

# FRG - Climate Change Impacts

# Purpose

- Inform the reference group of the three year collaboration with the BoM and CSIRO on the Electricity Sector Climate Information Project (ESCI)
- Update the reference group on quick wins:
  - incorporating climate change in maximum demand for the ESOO 2019
  - Incorporating reduced rainfall risk in hydro output for capacity expansion planning
- Inform the reference group on industry participation in assessing resilience and reliability risks

# Industry Need

- Forecasting horizons typically match asset lives (~50 years)
- Customer demand has long been highly responsive to weather
- In response to climate risk and changing technology, generation markets are transitioning away from fossil fuel based synchronous generators
  - Supply markets are now highly responsive to weather
  - Loss of synchronous generation increases demands on forecasting and modelling
- Models that do not understand or preserve spatial and temporal correlations between weather variables will likely mismatch supply and demand - underestimating the risk of customer outage
- Climate change is driving more:
  - extreme weather,
  - unobserved weather,
  - unobserved interactions between weather variables
- While electricity systems have always been built to withstand extreme weather, risk management processes may not be keeping up with the emerging weather extremes and interactions

# Electricity Sector Climate Information (ESCI) Project

- The Australian Government is providing \$6.1 million over three years, from 2018-19, to improve climate and extreme weather information for the electricity sector, as part of a response to the Finkel review.
- This project will make existing climate change data and information more accessible and useful for those making decisions on electricity infrastructure, to support improved long-term climate risk planning.
- The project will work closely with industry to understand their specific needs and deliver relevant information that is appropriate and useable by the electricity sector.



Australian Government  
Department of the Environment and Energy

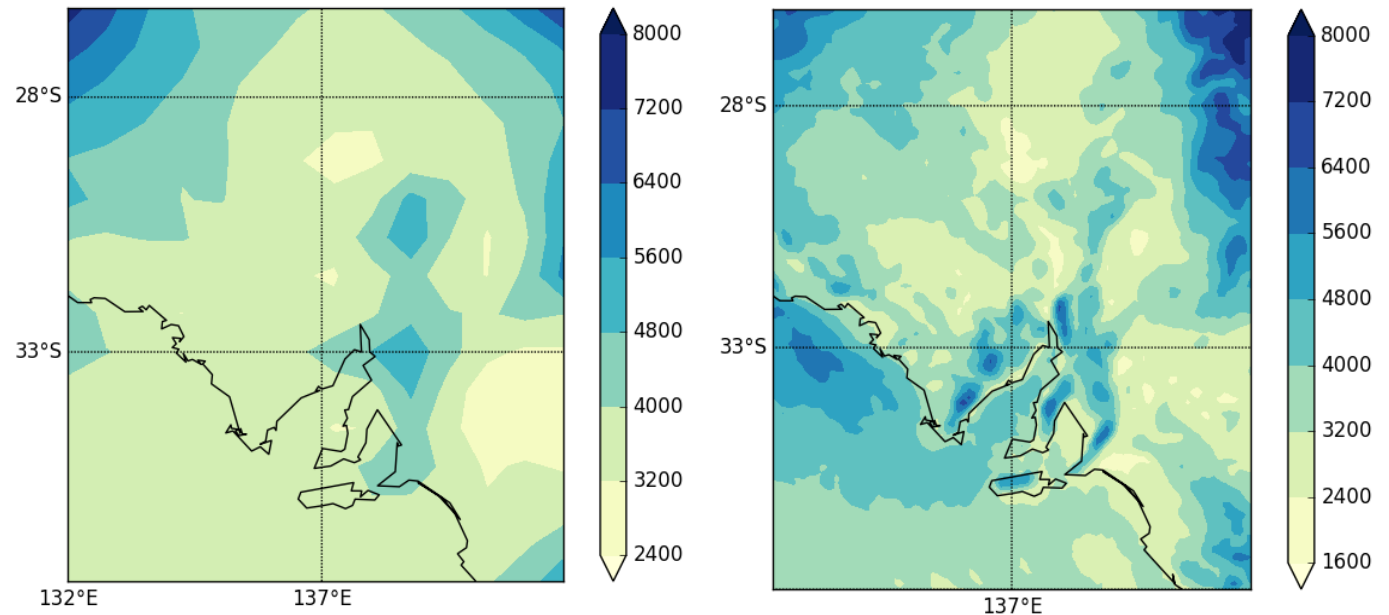


Australian Government  
Bureau of Meteorology



# Downscaling

- Downscaling makes the output of Global Climate Models relevant at finer spatial levels.
- The downscaling better captures extremes in weather



Regional mapping of severe thunderstorm risk diagnostics from ERA-Interim reanalysis 1979-2015 (left) and BARRA reanalysis 2010-2015 (right), based on convective available potential energy and wind shear.

# ESCI Project Goals

All relevant history has been re-sampled/downscaled

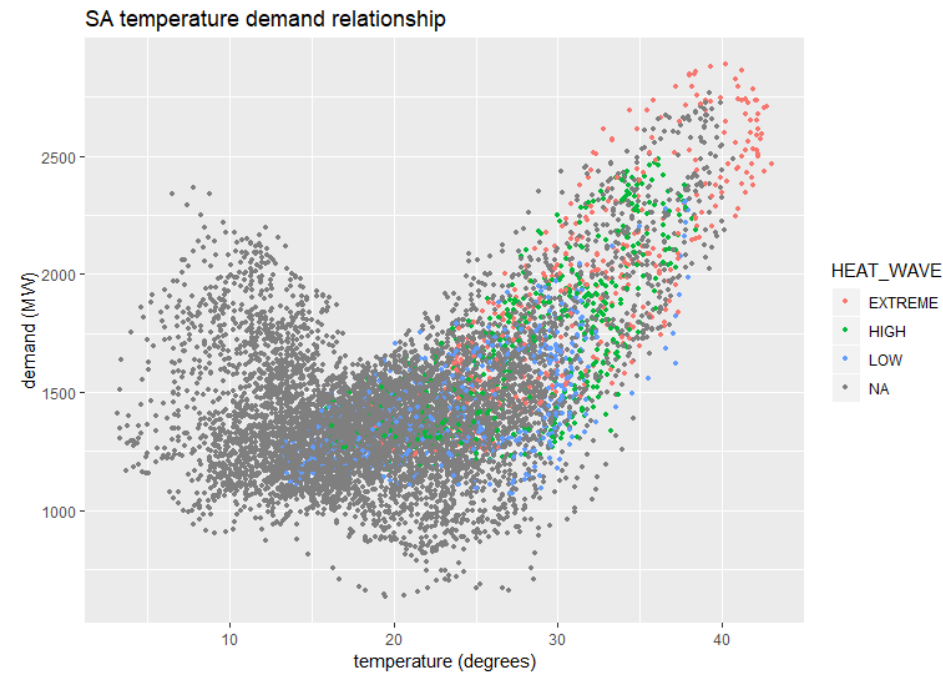
The project will now downscale future weather not yet observed

Goals include:

1. Support improved planning and investment decisions for the electricity network.
2. Support decision-makers in the National Electricity Market to access and use tailored climate information to improve long-term climate risk planning. It will do this by collaborating on existing information and planning processes. This will include identifying, and where possible, providing priority climate information that is critical to support these long-term planning processes.
3. Develop and demonstrate a best practice methodology for analysing climate change risks that can also be used by other sectors, for example telecommunications.
4. Improve information on likely future changes to extreme weather events such as heatwaves, wind, and maximum temperature thresholds, to inform analysis of long-term climate risk. A particular focus will be on concurrent and/or compounding extreme events.

# Demand Side – 2019 Quick Wins

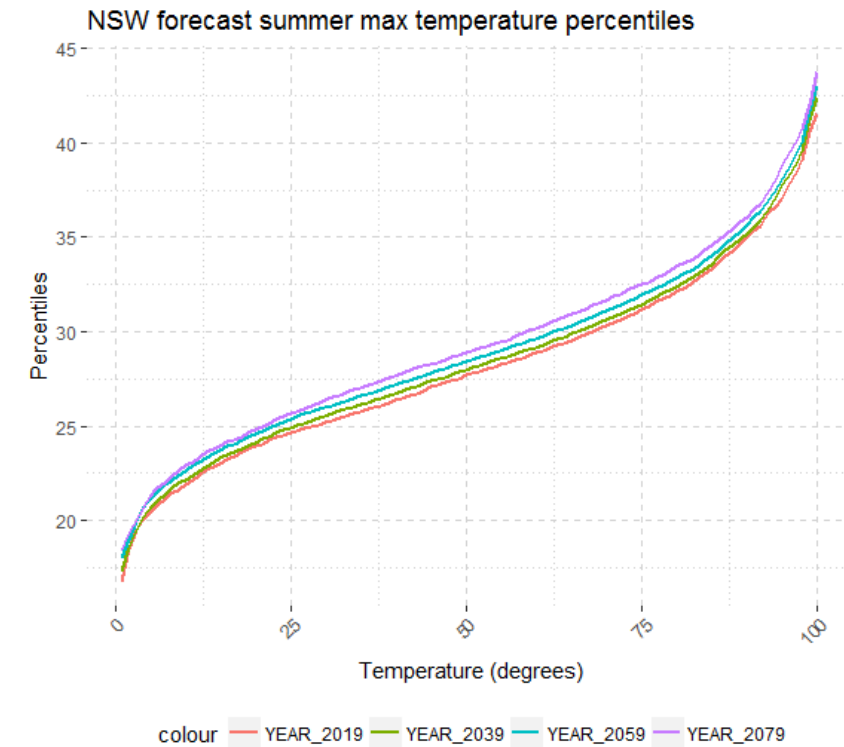
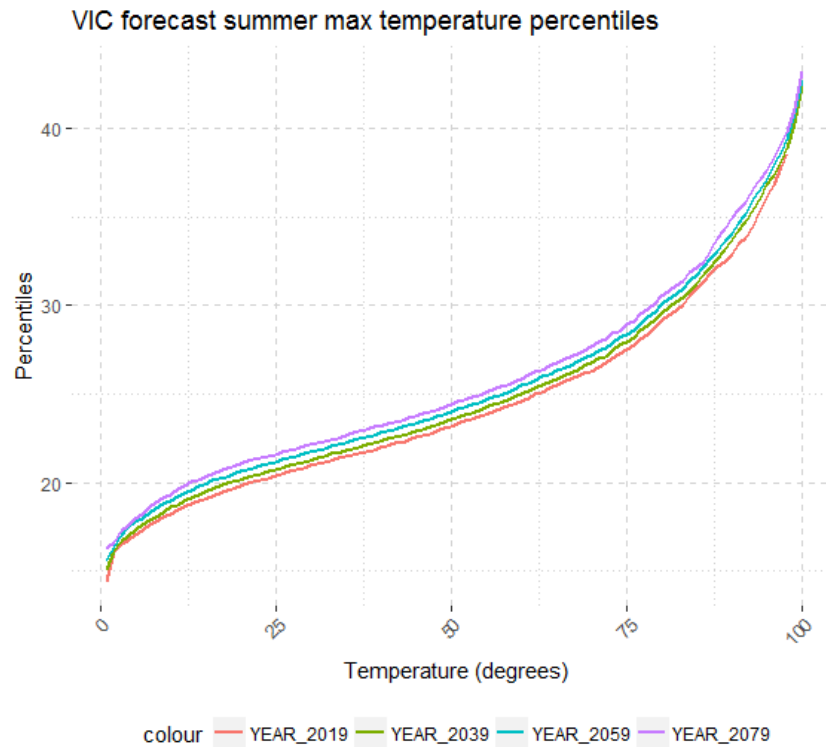
- AEMO simulate demand against weather and other demand drivers (such as technology and stochastic volatility)
- The weather component of demand is simulated by block bootstrapping temperature data from history
  - 20 years of half-hourly temperature data for weather stations in each region
- The BOM and CSIRO have further helped AEMO incorporate climate as a deliverable of the ESCI project
- The BOM/CSIRO will provide AEMO with downscaled climate data mapped to weather stations in each region
- Previous climate data was spatially average within the Global Climate Models (GCMs) available on Climate Change In Australia (CCiA)



# Demand Side – 2019 Quick Wins

The ESOO2019 will warm historical station data using the following method:

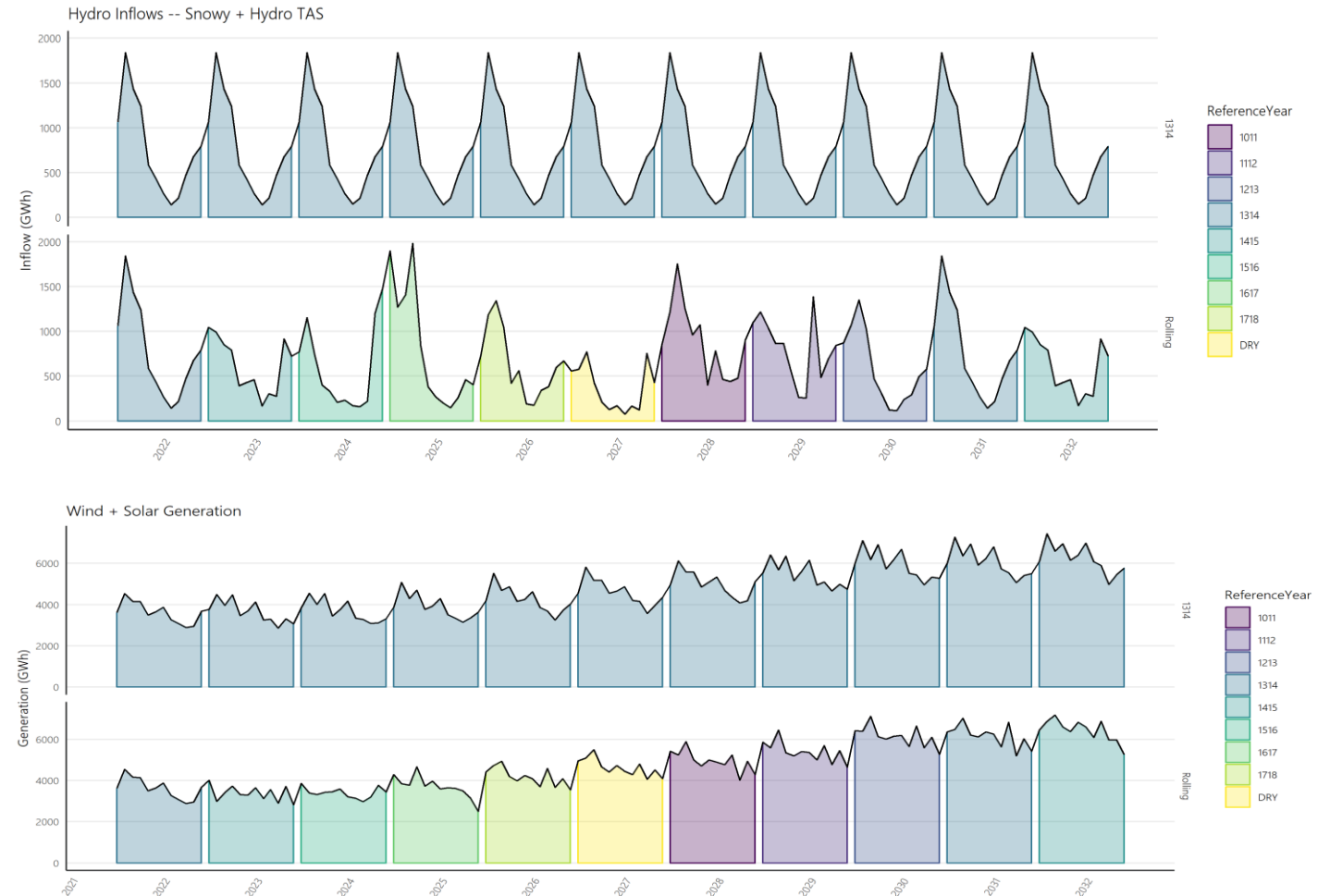
1. Quantile match GCMs tmax and tmin to historical tmax and tmin and spatially downscale to station data (new step)
2. Quantile match historical tmax and tmin to GCM tmax and tmin and temporally downscale to half-hourly frequency
3. Interpolate the scaling factor from the bookends of the tmax, tmin and average to the other half-hours in the day



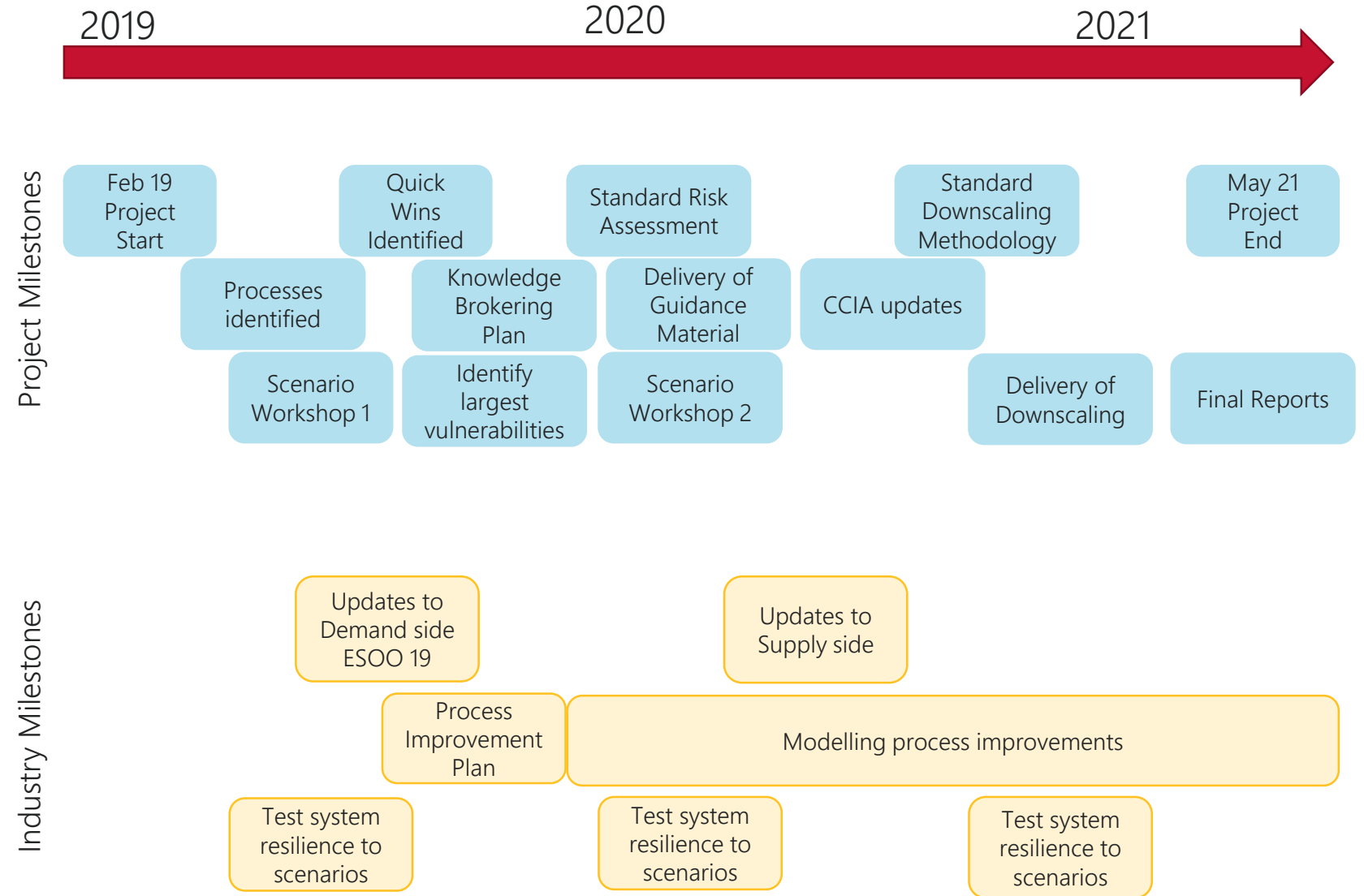


# Supply Side – 2019 Quick Wins

- Simulations are changing from Single Reference years to Rolling reference years for capacity expansion planning
- This reduces overfitting to specific weather events, leading to more robust expansion plans
- A composite 'dry' year has been included to capture the impact of reduced streamflow on hydro outputs



# ESCI Project Timelines



# Industry Participation

In this project, AEMO is acting as a representative for the electricity sector. As such, we are coordinating participation in a variety of ways.

- A communication and knowledge brokering plan is being developed for execution over the life of the project.
  - Those with an interest in the project are welcome to register for updates and/or participation
- 17<sup>th</sup> May Climate Scenario Planning Workshop - We are seeking participants with experience in the application of weather to reliability planning.
- Future climate/weather process updates will be brought to the Forecasting Reference Group