Summer Readiness Industry Briefing

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Wednesday 27 November 2019

Welcome

Tony Chappel
Chief External Affairs Officer

Agenda

Welcome and introductions

Weatherzone briefing

Overview of AEMO's Summer Readiness program

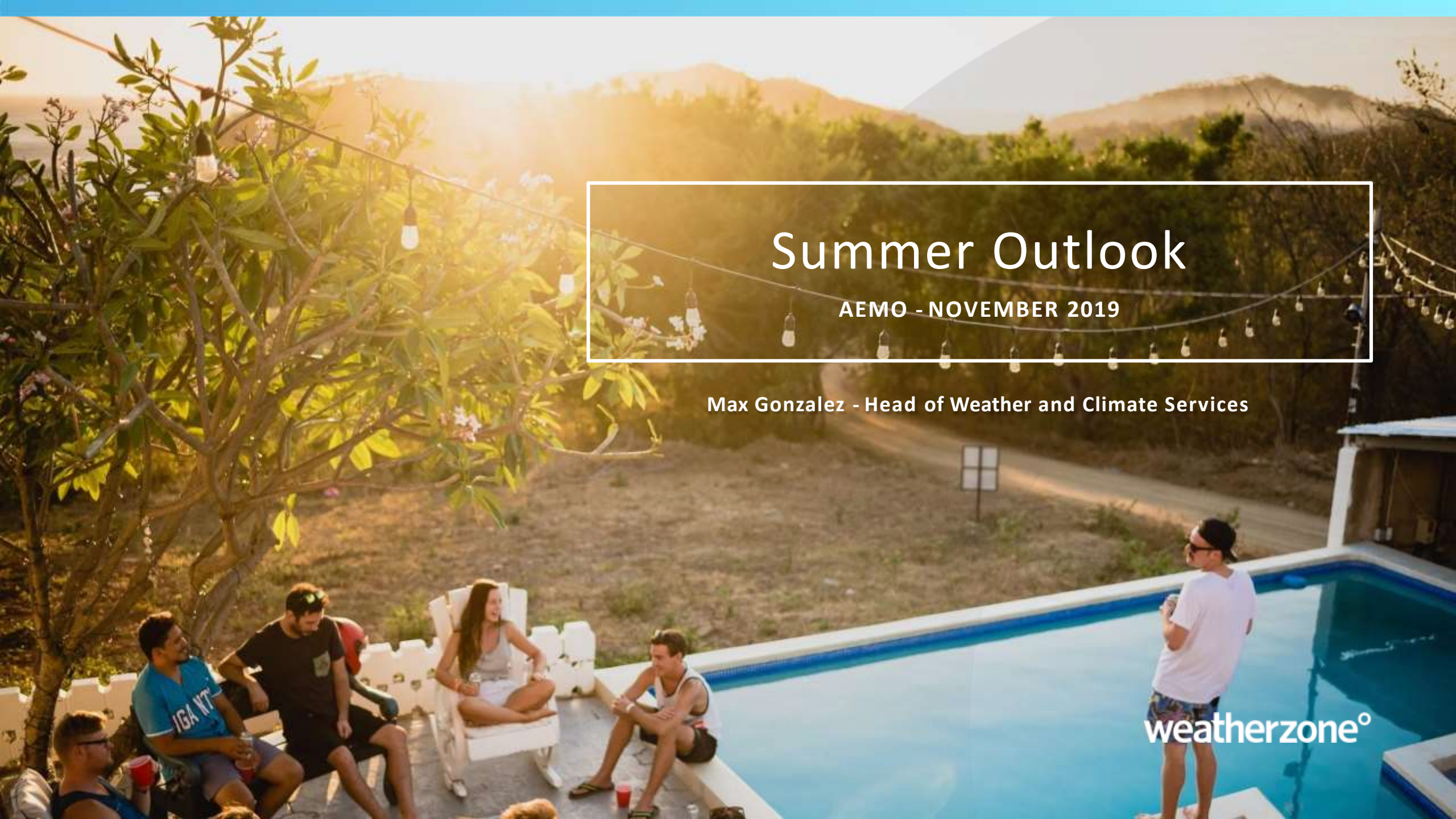
Rebidding and Technical Parameters

Case Study – Managing the power system on high demand days

Public Communications

Weather Briefing

Max Gonzalez
Head of Weather and Climate Services
Weatherzone



Summer Outlook

AEMO - NOVEMBER 2019

Max Gonzalez - Head of Weather and Climate Services

weatherzone°

Overview

Analysis of Summer 2018/2019

State of the climate

Outlook

Summer 2018/2019

SUMMER MEAN

Temperature

↑ **2.14°C**

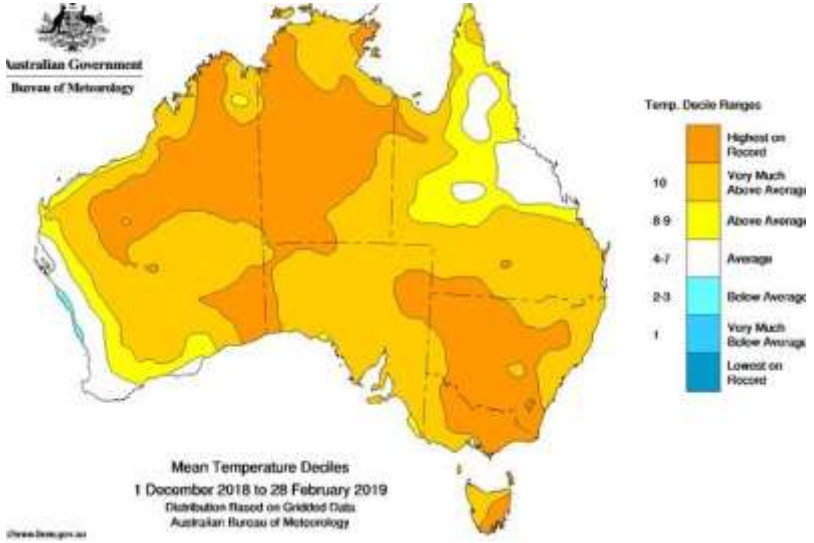
Above Average

- Warmest Summer on Record!
- Previous Warmest Summer: 2012/13 (1.28 Deg)

Max Temperature 2.61 Deg

- Warmest for all states and territories except Qld and Tas.

Min Temperature 1.67 Deg



SUMMER MEAN

Temperature

↑ **2.14°C**

Above Average

90 Days - Over 200 Records

Darwin: Failed to cool down below 30 Deg on December 12.

The Alice: 16 consecutive days of 42 Deg or above.

Cloncurry: 43 consecutive days of 40 Deg or above.

Wanaaring: Borrona Downs failed to cool down below 36.6 Deg on January 26th.

Bourke: 21 consecutive days above 40 Deg.

Hottest temperature - 49.5 **Port Augusta**

Canberra: 24 days of 35 Deg or above. 5x their average summer.

Adelaide: reached 46.6 Deg, our hottest capital.

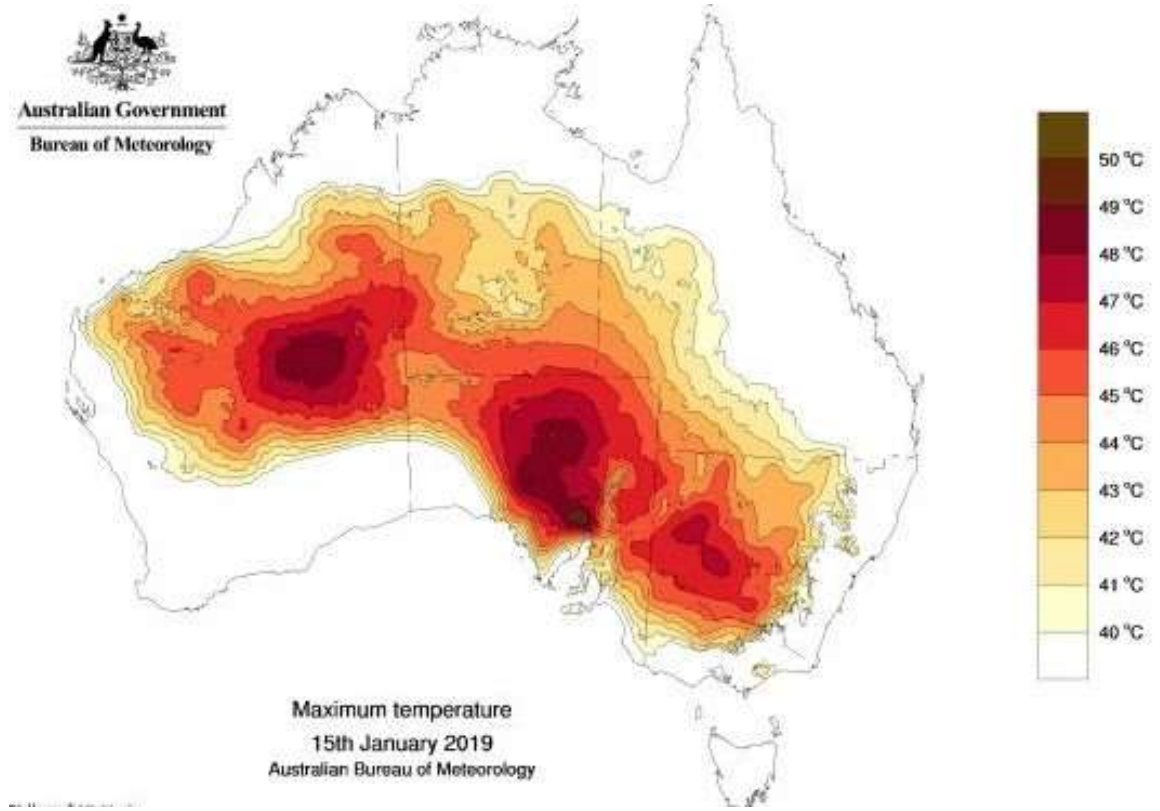
January 15th - 2nd Warmest AUS Day

SUMMER MEAN

Temperature

↑ **2.14°C**

Above Average



Summer 2018/2019

NATIONAL SUMMER

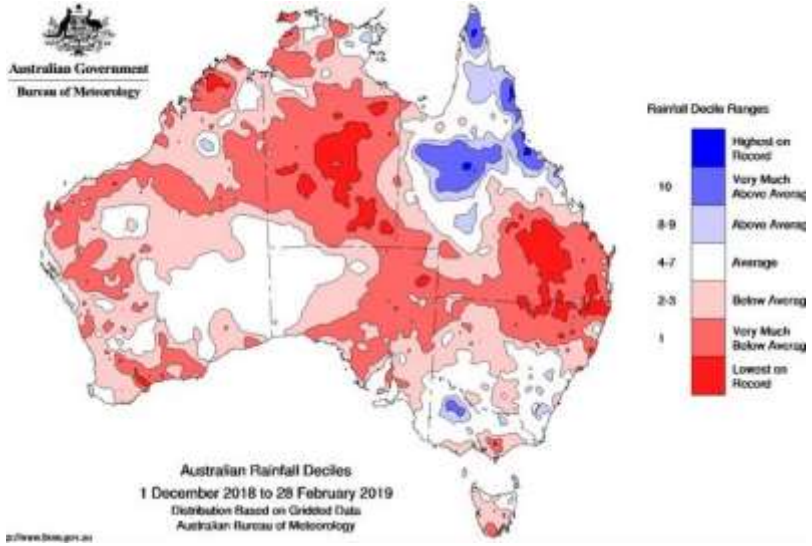
Rain

↓ 32%

Below Average

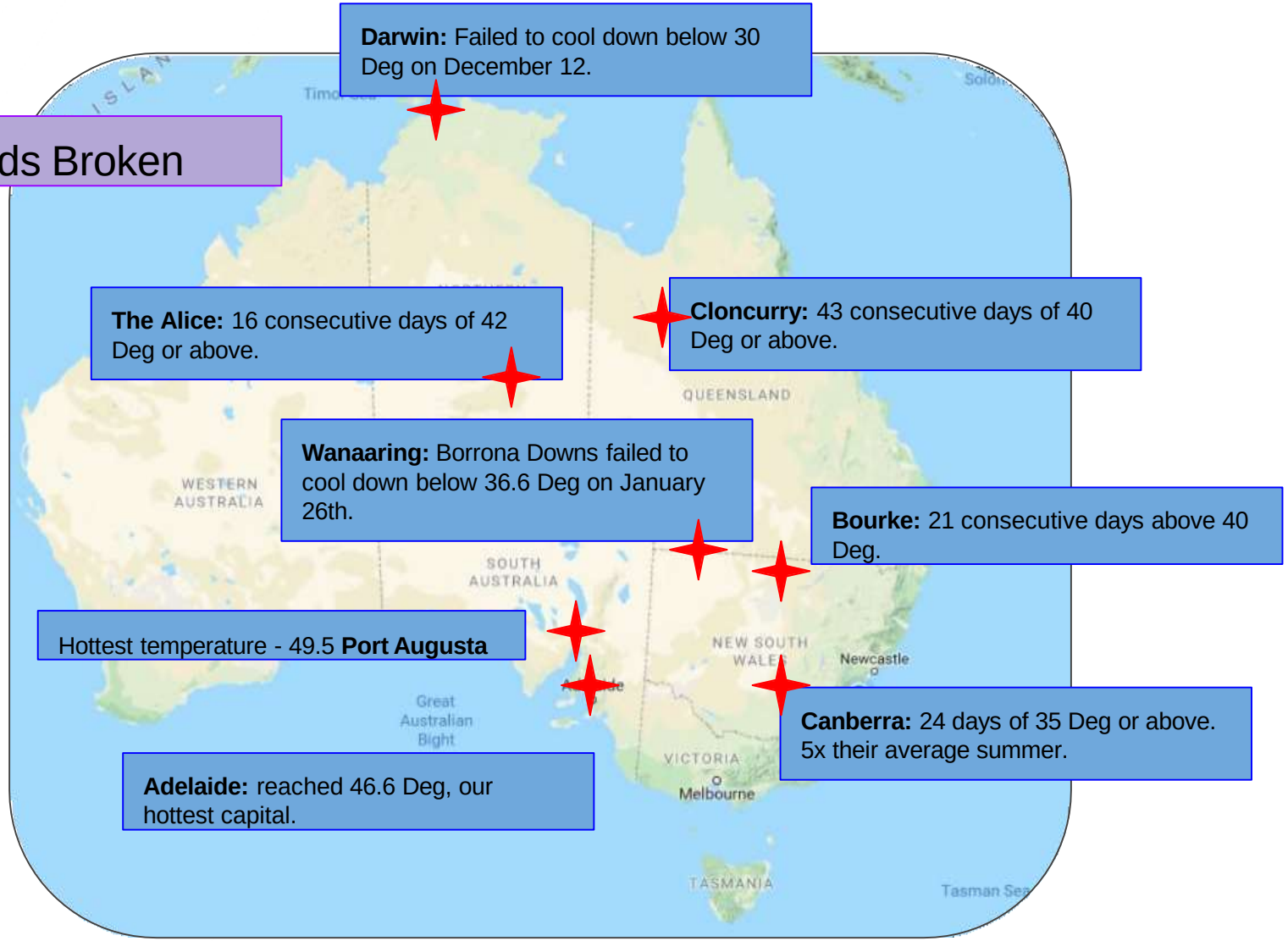
- Localised heavy falls over northern Qld due to TC Owen and active low.

North Australian Monsoon 2nd latest onset on record: late January.



Angry Summer

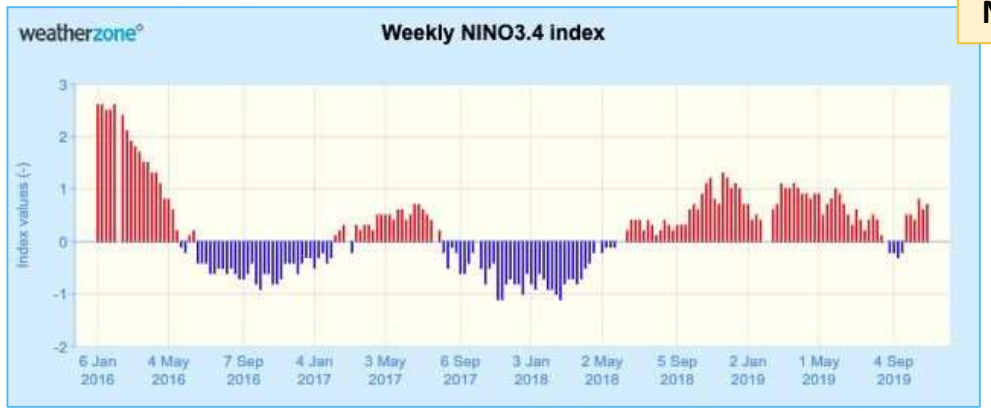
90 Days - Over 206 Records Broken

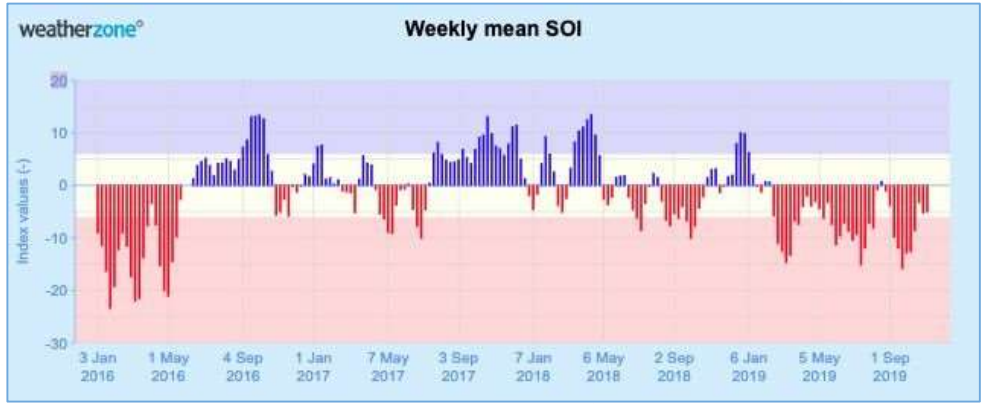


State of Climate

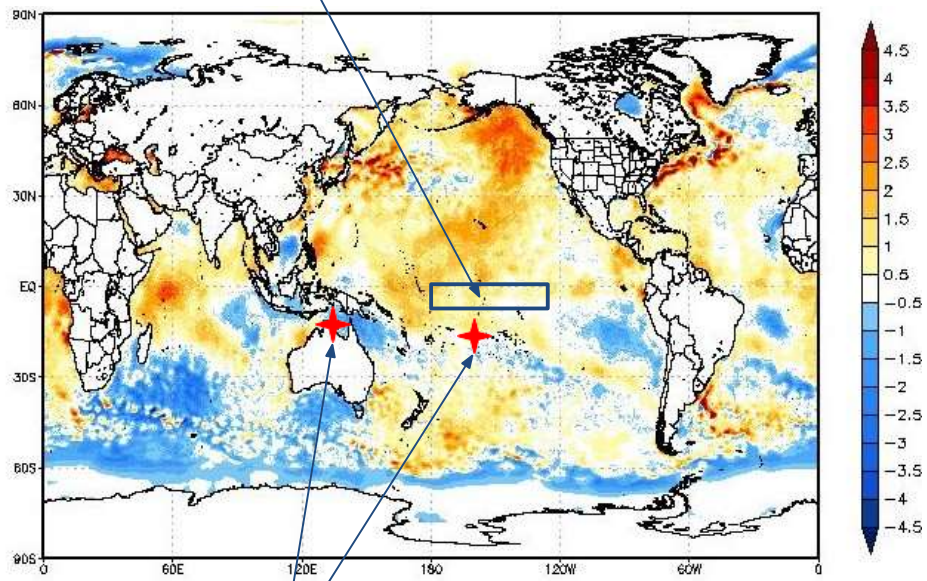
Driving our weather

ENSO State





NINO3.4 Index = Average SSTs across the 3.4 region

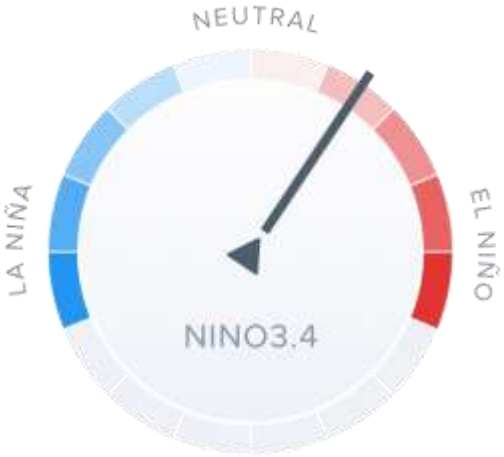


SOI = Atmospheric pressure difference between Darwin and Tahiti

> ENSO neutral conditions after a prolonged period of warmer than average sea surface temperatures (SSTs) across the Pacific.

ENSO Outlook - NINO3.4 Index

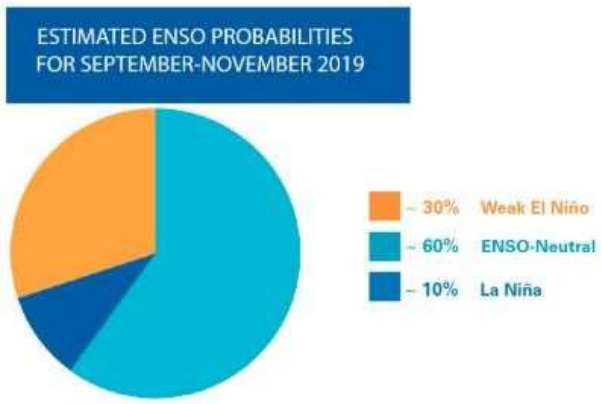
Current International Consensus



NOVEMBER
0.4 Index

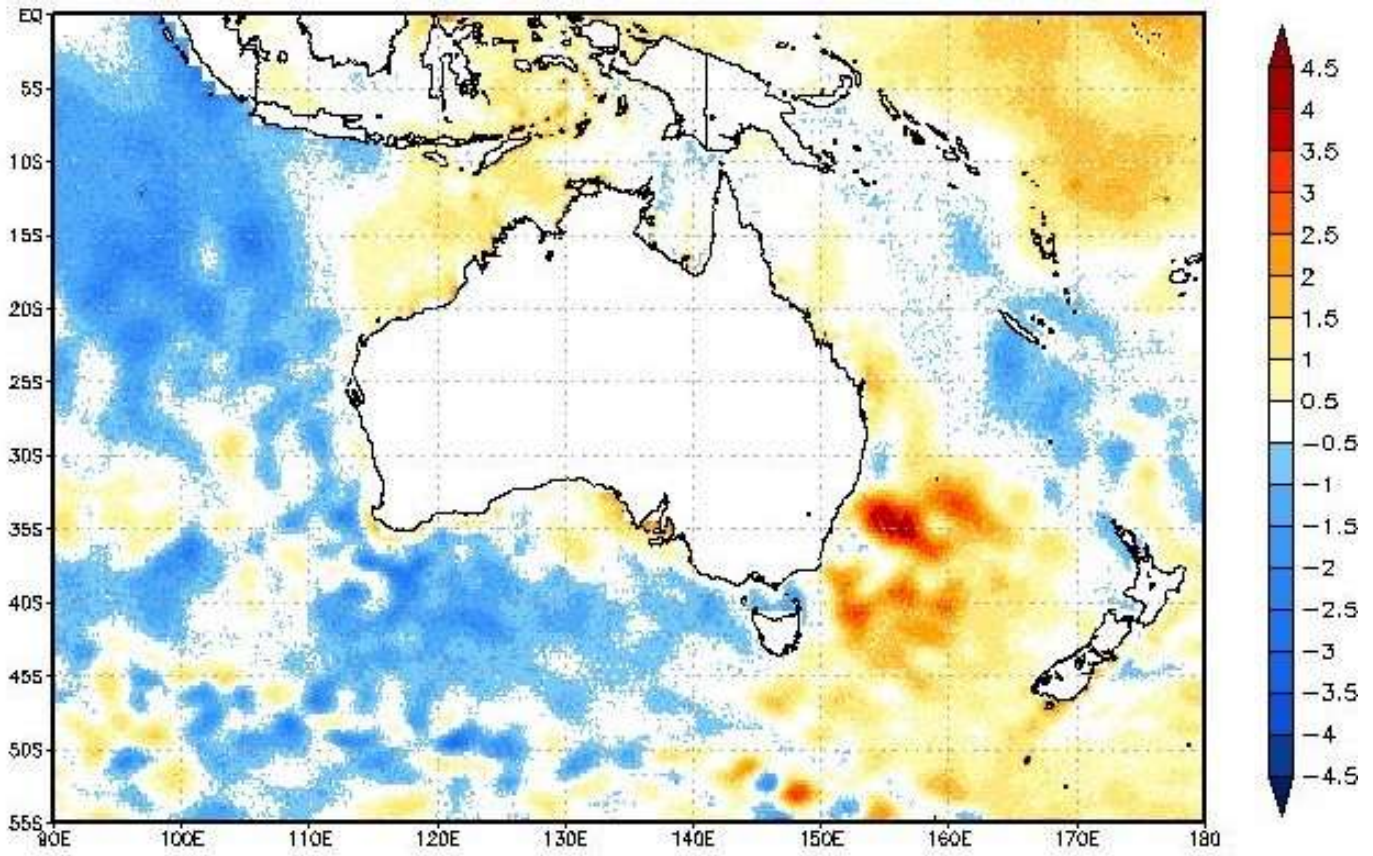
JANUARY
0.0 Index

MARCH
0.2 Index



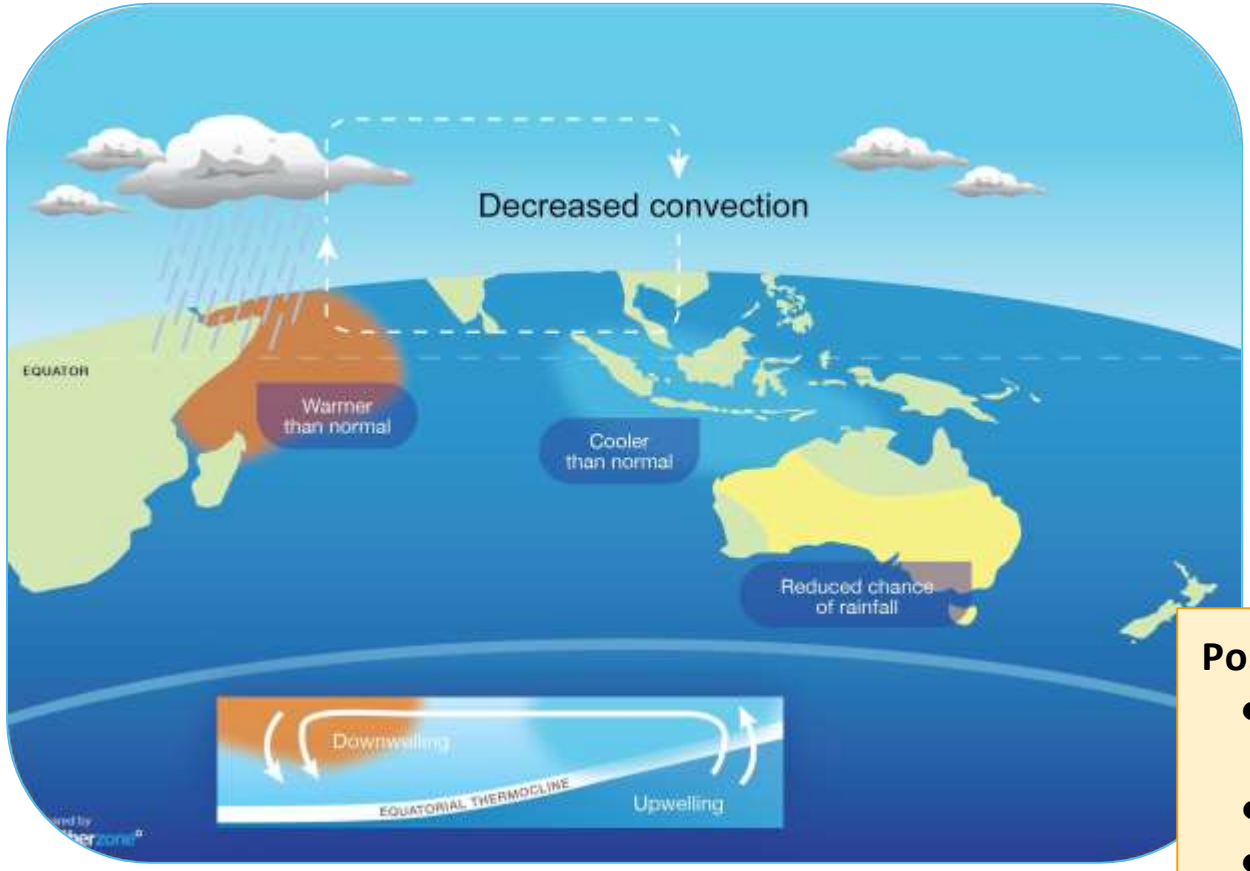
For a **La Nina** (-0.8) or **El Nino** (+0.8) to be declared, thresholds need to be met for at least 3 consecutive months.

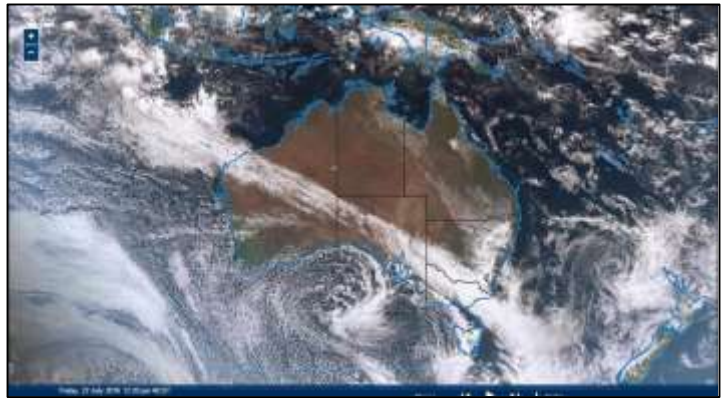
Sea Surface Temperature Anomalies



SSTs across northern Australia have been cooling down over the past few months. Most significantly over the NW Shelf.

Indian Ocean Dipole (IOD)





Positive IOD:

- SST gradient across the Indian Ocean
- Less moisture in the NW
- Decreased rainfall across central and SE AUS
- Decreased numbers of NW cloudbands

IOD Outlook - DMI Index

Current International Consensus

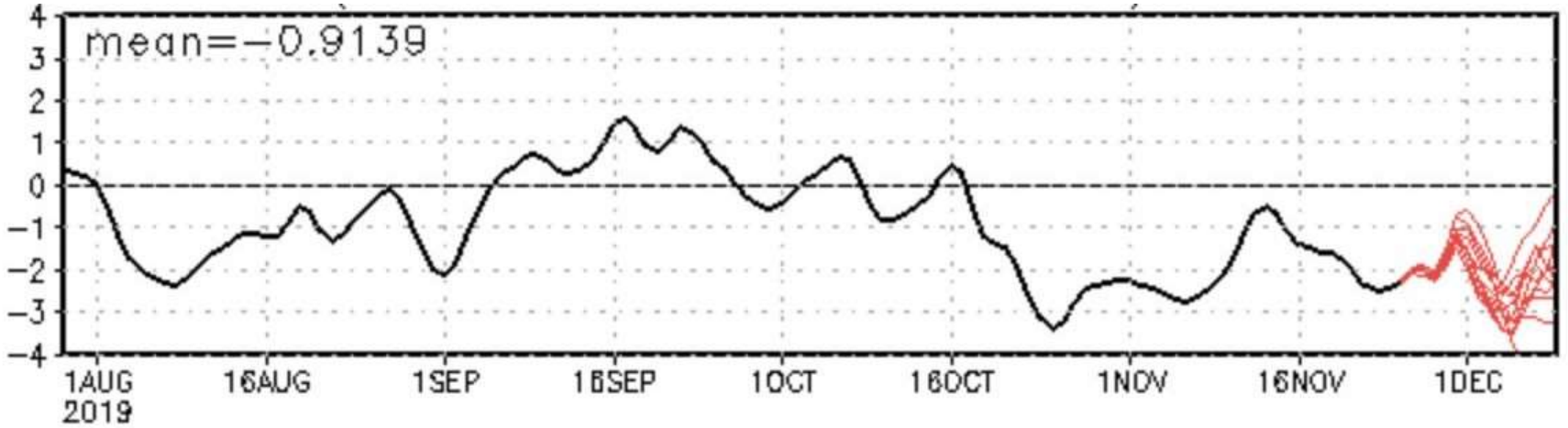
NOVEMBER
1.6 Index

JANUARY
0.5 Index

MARCH
0.2 Index

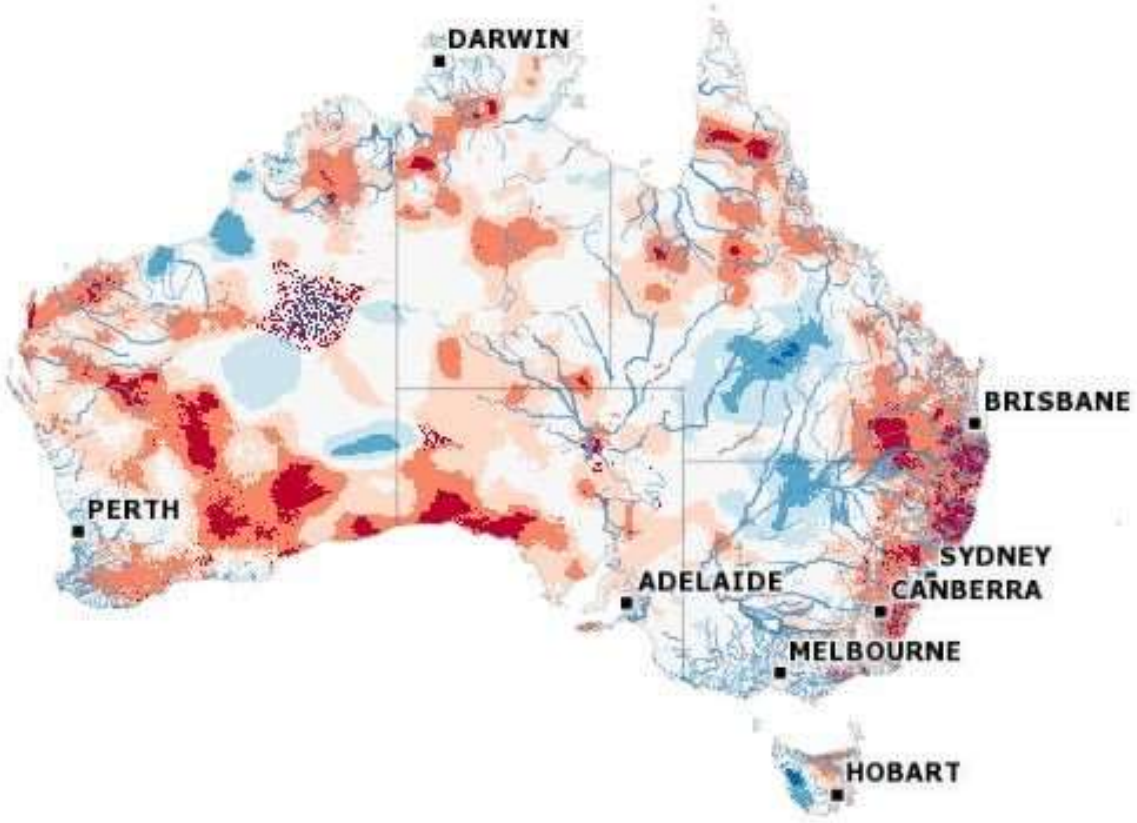
For a **Negative** (-0.4) /**Positive** (+0.4) to be declared, thresholds need to be met for at least 3 consecutive months.

Southern Annular Mode (SAM)



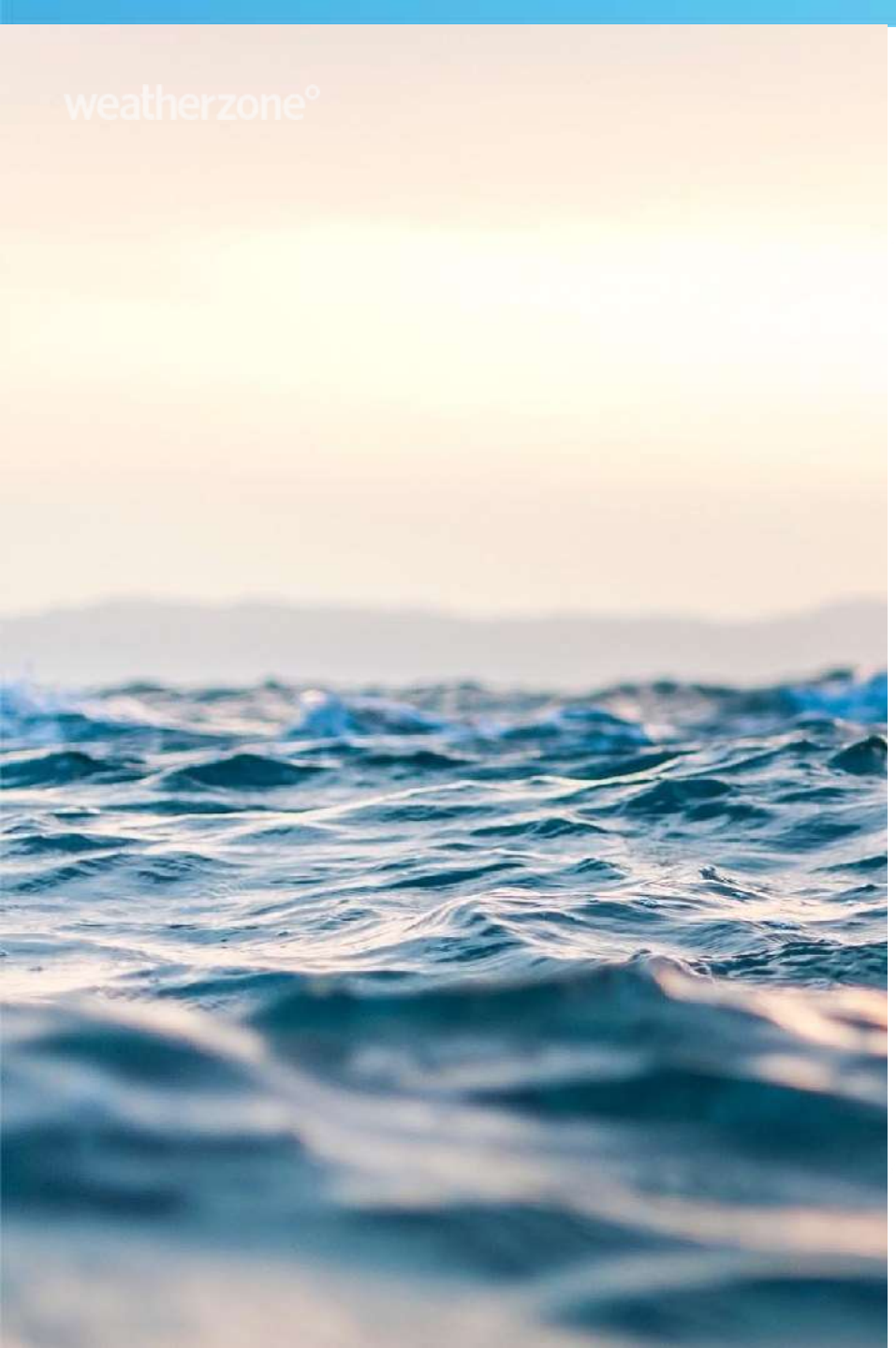
SAM was mostly positive through June 2019, but with a negative tendency since July.

Soil Moisture Anomalies



Highest 1%
Very much above average
Above average
Average
Below average
Very much below average
Lowest 1%

Root Zone Soil Moisture refers to sum of water available in the top 1m of the soil profile.



Climate Summary

ENSO = Neutral

SAM = Trending -ve since July

SSTs = Significantly cooler around NW AUS

IOD = Positive event in place

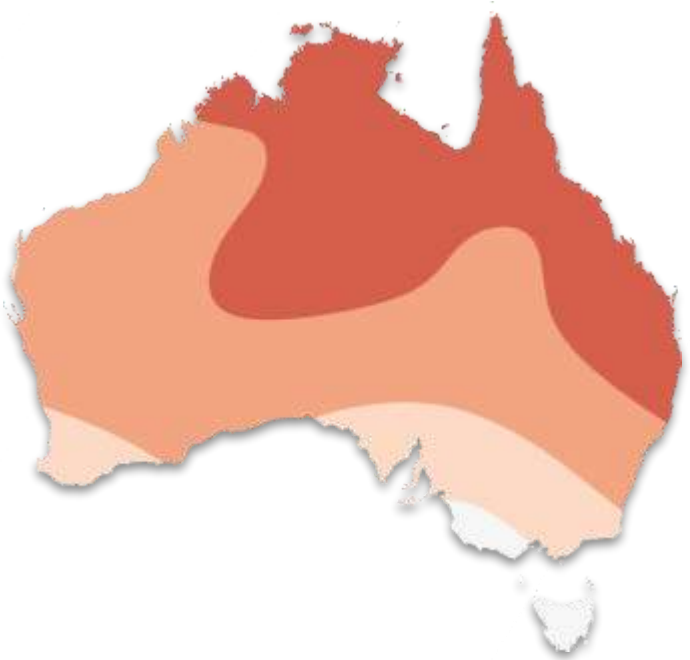
All models are favouring Neutral ENSO for the remainder of 2019 with a 60% chance of Neutral ENSO.

Outlook

Summer

National Outlook - DJF

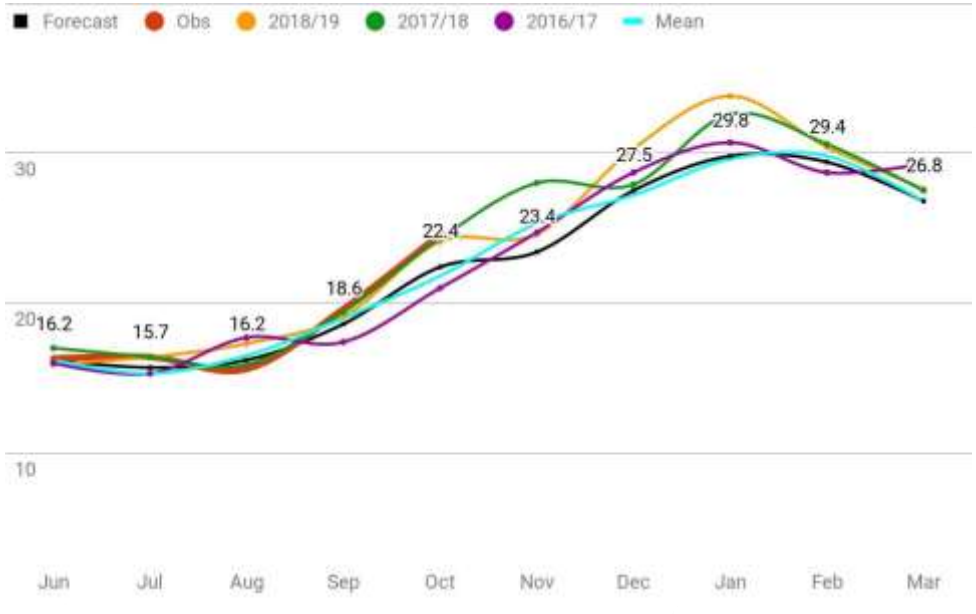
Maximums



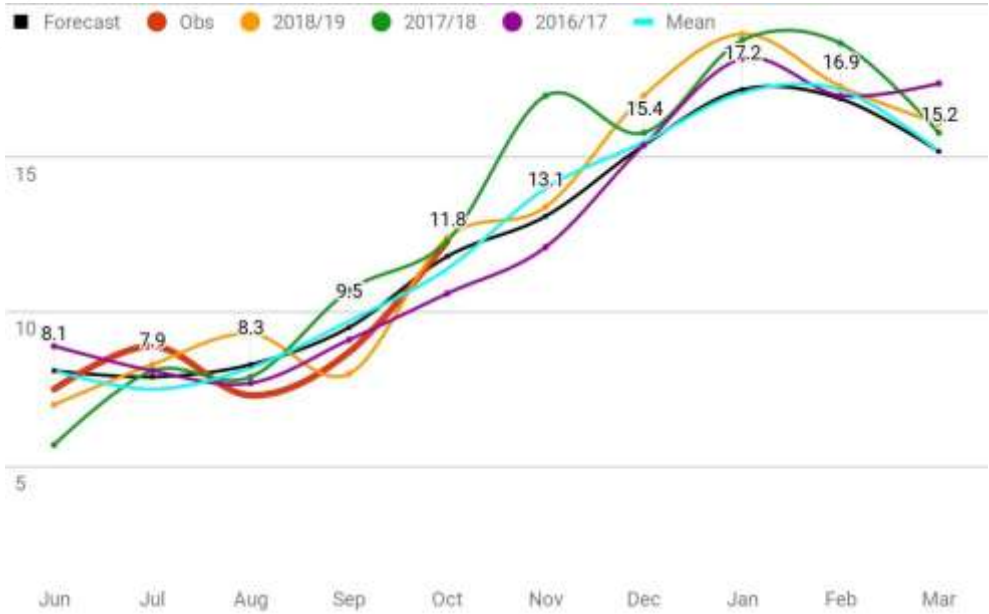
Minimums

Adelaide

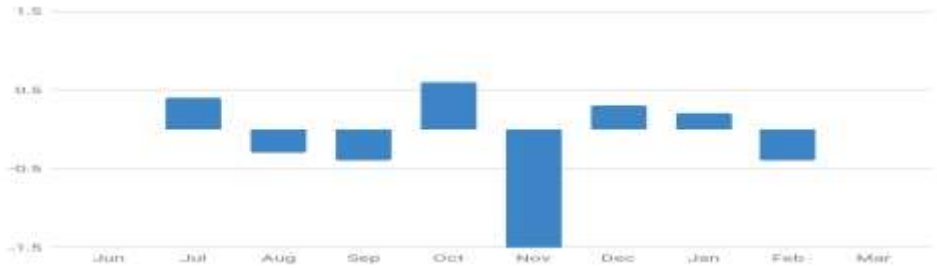
Maximums

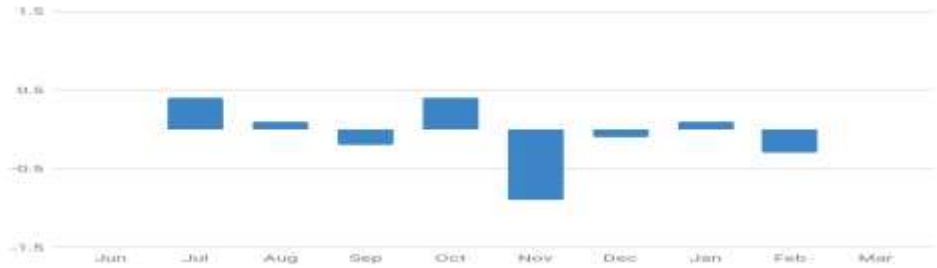


Minimums



Forecast Anomaly (1981-2010 mean)

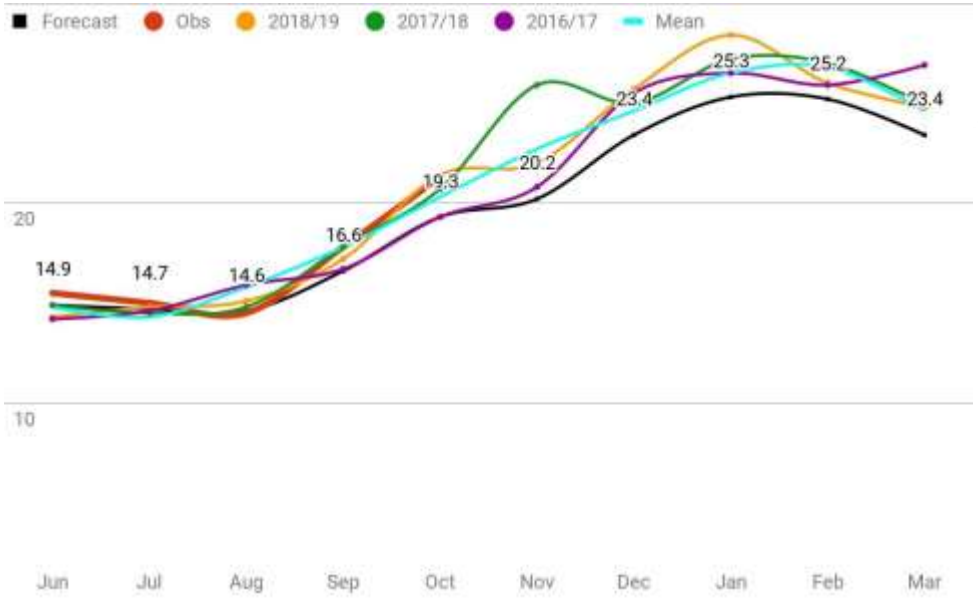




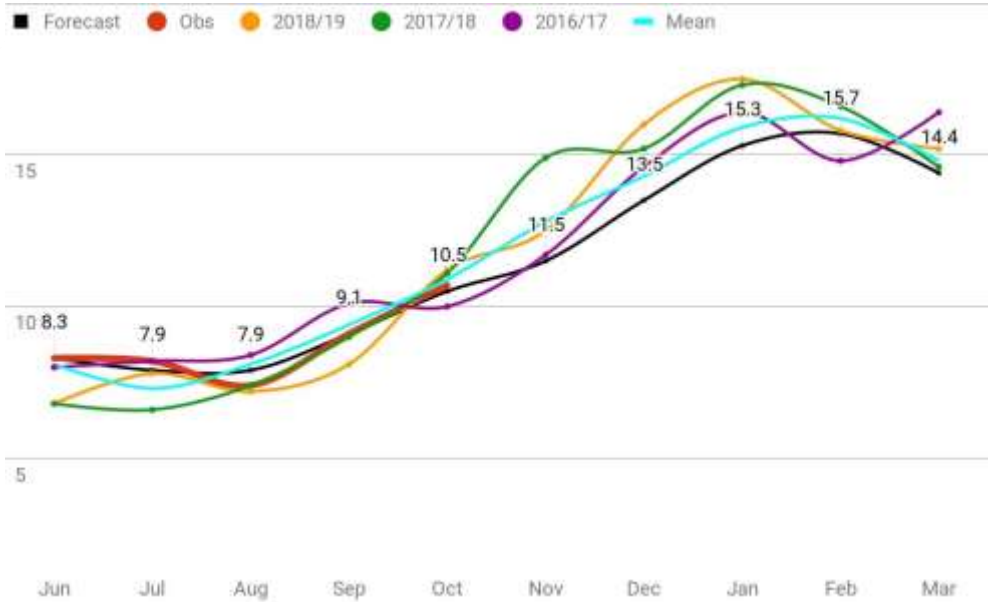
Adelaide - Days above 35 Deg (DJF)

Melbourne

Maximums



Minimums



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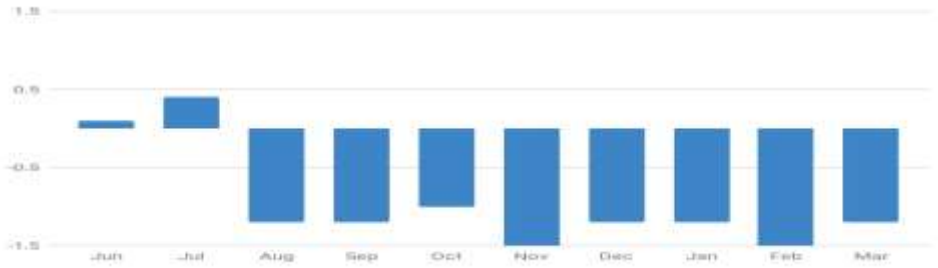
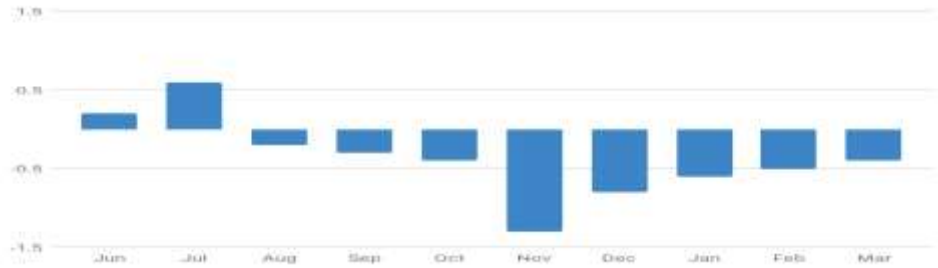
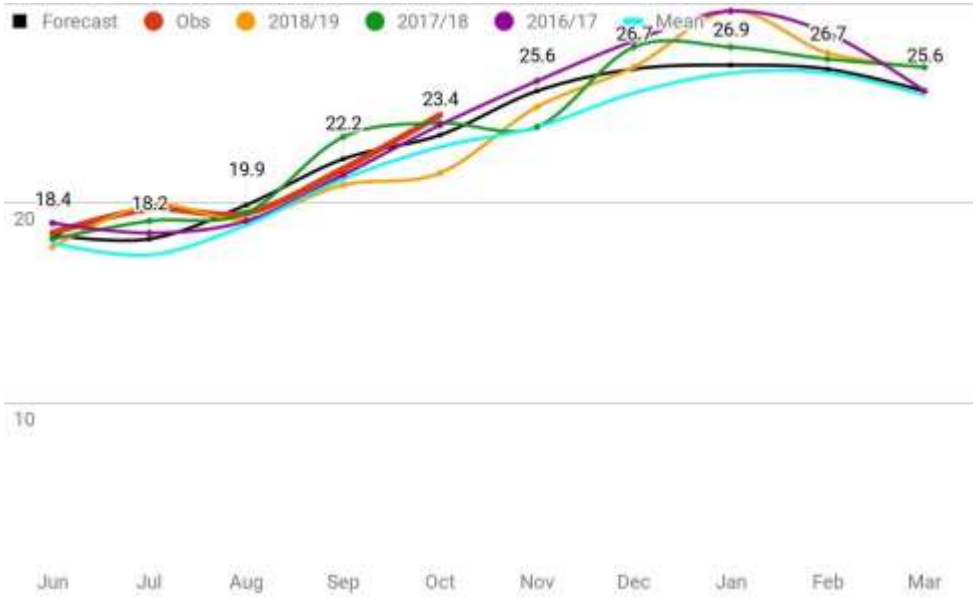




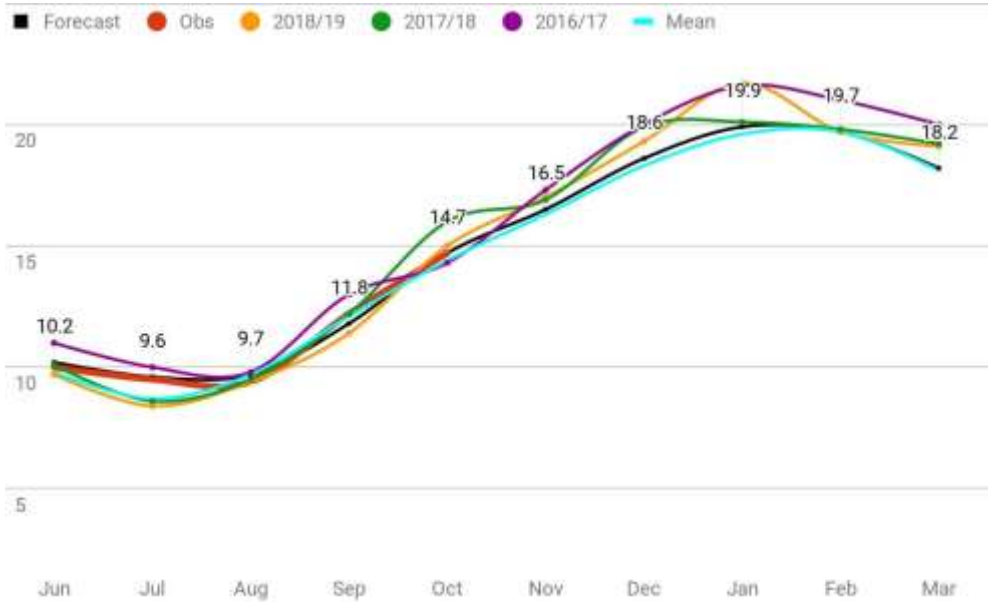
Melbourne - Days above 35 Deg (DJF)

Sydney

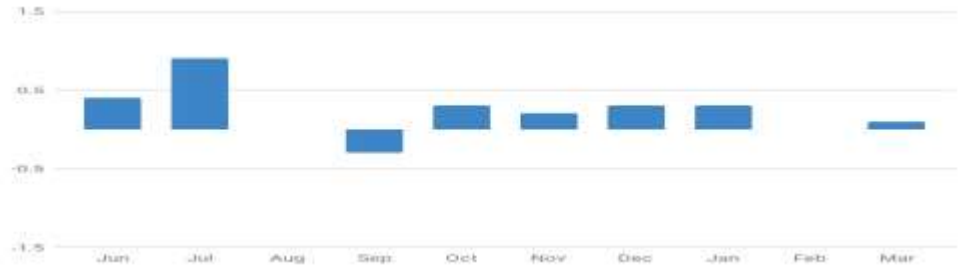
Maximums



Minimums

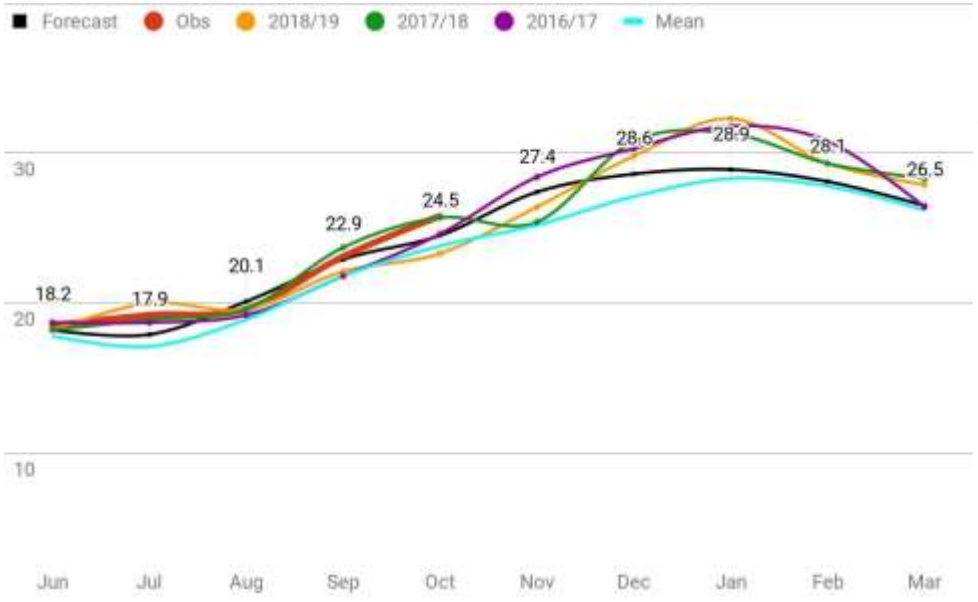


Forecast Anomaly (1981-2010 mean)

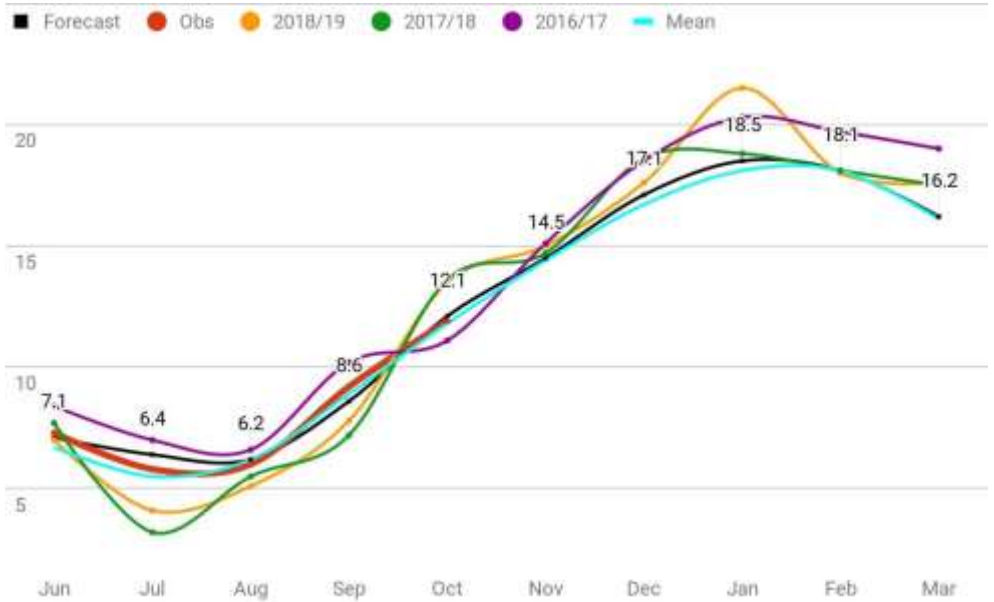


Bankstown

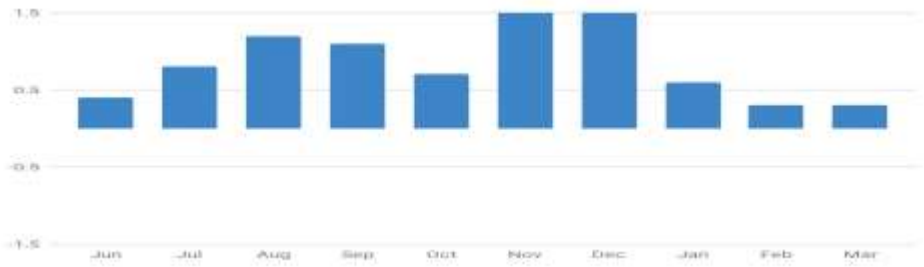
Maximums



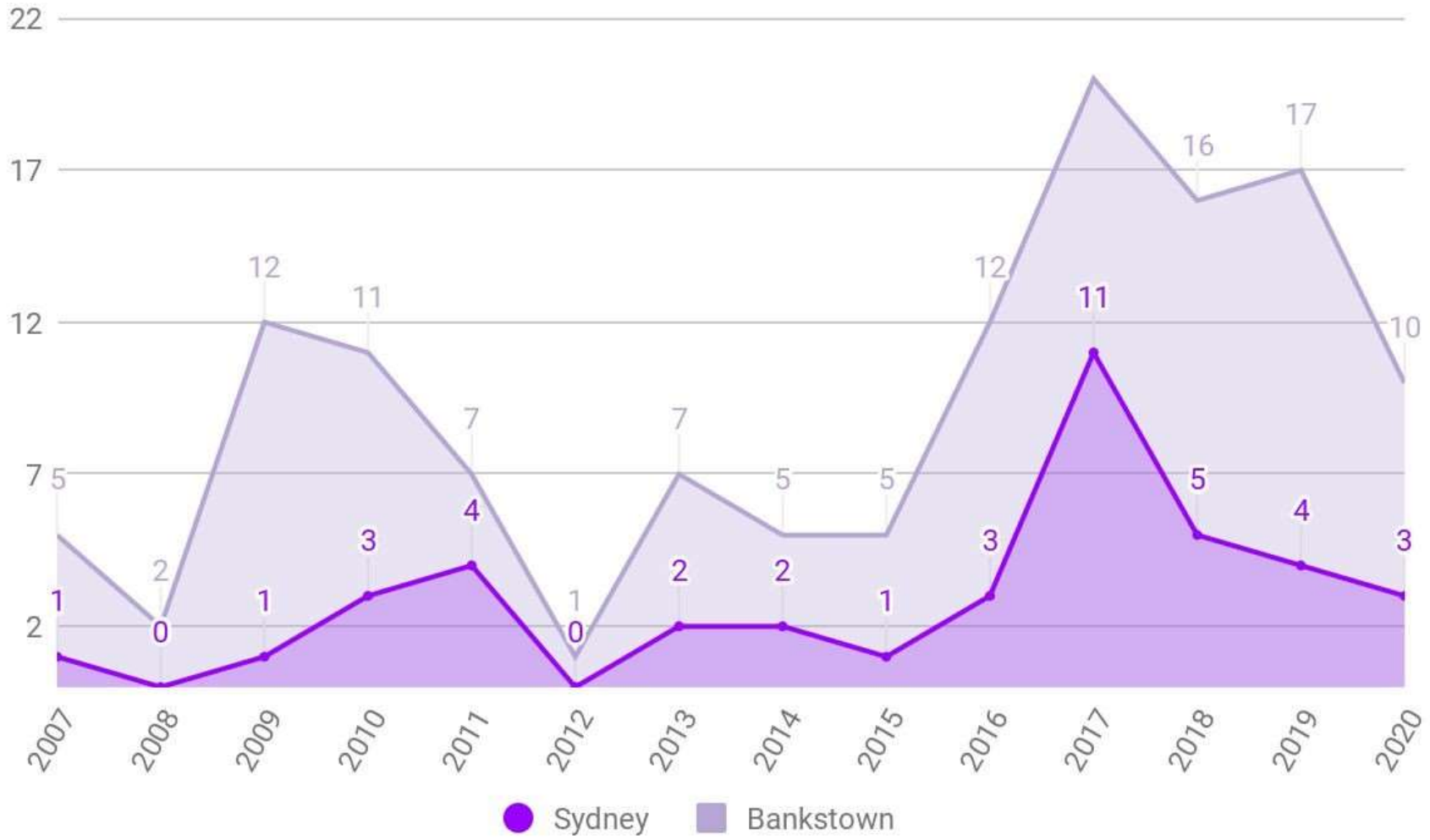
Minimums



Forecast Anomaly (1981-2010 mean)

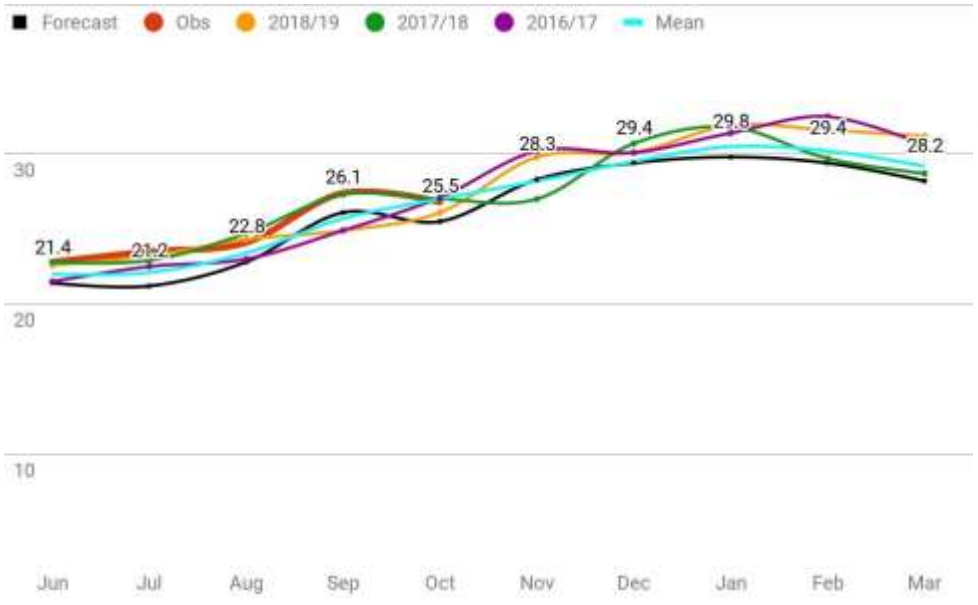


Sydney Basin - Days above 35 Deg (DJF)

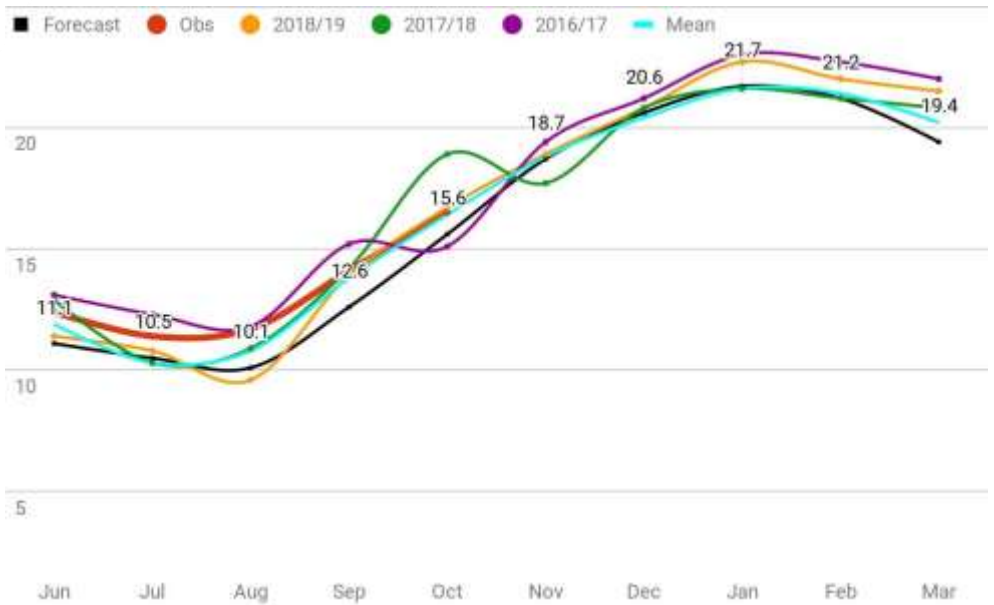


Brisbane

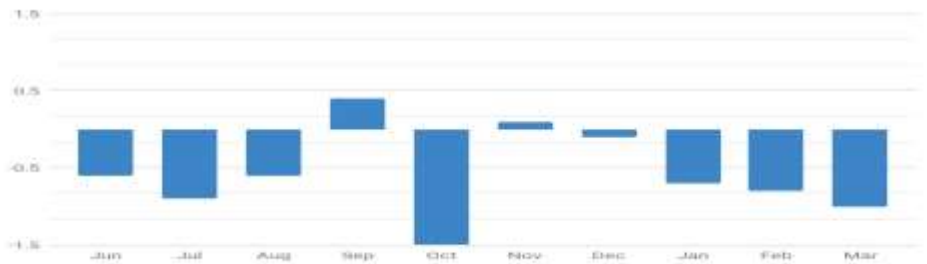
Maximums

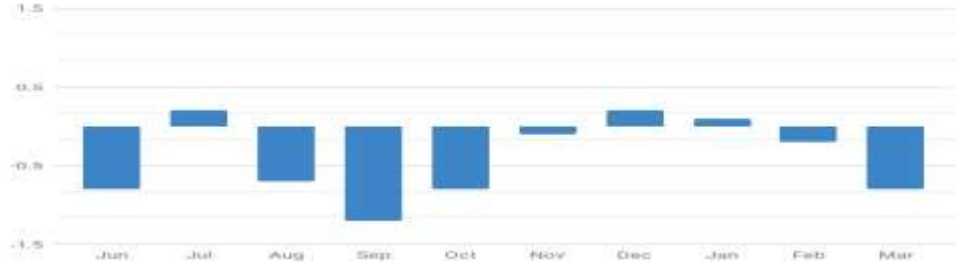


Minimums

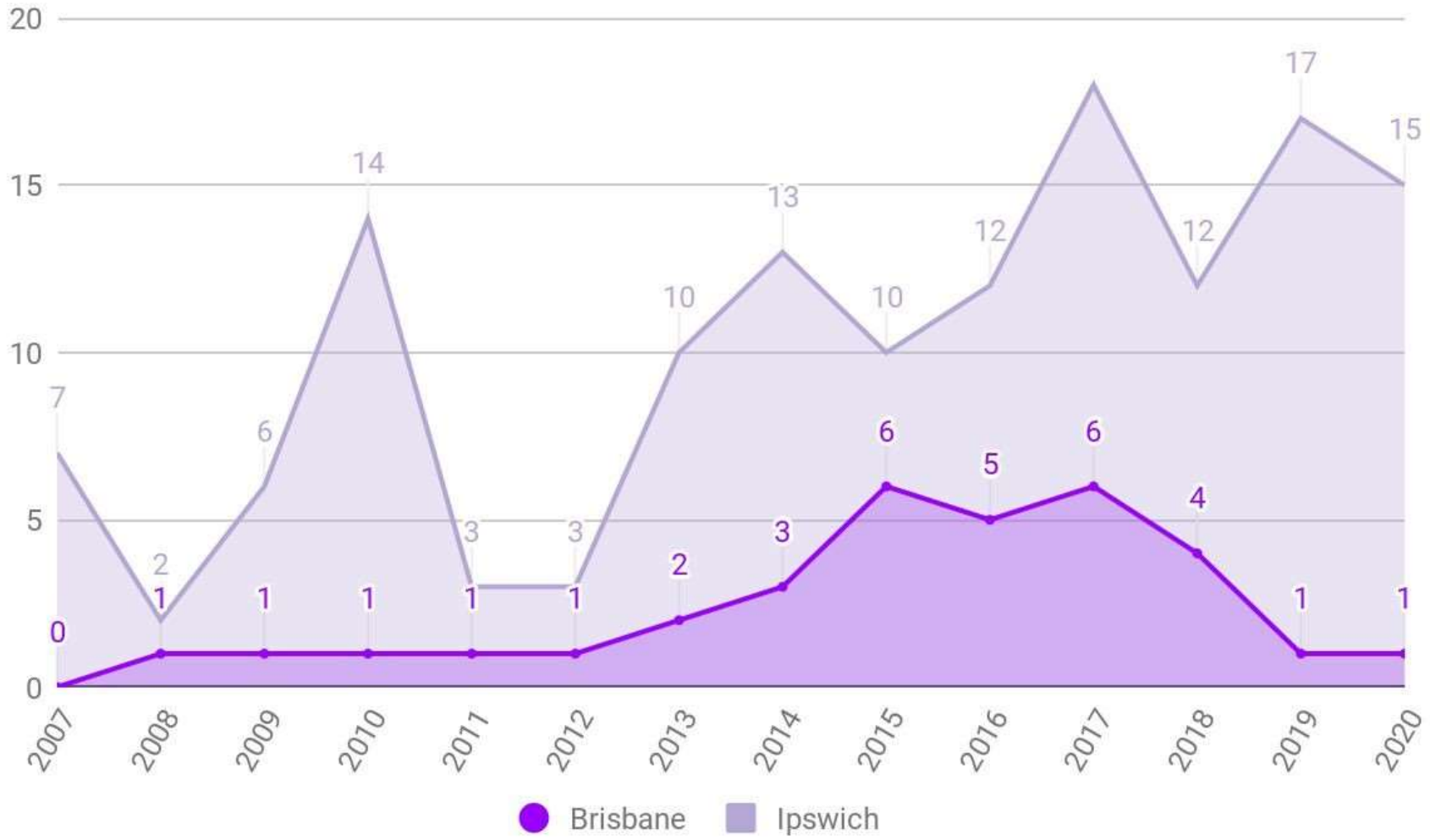


Forecast Anomaly (2000-2019* mean)



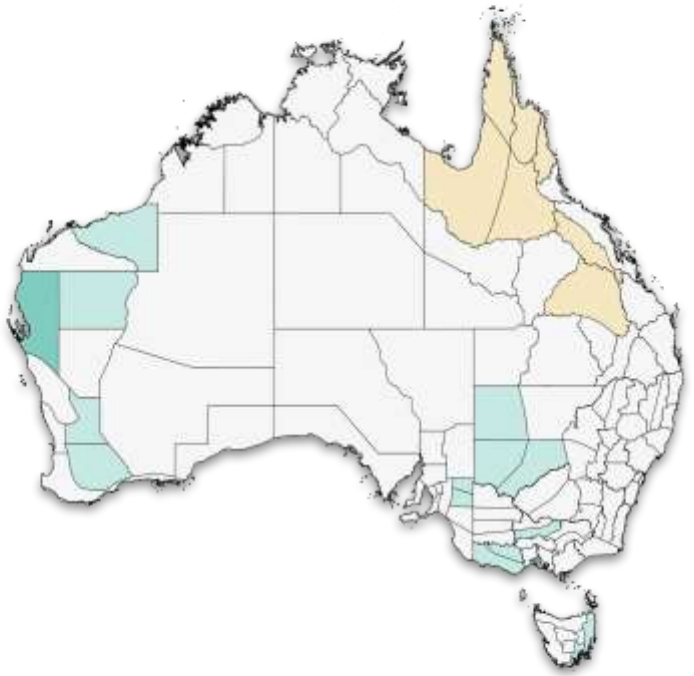


Brisbane Basin - Days above 35 Deg (DJF)



National Outlook - DJF

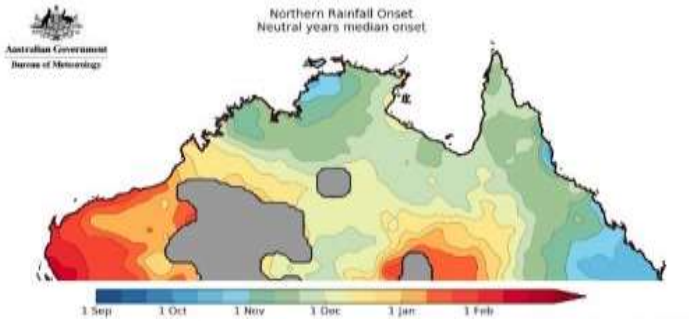
Rainfall



Historical Comparison

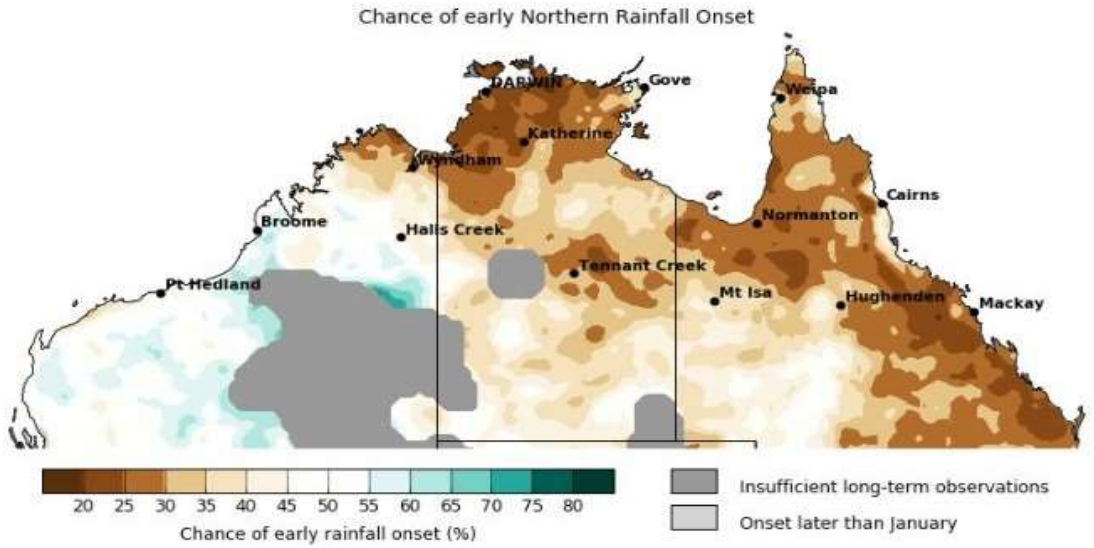
Based on the current climate drivers

Something to keep an eye on …



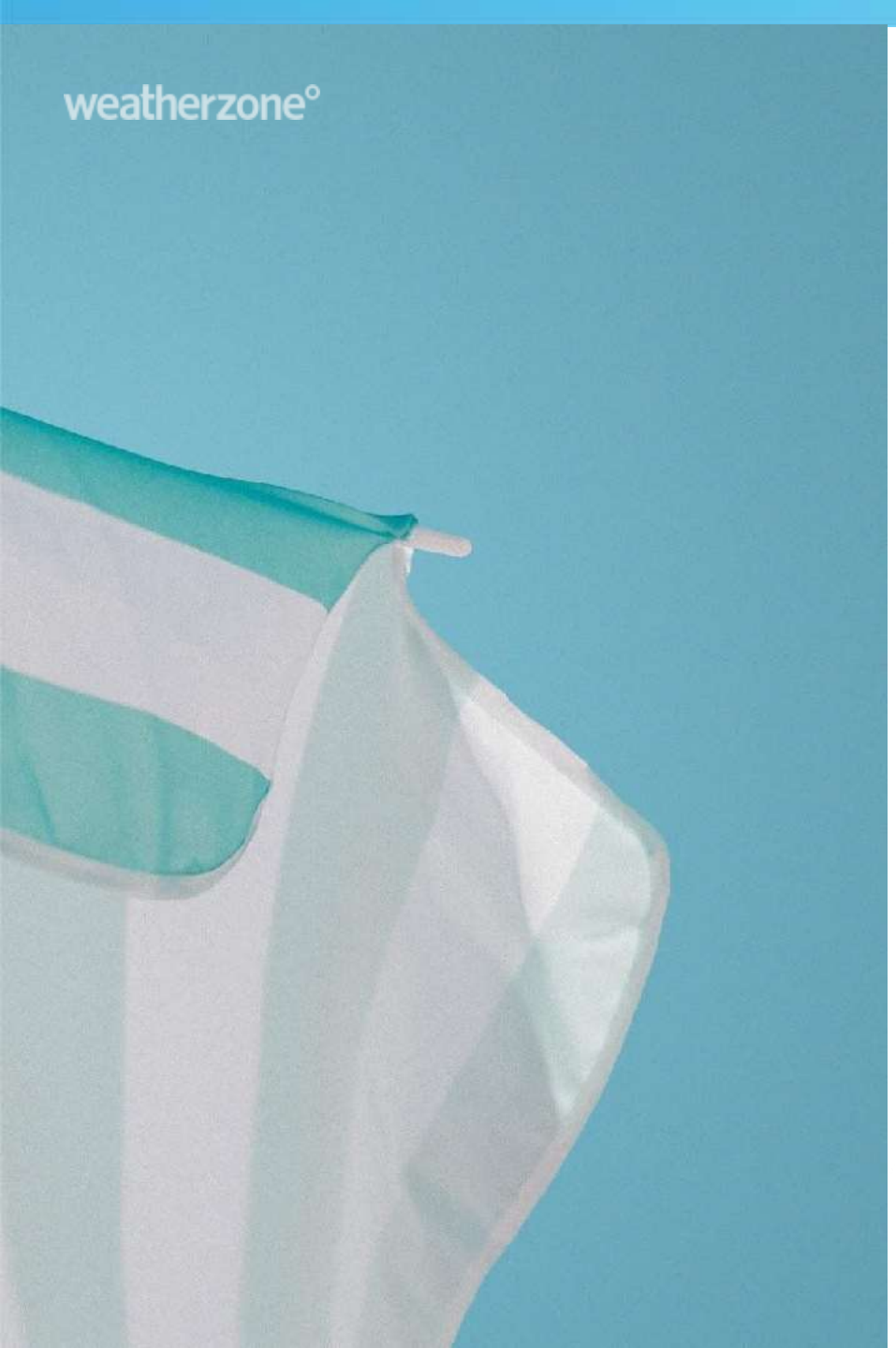
Average Onset Date

North Australian Wet Season



Forecast Onset 2019

> The onset of the wet season occurs when: at any specific location, the accumulated rainfall reaches 50mm since September 1st.



Summary - Summer Outlook

- Closer to average temperatures favoured for far southeastern summer.
- Extreme hot days/short heat bursts remain likely, ahead of fro

- Warmer than average temperatures across the eastern states prolonged heat under clear skies/lighter winds regime.
- Humidity levels increasing through early summer along the co further inland.

- With all key climate drivers in a neutral phase, most of Aus exh summer.

Questions

weatherzone

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AEMO's Summer Preparedness

2019/2020

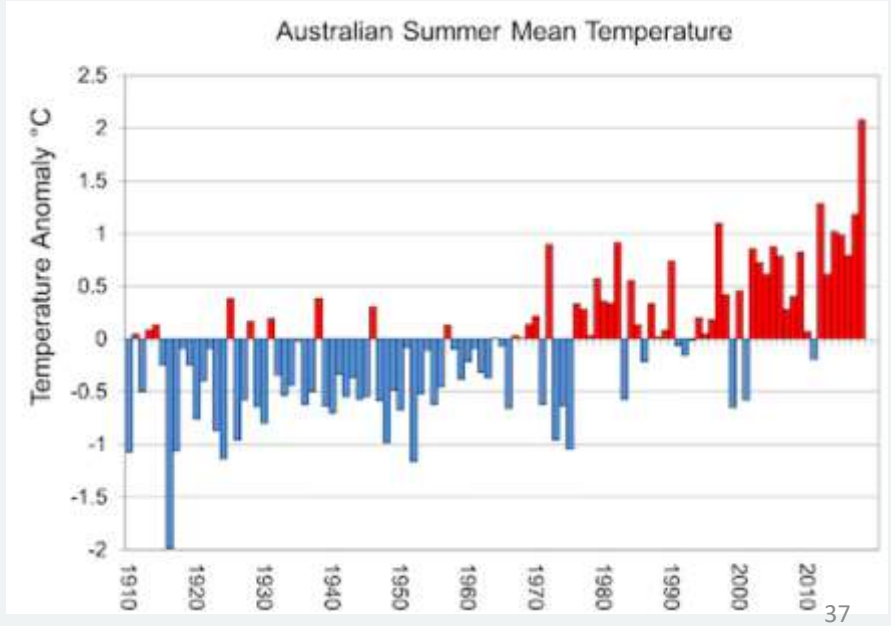
Damien Sanford
Chief Operations Officer, Operations

Weather last summer – the new norm?

- Maximum and minimum temperatures were above average
- All capital cities in the National Electricity Market (NEM) exceeded their average number of days over 30°C

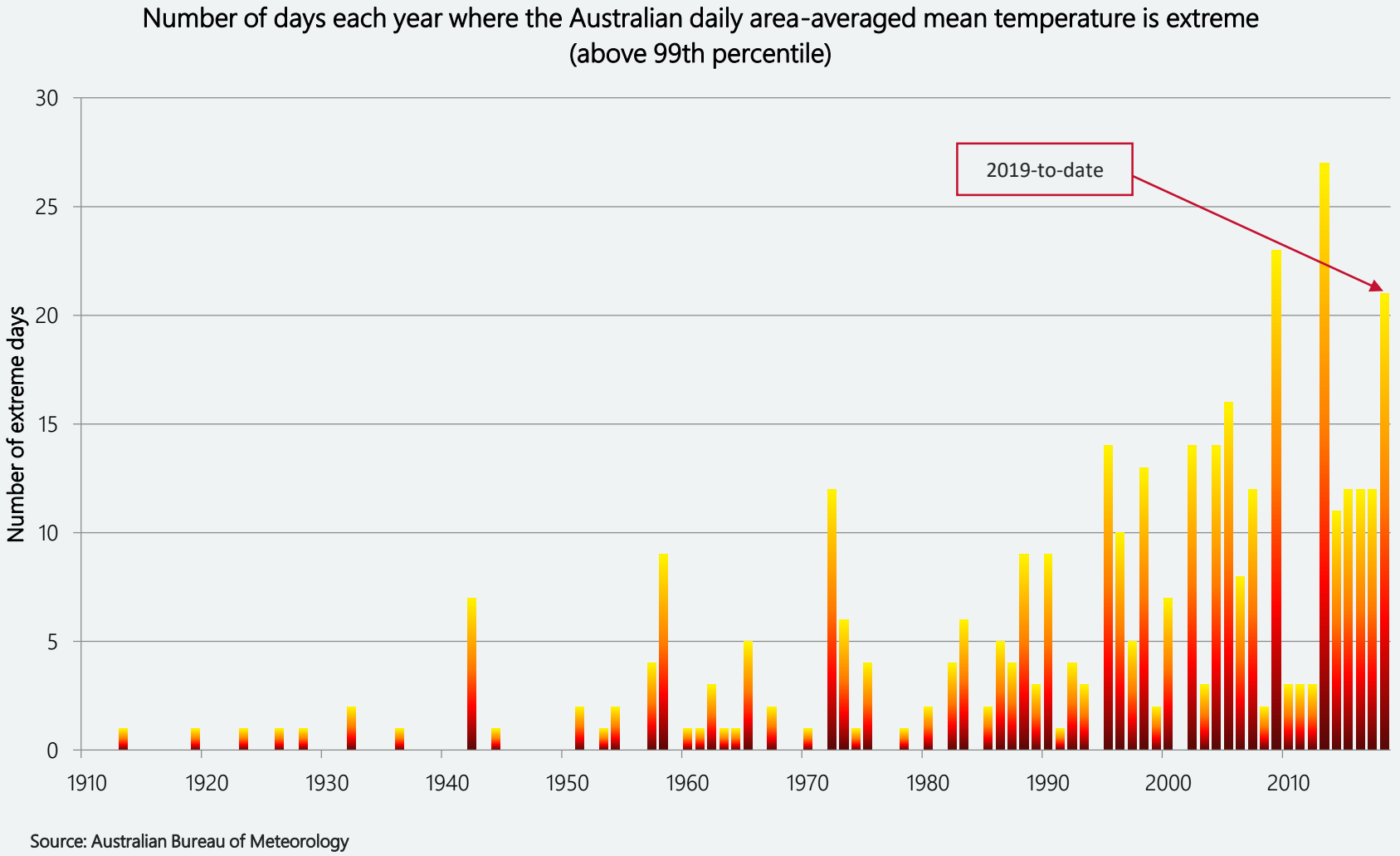
2018/19 was the hottest summer on record with January 2019 being the hottest month in Australia thus far

- Eight of the 10 hottest days on record for the nation occurred during January 2019.
- Last summer 28 days exceeded the 99th percentile for the month. This exceeded the previous record of 11 days.



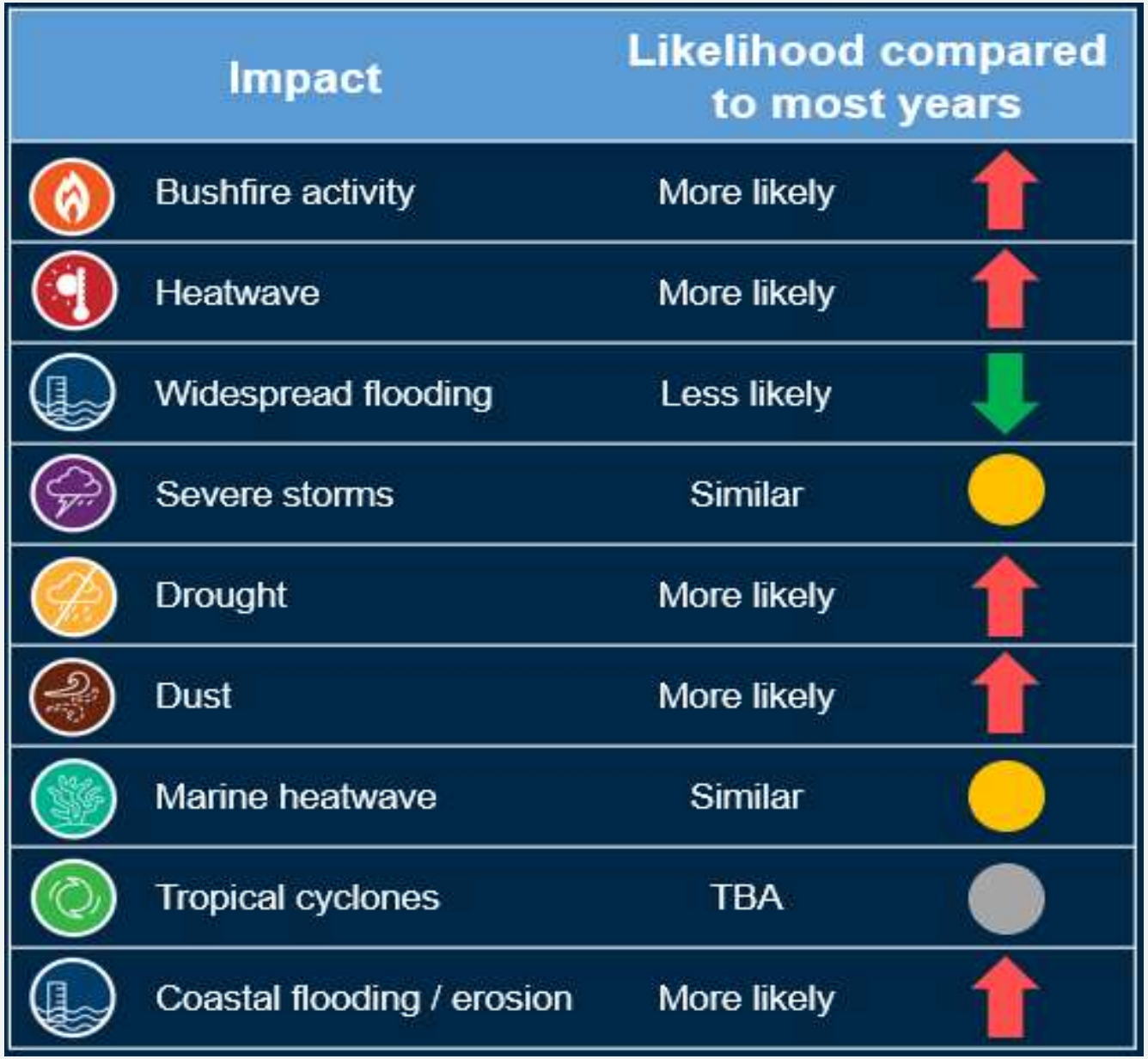
Weather outlook

- In the past extreme average mean days was not a regular occurrence
- The number of days are increasing whilst the time between events is decreasing

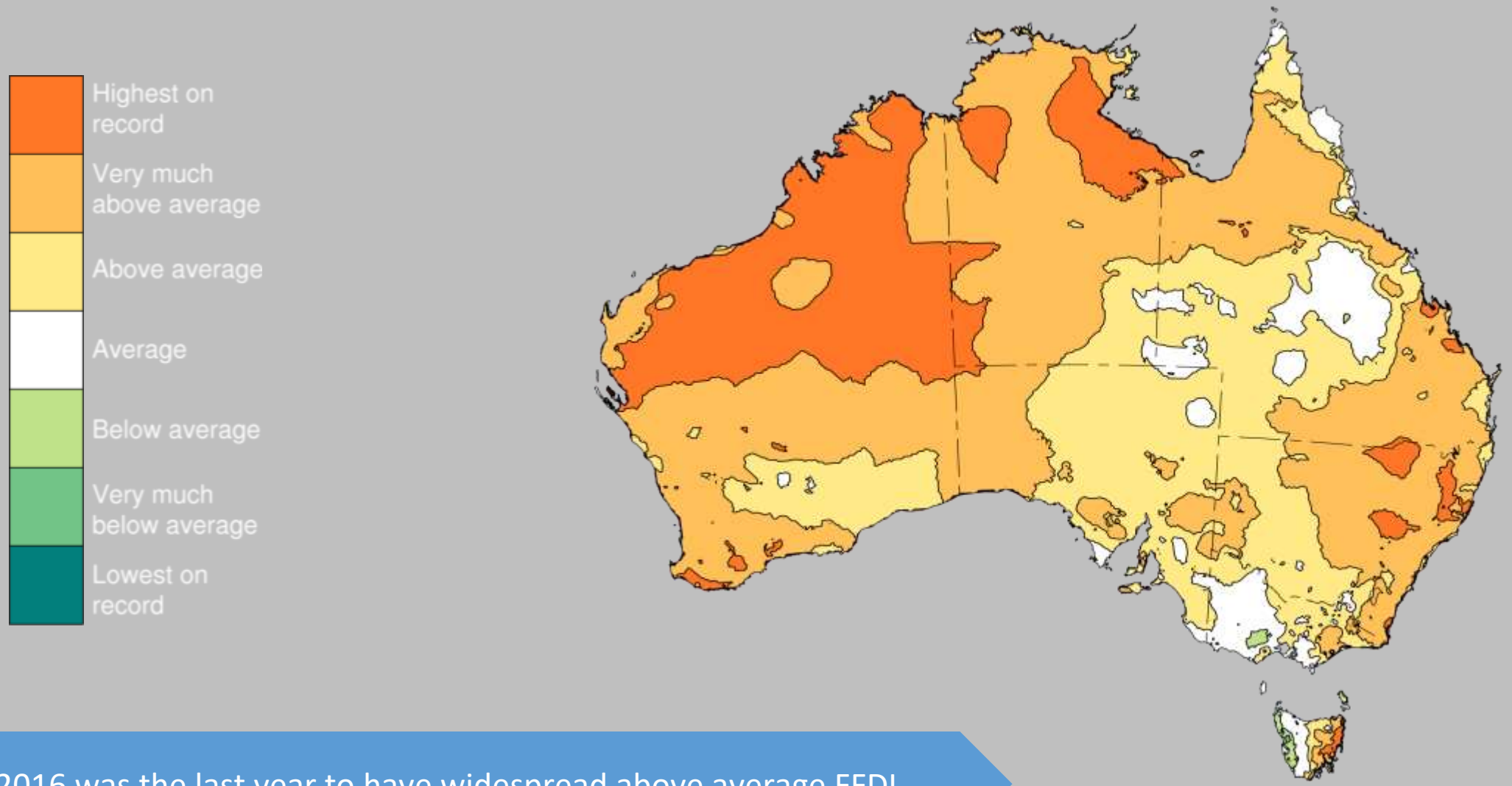


Weather outlook

- Rain deficiencies – Lowest on record Gippsland and NSW
- Forest fire danger index high especially around interconnector corridors for QLD-NSW & NSW-VIC.
- Dust storms in central NSW and in vicinity of QNI



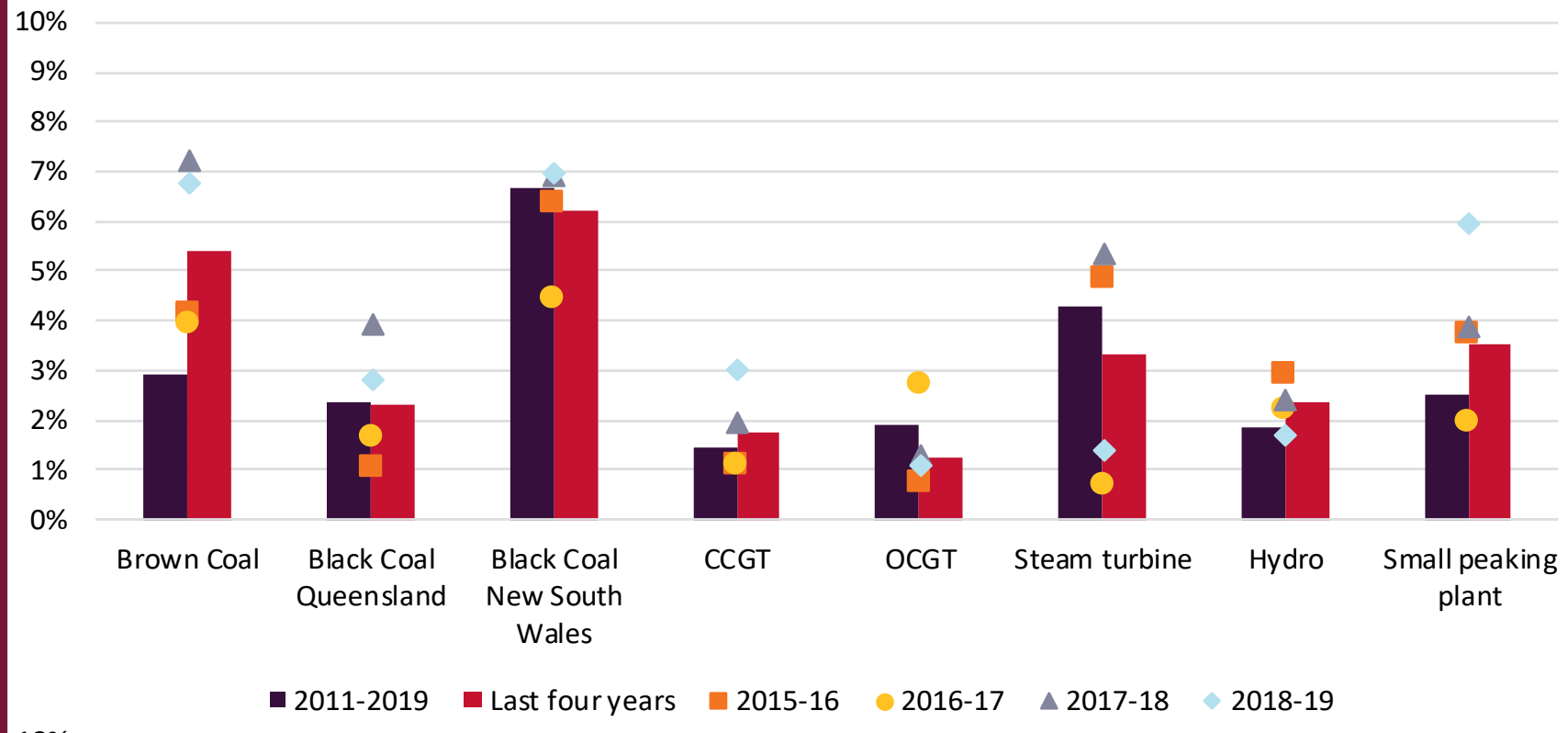
Forest Fire Danger Index

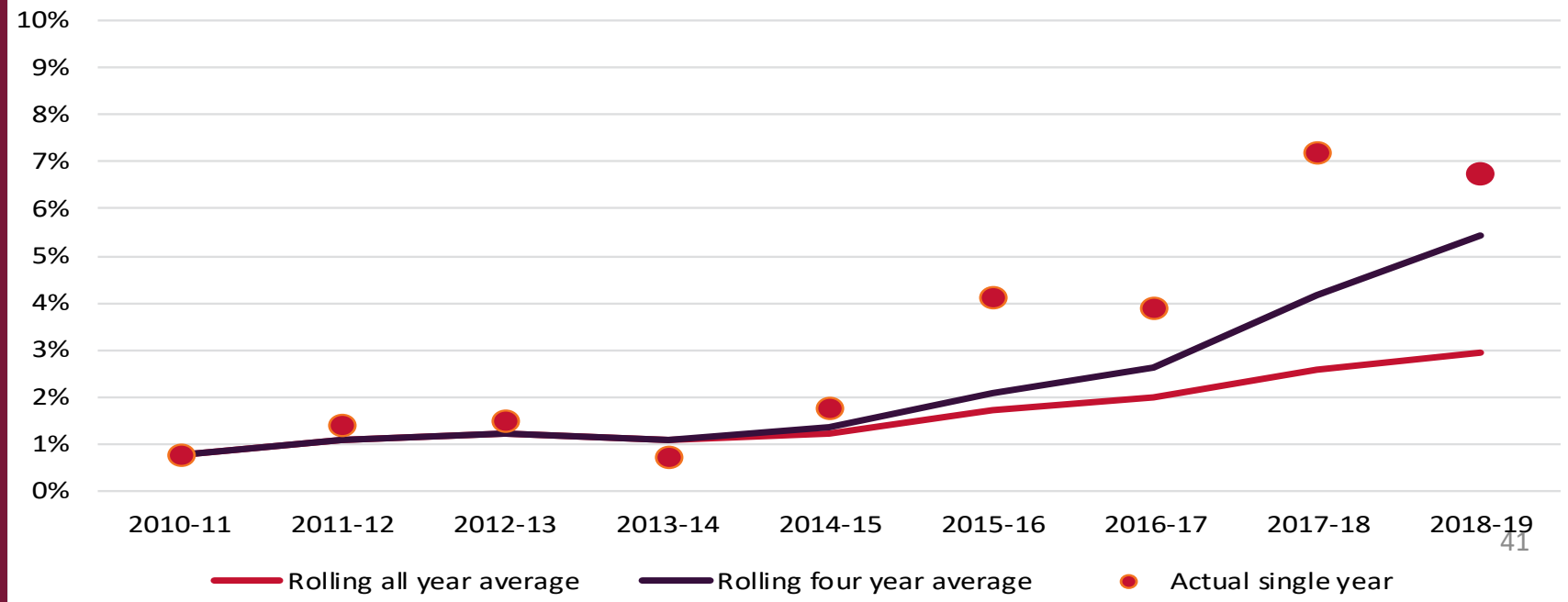


2016 was the last year to have widespread above average FFDI

NEM forced outage rates

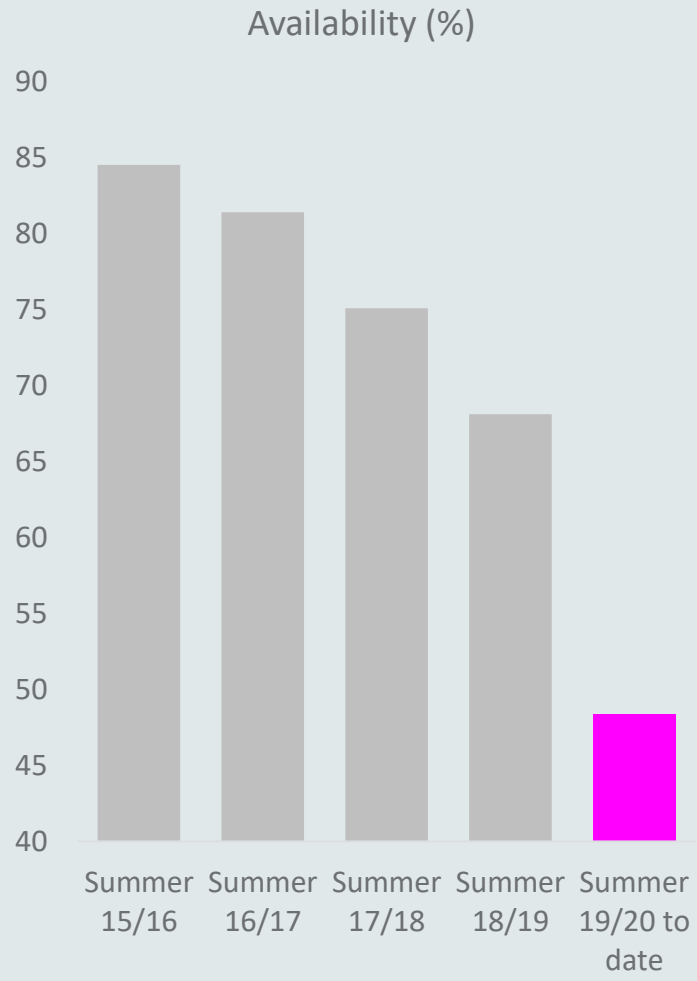
Besides high demands forced outages are becoming problematic for system reliability



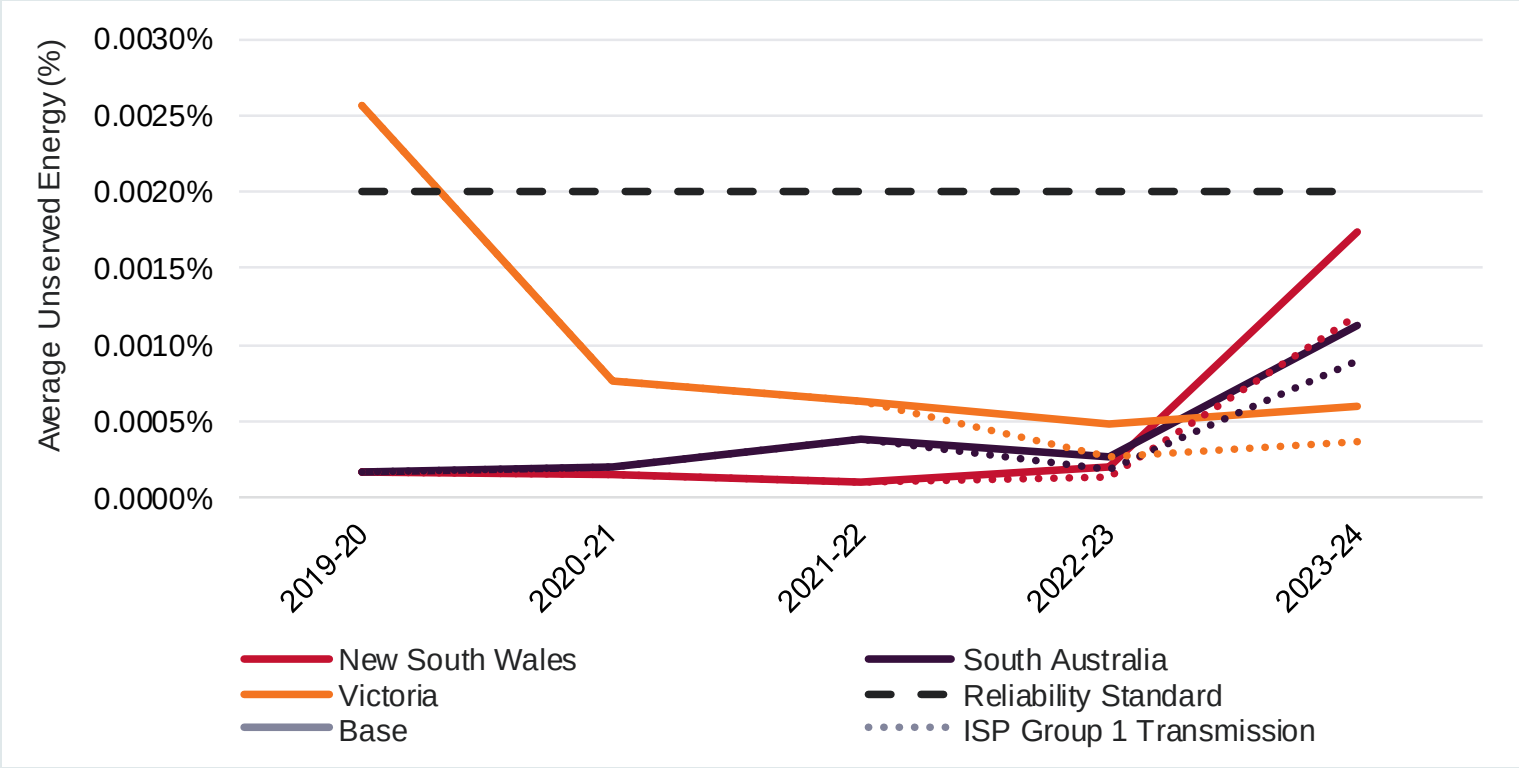


Generator reliability

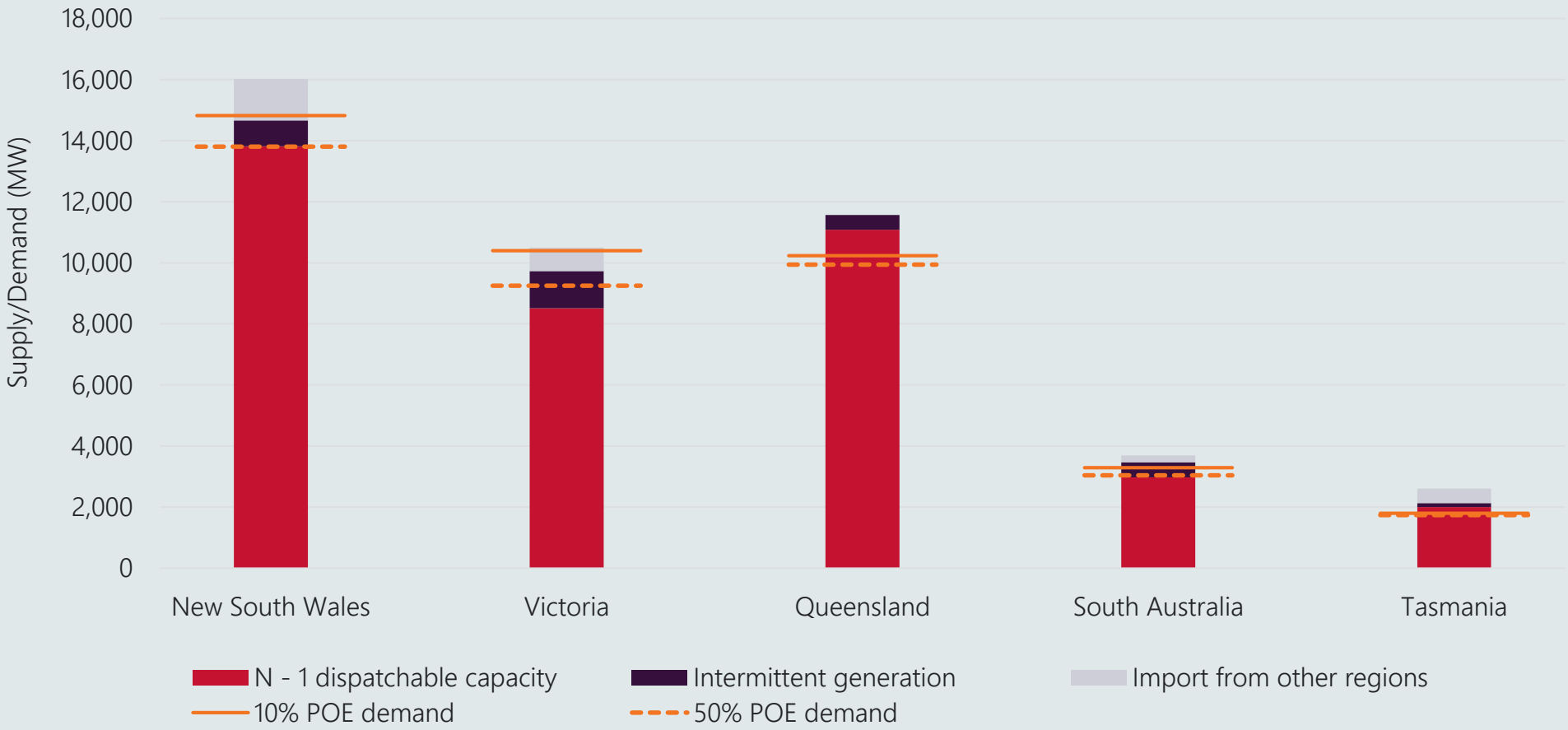
- Prior to summer, September / October are months typically assigned by generators to undertake planned maintenance, as the ‘shoulder’ period should represent lower market volatility and portfolio risk.
- Due to a variety of factors, such as aging plant, increased operational stress etc, this period of planned maintenance has also recorded a series unplanned outages and has seen units delayed in returning to service.
- The beginning of November saw LOR1 conditions in NSW, which at one point had 5000+ MW of black coal generation offline - ~50% of which was unplanned.
- Some units have struggled more than others showing worst reliability for several years (November through March)



NEM unserved energy projections



Indicative Supply-demand balance in the NEM this summer



2019/20 RERT Portfolio

Combined Victoria and South Australia where reserves are shared – including $3.9million in fixed charges, weighted price estimate $12,600 MWh for a 6.5 hour activation

Residual risks

Network and generation forced outages exceeding limits historically observed

Bushfires impacting fuel supplies (coal or gas production), generation or network assets

Inter-regional issues impacting energy transfers into Victoria – bushfires in particular

Very severe summer storms that could require constraints to protect the network on the tail-end of heat events

Emerging risks - non-summer specific

1. Low load conditions and economic displacement of synchronous plant in real time leading to system strength and voltage management issues
2. Non-scheduled and semi-scheduled ‘price contingencies’ during very low load and negative price events leading to voltage management and power swings on the network
3. Contingency sizes increasing beyond the tractional single largest generators loss – some contingencies now near 1,000MW
4. Compressed windows annually for generation, transmission and gas system planned outages
5. Digitised output of non-scheduled solar – now the largest generator in the NEM – during unforecast cloud formations, dust storms
6. Saturation of networks with inverter connected plant leading to accelerated need for network investment to manage system strength

These risks are not necessarily correlated, but can occur concurrently making grid management more complex than ever

Break

Rebidding and Technical Parameters Guidelines

Joanna Gall
Director – Compliance and Enforcement
Australian Energy Regulator (AER)

NEM Summer Readiness in an evolving power system

Joanna Gall

27 November 2019

Introduction

- AER's role
- AEMO conditions predicted for summer
  - AEMO's 2019 *Electricity Statement of Opportunities* notes greater risks of load shedding due to uncontrollable but increasingly high impact events such as coincident unplanned outages

Risks of our evolving power system

- What is a risk to power system security is evolving over time
- Risks are not limited to during peak periods
  - Low voltage issues at night
  - Low demand periods
- Participants shouldn't focus too narrowly on easily quantifiable or identifiable risks

Being prepared: awareness, vigilance, adaptability

- Awareness
  - You must be aware of your various obligations under the Electricity Rules
  - You are best placed to observe and understand local conditions at your own plant, and how those conditions may affect its operation
- Vigilance
  - Continually monitor what is happening in the market and think about the implications for the operation of your plant, given other factors that you are aware of
- Adaptability
  - Flexible training of staff to enable them to adapt to new and emerging risks within the power system and effectively communicate these risks/threats to AEMO
  - Analyse how your plant has reacted to an event and use as a lead indicator as to how it may react in the future

Information provision to AEMO

- This is an AER compliance and enforcement priority for 2019/20
- It is critical that AEMO has timely, accurate and complete information
  - Efficient operation and dispatch of the market
  - Managing power system security
- Participants have a range of obligations under Chapters 3 & 4
  - Different time horizons – 2 years out, day ahead, pre-dispatch to real time
  - Different information requirements – availability, offer requirements, plant status

4.8.1 Registered Participants' advice

A *Registered Participant* must promptly advise *AEMO* or a relevant *System Operator* at the time that the *Registered Participant* becomes aware, of any circumstance which could be expected to adversely affect the secure operation of the *power system* or any equipment owned or under the control of the *Registered Participant* or a *Network Service Provider*.

Other foundational NER obligations

- Key operational requirements
  - Submission of availability data (cls 3.7.2, 3.7.3, 3.7B(b), 3.13.2(h))
  - Honouring latest offer (cl 3.8.22A)
  - Plant must be capable of complying with offer (cls 3.8.20(g), 4.9.8(b)-(e))
  - Following dispatch instructions (cls 4.9.4, 4.9.8(a))
  - Having systems to receive dispatch instructions and personnel available to act on them at all times (cls 4.9.2(d), 4.9.3A(c))
  - Ensuring details for plant operators are up to date outside the commissioning and registration stage (cl 4.11.3)
  - Notifying AEMO of plant changes, defects or failures (cls 4.8.2, 4.9.9-4.9.9D, 4.9.4, 4.15)
- The AER's Summer Readiness checklist outlines our expectations in relation to various obligations
  - Updated standalone Compliance Bulletin will be released December 2019

Recent AER publication – Rebidding and Technical Parameters Guideline

- Includes amendments to account for five minute settlement
- Changes effective from 1 July 2021
- Changes were minor and included updating:
  - the reference to the number of trading intervals in a day from 48 to 288; and
  - the 'form of a rebid' section to reflect AEMO's proposed new bid/offer submission format that will apply from the commencement of five minute bidding
- Also took the opportunity to clarify that 'time adduced' in the Rules refers to the time the technical issue occurred, not when it was identified

Questions

Case study

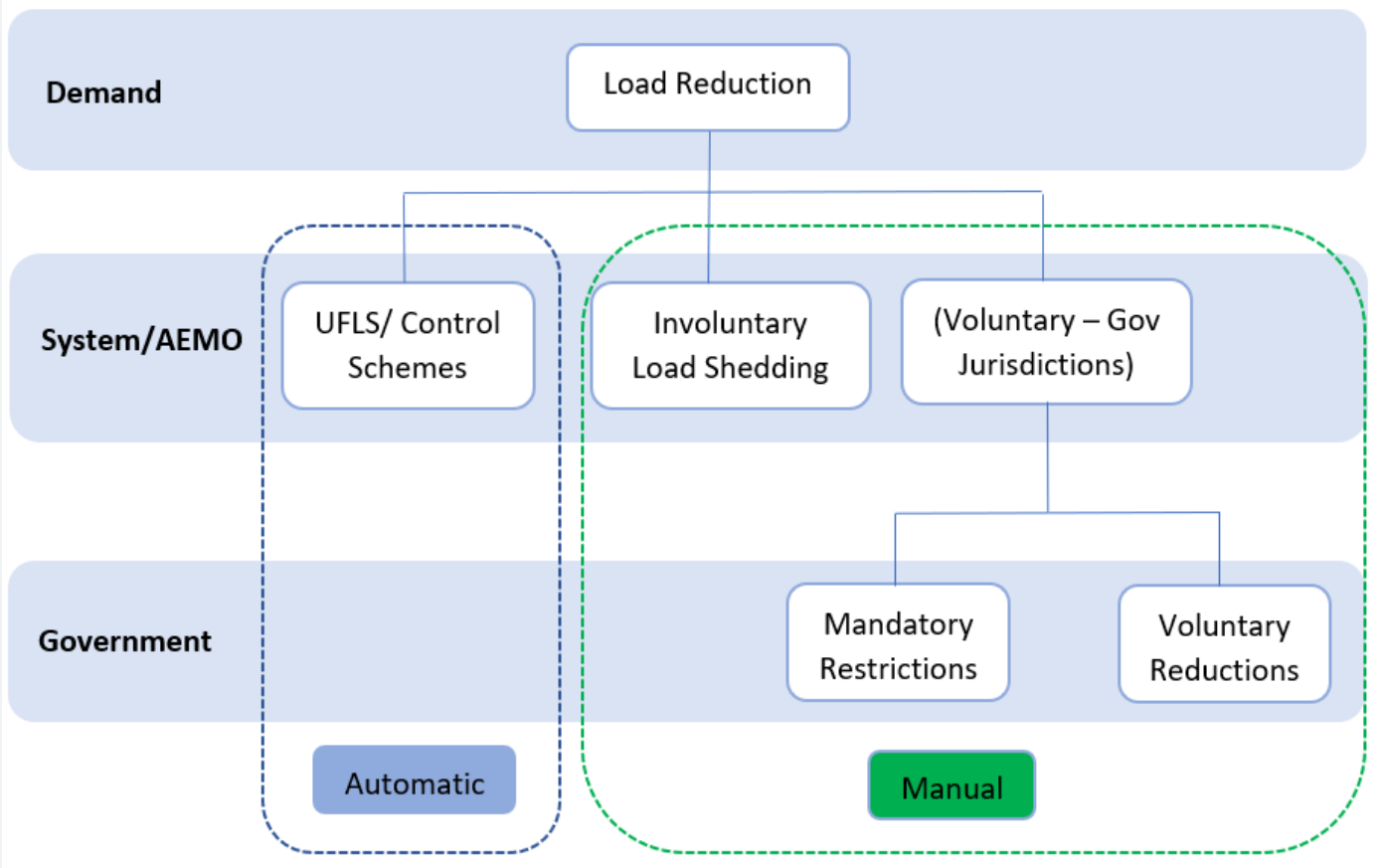
Managing the power system on high demand days

Tjaart Van Der Walt
Group Manager, NEM Real Time Operations

Load Shedding

What is load shedding?

- Controlled involuntary load shedding (disconnection of customer supply)
- May be implemented when there is a shortage of electricity supply or avoid overloading transmission and distribution lines
- Can occur automatically in response to faults on the power system



Reserve Levels

Within ST and PD PASA timeframes market notices are sent out notifying of LOR conditions

On an LOR 2 & 3 conditions AEMO request for tender for SN RERT

Explanation of reserve levels

- Reserve levels are described in clause 4.8.4 of the National Electricity Rules.

Lack of reserve level 1 (LOR 1)

- When supply exceeds demand by an amount less than the larger of either the forecasting uncertainty measure or the sum of the two largest credible supply contingencies for the region.

Lack of reserve level 2 (LOR 2)

- When supply exceeds demand by an amount less than the larger of the forecasting uncertainty measure or amount of the single largest credible supply contingency for the region.

Lack of reserve level 3 (LOR 3)

- When the available capacity reserves for a region are equal to or less than expected operational demand (there is no buffer), meaning load shedding is occurring or expected to occur.

South-Eastern Australia Heatwave

Regular briefings with weather providers

Operational briefings with TNSP

Jurisdictional briefings

A series of hot days across south-eastern Australia from 22–27 January 2019 presented significant operational challenges for the NEM.

- **24 January:** Adelaide experienced its hottest day ever, reaching 47.7^{O}C at Kent Town
- **25 January:** Melbourne experienced its hottest day since 2014, reaching 42.8^{O}C. Hobart also recorded its second-hottest day on record, recording 40.1^{O}C at Hobart Airport

Day ahead temperature forecasts, temperature observations, demand forecasts and actual demand for 24–25 January in South Australia and Victoria were as follows:

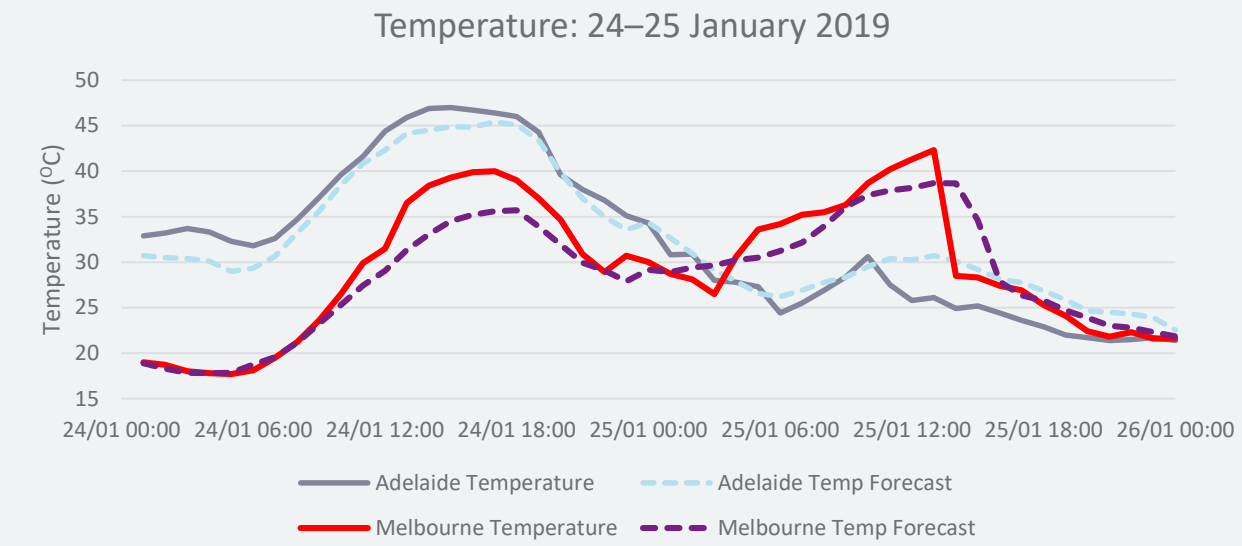
	Melbourne Temp Forecast	Melbourne Temp Actual	Victoria Forecast Demand	Actual Victoria Demand
24 January 2019	37	40.8	9,000	9,328
25 January 2019	42	42.8	9,220	9,298

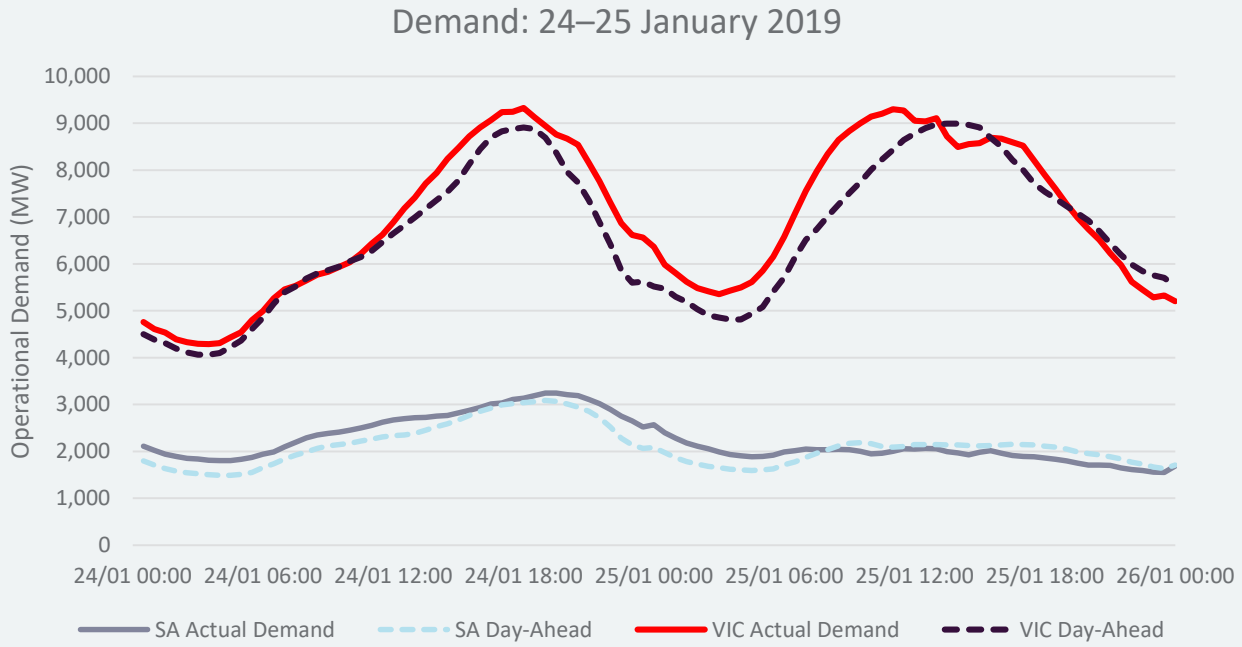
	Adelaide Temp Forecast	Adelaide Temp Actual	South Australia Forecast Demand	Actual South Australia Demand
24 January 2019	46	47.7	3,166	3,240
25 January 2019	32	31.9	2,186	2,396

South-Eastern Australia Heatwave

Regular briefings with weather providers

Regular reviews and updates by operational demand forecasting team





Generator Updates

Constant communication and updates with generators is key

Excellent communication with generators during the two day event in Victoria

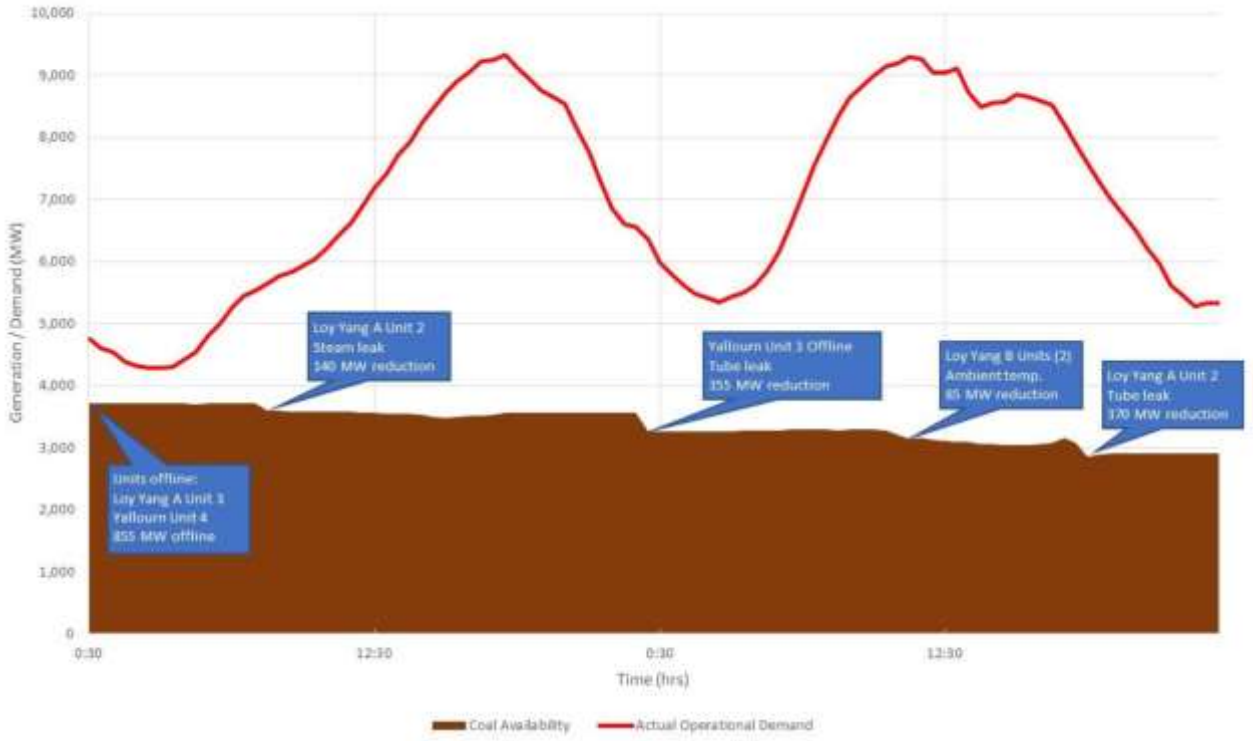
Having operational relationships and trust is important

Table 7 Thermal generator capacity not available in VIC on 24 and 25 January 2019

Date/ Market time	Thermal generating unit	Status	Outage/ reduction (MW)	Reason
19-1-19 at 00:00	Yallourn 4	OFF – UNAVAILABLE	355	Overdue maintenance
22-1-19 at 15:00	Loy Yang A3	OFF - UNAVAILABLE	530	Unplanned plant outage
24-1-19 at 08:00	Loy Yang A2	Reduced Capacity Availability	140	Unplanned capacity reduction
25-1-19 at 01:00	Yallourn 3	OFF - UNAVAILABLE	355	Unplanned plant outage
25-1-2019	Various	Reduced Capacity	232	Plant capacity reductions as equipment reached temperature-based operating limits

TOTAL Reduction from thermal plant outage and capacity reduction in VIC = 1,612 MW.

Figure 9 Coal generation and actual demand in VIC, 24 and 25 January 2019



AEMO Market Notices

The typical sequence of market notices you would expect to see is as follows:

Day Ahead

- Forecast LOR 2/3 market notices seeking market response

Intra-day

- Further forecast LOR2/3 market notices
- Market notice of intention to commence RERT contract negotiations from SN RERT panel
- Market notice advising instruction to activate reserve contracts
- Market notice of actual LOR 3 declared
- Market notice of load shedding direction

Interconnector transfer is key

Generation mix during the 24 & 25 Jan

Key takeaway:

- Interconnector flows

- Solar roll-off

Figure 11 24 and 25 January VIC, contribution to operational demand by fuel type

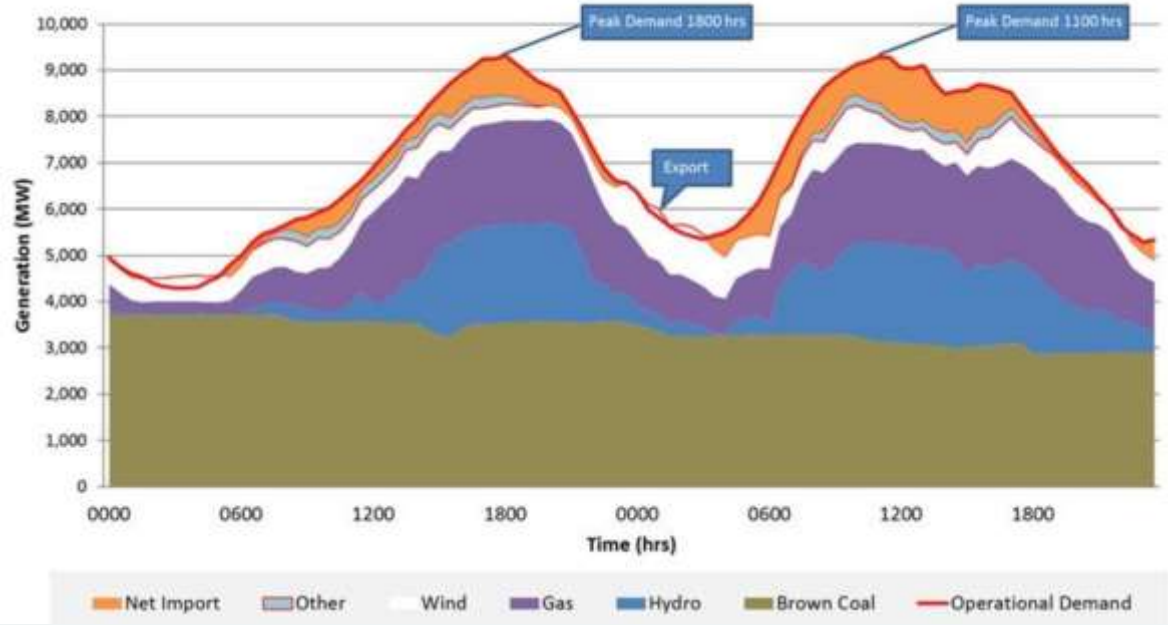
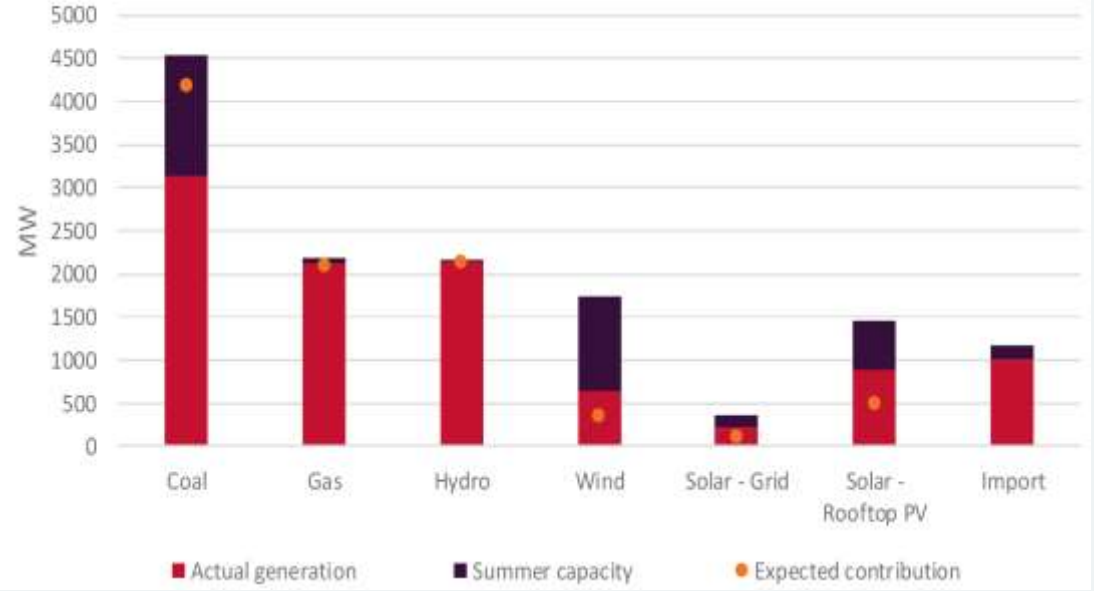


Figure 14 25 January – VIC actual generation by fuel type at trading interval ending 1100 hrs

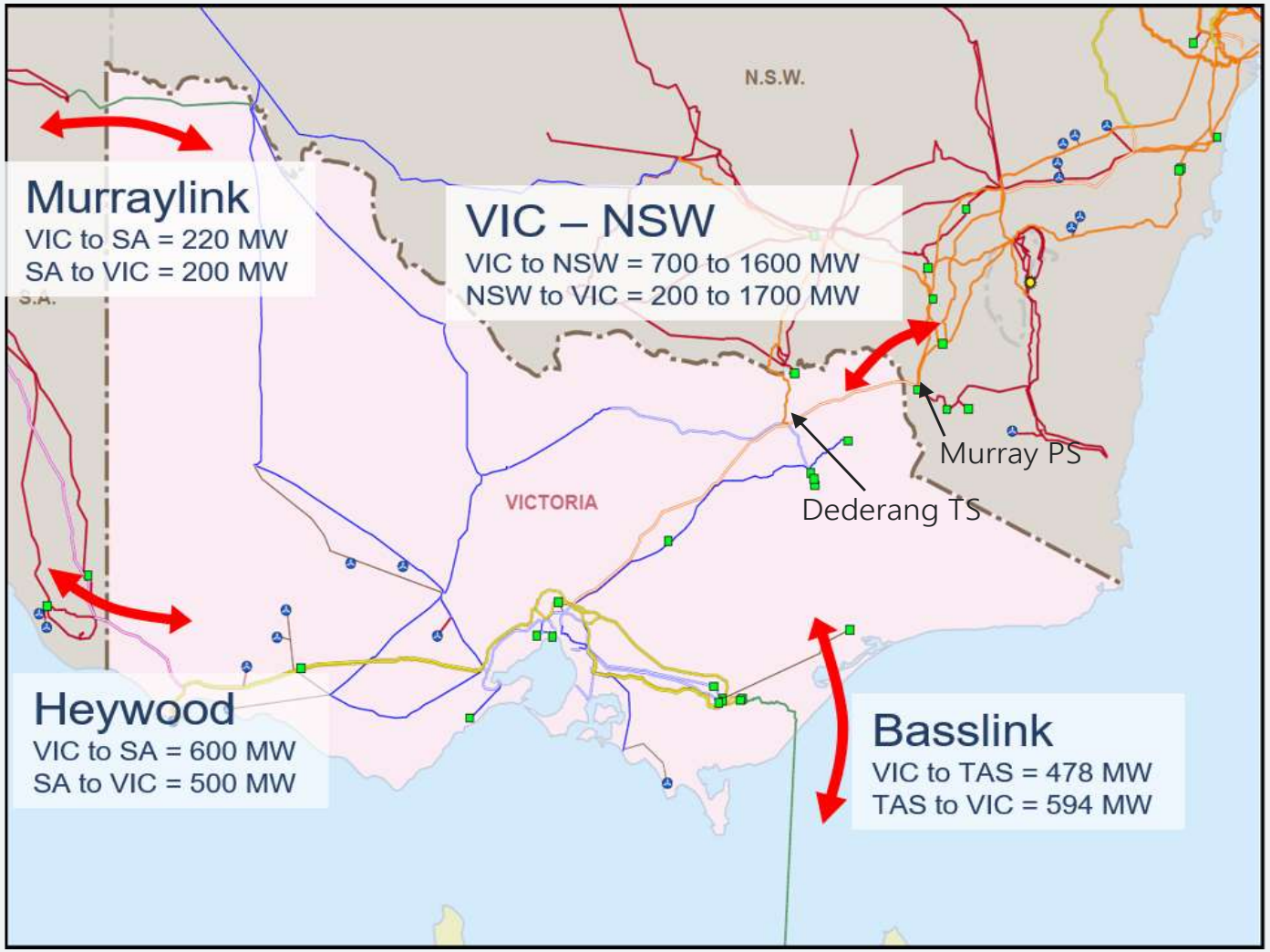


Interconnector Flows

Flows maximised through improving voltage collapse limitations and System Integrity Protection Schemes (SIPS)

Fast response RERT is activated to maintain interconnectors within limits

All RERT exhausted and interconnector constraints still violating, instruct TNSP to conduct involuntary load shedding



Direction to TNSP for Load Shedding

24–25 January 2019

Load Shedding 24 January 2019

- 18:10 – AEMO directed AusNet to shed load immediately in accordance with priority load shedding schedules.
- The first Portland Smelter potline consuming approximately 266 MW of electricity was sufficient to clear LOR3 in both VIC and SA regions.
- 19:05 – AEMO confirmed with AusNet that the load shedding is still required, AusNet informed AEMO Portland Smelter potline 1 (190 MW) would be swapped out with potline 2 (266 MW).

Load Shedding 25 January 2019

- 11:00 – AEMO directed AusNet to shed 100 MW of load as per priority load shedding schedule to maintain interconnector flows within operational transfer limits.
- On Alcoa advice, Portland smelter potlines could not be disconnected until 13:00 following 24 January load shedding.
- 11:30 – AusNet directed to shed additional 150 MW of load as per priority load shedding schedule to maintain NSW to VIC interconnector flow within operational transfer limits.
- Approximately 60,000 customers shed on rotational basis, impacting up to 200,000 customers.
- 11:30 – VIC prices reach CPT with energy prices capped at APC of $300/MWh.

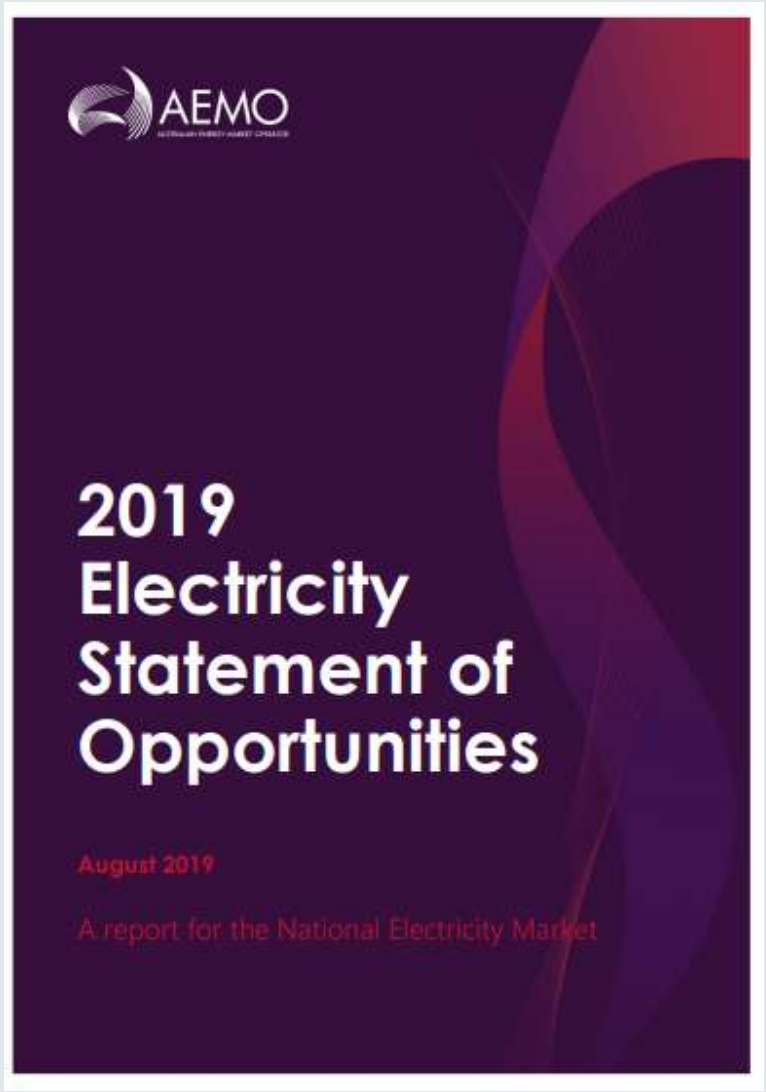
Public Communications

Jonathan Geddes
Principal Media and Corporate Affairs Advisor

Objectives for summer 2019/20

AEMO's summer communication objectives are to promote and engage our stakeholders on **expected operational conditions and contingency planning**; and to **inform and educate them on key summer topics and operational processes.**

Operational conditions



The 2019 Electricity Statement of Opportunities forecast tightly balanced supply and demand in several NEM regions for summer 2019-20, with all regions other than Victoria expected to meet the current reliability standard.

…involuntary load shedding may be experienced in Victoria during extreme weather events, potentially over multiple events, equivalent to between 260,000 and 1.3 million households being without power for four hours.

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Contingency planning

AEMO has engaged with stakeholders across government and industry to establish working groups and share contingency plans, procure RERT, co-ordinate gas and electricity outage management plans, facilitate new generator connections, confirm fuel availability, undertake emergency exercises, identify and implement forecasting improvements, and improve network resilience

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Communications and stakeholder engagement

Conduct '**Summer Readiness' stakeholder briefings**

Commence **weekly NEM briefings** (NEMEMF and jurisdictional NGERAC members)

Collaborate with industry and government to manage and issues (lack of reserve conditions, RERT, load shedding)

October - November

From 1 December

Managing issues

Summer communications campaign – key topics and AEMO processes from via AEMO's digital channels

Proactive media engagement across all platforms and channels (aligned to VEEC and PSEMP protocols)

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Summer communications campaign

2019/20 Summer communications campaign

Draft and publish summer-related topics and processes

- Lack of reserves (LOR)
- RERT
- Load shedding

Brief media and jurisdictional communications teams

- ESOO
- Summer Readiness Plan
- LOR, RERT, load shedding

Draft and publish a range of energy-related stories via our communications channels

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Communication channels

Channel	Users
Energy Live portal	250,000 visitors last year
Energy Live app	1,500 downloads/users
Energy Live fortnightly eNewsletter	9,000+ subscribers
AEMO's Twitter account	5,900+ followers
AEMO's Facebook account	3,300+ followers
AEMO's LinkedIn account	21,700+ followers
Aemo.com.au	4,000 visitors daily

Questions