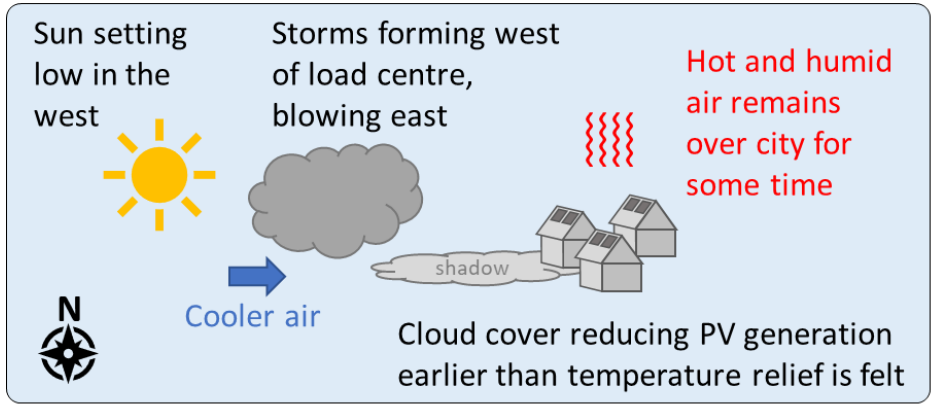
- Maximum demand was on Thursday 15 Dec at 7:00 driven by cold weather. It fell outside the 10%-90% POE range and *will be further assessed* ahead of the 2023 ESOO.
- Demand did reach 1,456 MW on 15 November i.e. outside Tasmanian summer
- Minimum demand fell within the forecast range. It excludes the min on 15 Feb that was a result of Basslink tripping.



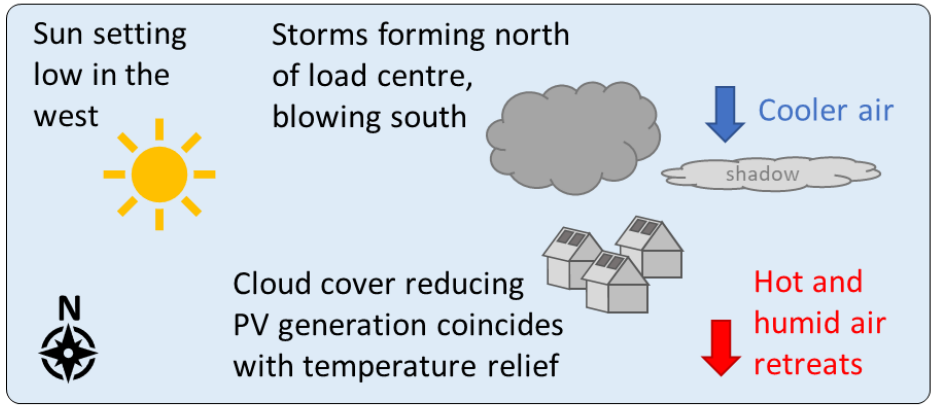
Western Australia

Max/min	10% POE	50% POE	90% POE	Actual
Max	4,042	3,781	3,533	3,676

- Western Australia had its summer peak happening quite early (4 pm local time) on 2 March.
- Afternoon storms may give relief, lowering temperatures – which can reduce demand more than PV generation is reduced. The net impact is a lower peak demand.
- Afternoon storms may reduce PV before any temperature relief is felt, increasing peak demand relative to a situation without storms. This was the case for Western Australia this year, with cloud cover causing demand to rise in the half-hour leading up to 4pm, after which the reduced relief from the sun caused demand to decline.



Example: Cloud cover increases operational demand



Example: Cloud cover decreases operational demand

Next steps

- Apply learnings to ESOO 2023 forecast
- Forecast Improvement Plan update presented at April FRG
- Final 2022 Forecast Improvement Plan publication
- Draft ESOO maximum and minimum demand forecasts presented at June FRG

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