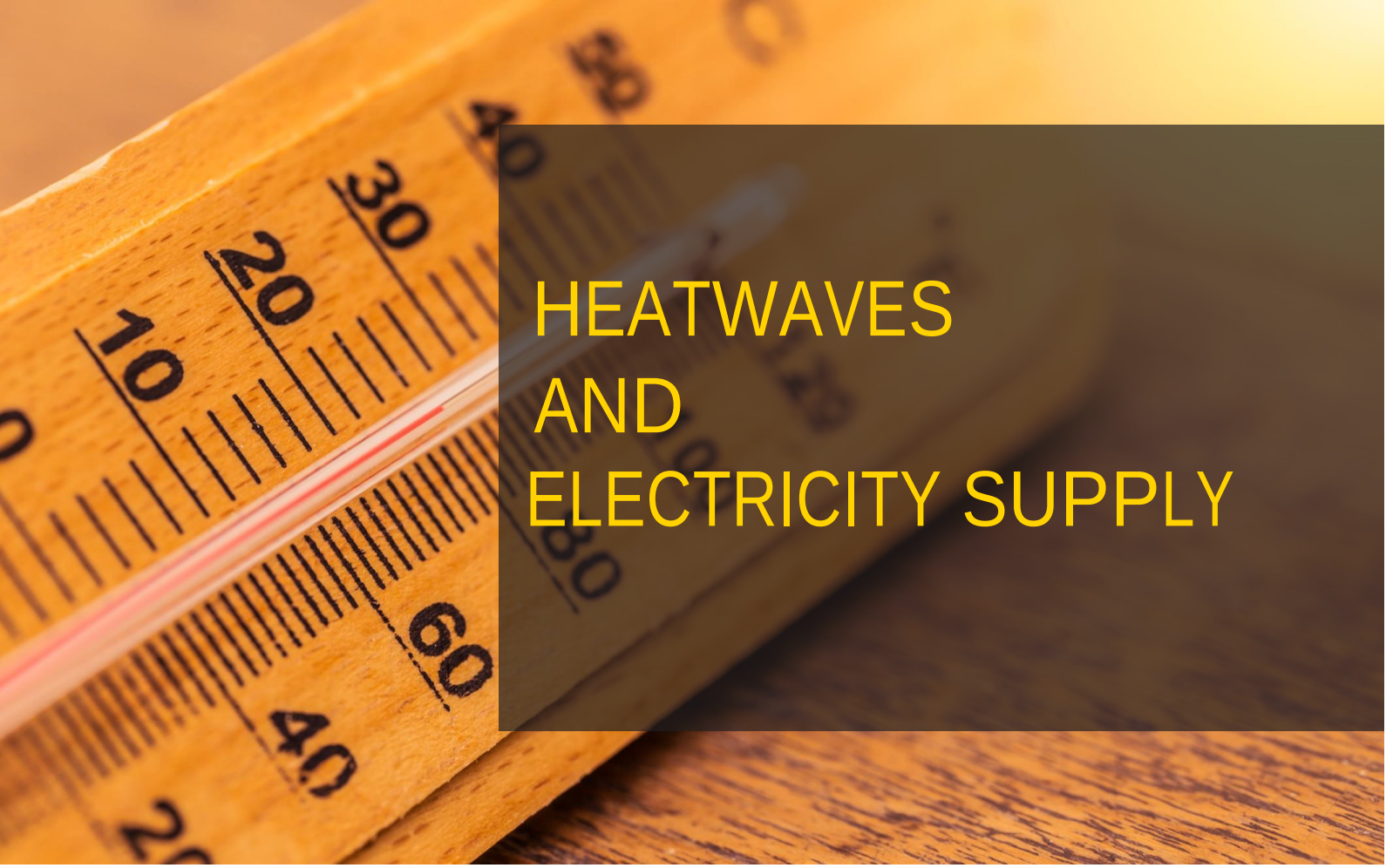

HEATWAVES AND ELECTRICITY SUPPLY

Summer is the time of heatwaves in many parts of Australia.

Hot weather places significant demand on the electricity system, increasingly so over the last decade with the increased use of air conditioners in homes and businesses.

Heatwaves are three or more consecutive days of unusually high temperatures. They place the grid in many parts of mainland Australia under great stress, sometimes resulting in blackouts. These can be caused by a number of factors: local faults, bushfires or generator faults.

PEAK DEMAND

Peak demand is the maximum amount of electricity demanded by a state, region, or even a street. In order to make sure electricity is available for peak events, the grid is built to meet this capacity – even though it won't always be needed. In all Australian states, except Tasmania, peak demand occurs in summer during heatwaves. Peak demand is measured in megawatts (MW). The scorecard for peak demand events and the season in which they occurred are shown below.

Table 1: Seasonal grid supplied peak demand by region

Peak	QLD	NSW	VIC	SA	TAS	WA
MW	9412	14744	10576	3399	1790	4304
Period	Summer 2016/17	Summer 2010/11	Summer 2008/9	Summer 2010/11	Winter 2008	Summer 2015/16

Source: AEMO; Western Power. WA data covers the South West Interconnected System, with population centres in the state's south west region. Summer demand refers to the period 1 Nov-31 Mar and winter demand refers to the period 1 May-31 Jul each year. Data is current at 30 June 2017.

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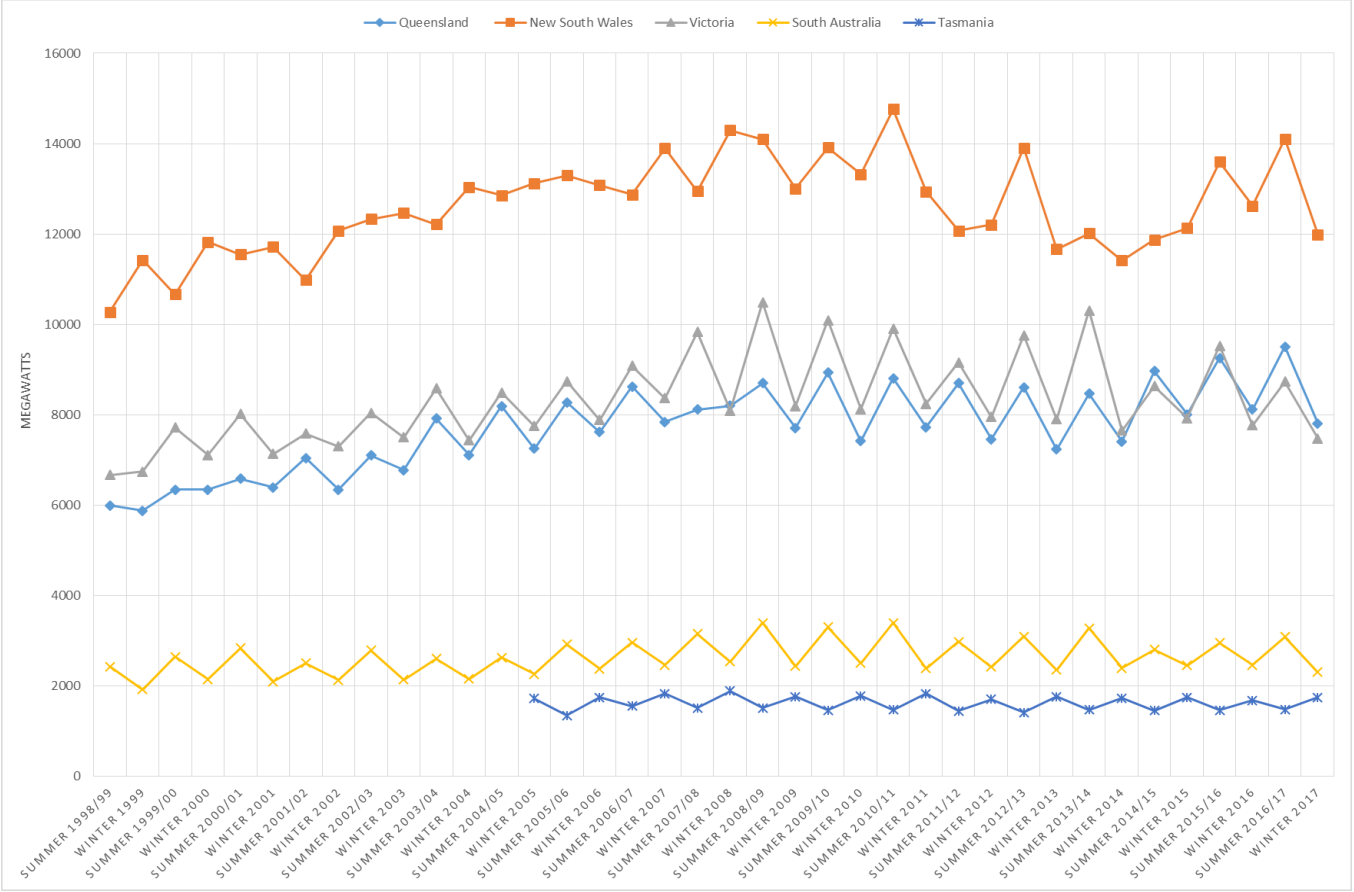
Peak demand events have changed because of the increased role household solar is playing and a reduction in demand from large industrial facilities, some of which have closed. The exception is Queensland, where large uptake of rooftop solar PV has been offset by growing demand, particularly in liquefying coal seam gas for export. The chart below shows the trend for peak demand in summer and winter over the past two decades.

Figure 1: Peak demand by state, summer 1998 - winter 2017



Source: Australian Energy Regulator

Heatwaves occur across Australia and have the biggest impact on the electricity grid in January and February, especially when multiple states have concurrent heatwaves. South Australia and Victoria, for example, often have heatwaves at the same time and the two power systems have strong interconnections.

Power systems across the eastern seaboard have interconnections and normally high demand in one state can be met by extra generation from another.

This summer The Australian Energy Market Operator (AEMO) has entered agreements with large electricity users and generators to secure a total of 1150MW of reserves across Victoria and South Australia that can be called on in emergencies, such as multi-day heatwaves occurring concurrently across both states. This is via the Reliability and Emergency Reserve Trader (RERT) process. For more information visit AEMO's energy live site.

Heatwaves and electricity demand

The occurrence of heatwaves is predictable and the following range of identifiable factors can vary the level of demand:

Duration of the heatwave: both temperatures and electricity demand tend to increase in the third and fourth days of consecutive hot days, as air conditioners increase output to manage the accumulating heat load in buildings.

School holidays and weekends: demand tends to be higher towards the end of January (or February) when schools and businesses have resumed, and weekdays have higher demand than weekends.

Solar PV: increased deployment of rooftop solar PV helps reduce system demand during most summer heatwave peaks (providing there is no cloud cover) but shifts the maximum peak event to later in the day as the sunlight dwindles.

WHAT HAPPENS IN A HEATWAVE?

We know when heatwaves are coming and plan accordingly. Ongoing maintenance takes place to keep the grid and generators in good working order before summer and electricity networks have specific operational plans developed in advance of the hottest days to keep customers safe and comfortable while maintaining the reliable performance of the network. They will also have emergency response crews ready to respond if equipment fails or if there is an emergency to minimise the time customers are without power.

While pressure is placed on the grid by high demand, high temperatures and associated heavy loads can also impair the operation of key infrastructure like generators and transmission lines. Bushfires or the risk of bushfires can force transmission lines to be switched off. These impairments impact on the operation of the system.

Networks also use smart technology and demand response to manage demand on the network on the hottest days. We are also seeing new services and technology working with the grid to allow customers to make the most of their solar and batteries and to engage and incentivise customers to help shift their electricity usage voluntarily.

In preparation for an extreme heatwave, some large industrial customers will undertake voluntary load shedding. That is, they agree to switch off part of, or all of, their operations. This helps reduce demand on those days. Some industrial customers have greater flexibility than others in being able to voluntarily reduce their electricity demand on these days.

During hot days, it's not unusual to see high spot prices in that particular state's wholesale electricity market. This is how the market is designed to work. Higher prices signal to generators to enter the market to help meet supply. Peak generators are built specifically for these types of events, and can sometimes run for only a few days a year. These higher wholesale prices do not translate into higher retail electricity prices during a heatwave, because retail prices are fixed across a year and retailers manage the price risk for their customers. As rooftop solar PV operates behind the residential meter, we can only estimate its total generation. Its impact shows as reduced demand, when in fact it is a different, distributed source of generation.

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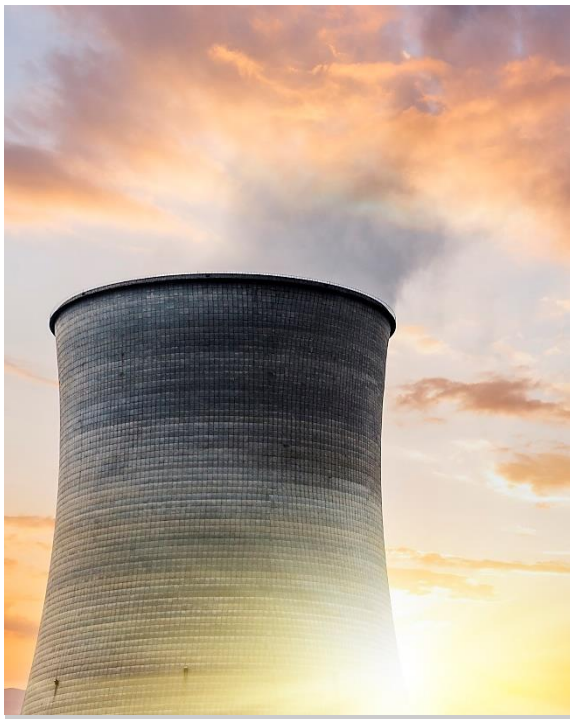

The impact of recent and announced power stations closing

In May 2016 the 544MW Northern Power Station closed in South Australia. It was the last remaining coal-fired generator in that state. In March 2017, the 1,600MW Hazelwood power station closed in Victoria.

AEMO has assessed the market in South Australia and Victoria and has advised there is sufficient generation to meet maximum demand for the 2017/18 summer.

The closure of power stations has increased the cost of wholesale electricity, as there is reduced supply to meet the same demand. This has flowed through to higher power prices in South Australia and Victoria.

LOSS OF SUPPLY

There are two basic types of power interruptions that can occur during a heatwave:

1. Localised outages: these can be for any number of factors, such as a tree limb on a line, a truck hitting a pole, equipment failure (not usually heat related). Some may be due to heat and high demand. These are generally communicated by local network operators to customers via websites, twitter and other social media. They can involve a handful or a few thousand households depending on the cause, and supply is restored once repairs take place.

2. Involuntary load shedding: in the rare event that there is not enough supply to meet demand, as a last resort measure AEMO will direct network businesses to switch off sections of the grid until increased supply can be restored or demand reduces, generally in the evening. These are known as rolling blackouts, as different parts of the grid take turns being without power. These are infrequent and efforts are taken to minimise their frequency and duration.

The shortage of electricity supply can be the result of a number of factors. It could be a fault or heat-related stress in a generator (or generators) which reduces supply at critical times. A transmission line may have its capacity reduced to avoid equipment damage resulting from high temperatures (the lines can sag under heavy load and high temperatures) or shut off because of the risk of bushfires. Any of these events, under certain conditions, can increase the risk of outages but most will affect only localised parts of the grid at any time.

Rooftop solar PV or batteries by themselves will not protect your house from experiencing an outage unless they are configured to do this. Few will be set up for this, so you can still be affected and should be prepared.

THE IMPACT OF INCREASED RENEWABLE ENERGY

Rooftop solar PV contributes to the supply of electricity on hot days. Wind generators may also contribute to supply during heatwaves, depending on the amount of wind blowing.

South Australia has the highest penetration of intermittent renewable generation in the world. Around 40 per cent of the state's generation comes from wind energy. This means generation only occurs if the wind is blowing. While there is technically sufficient capacity to meet demand in South Australia, even if there is no wind blowing during a heatwave, the supply-demand balance is tighter during these conditions.

Increased use of renewable energy requires careful planning to ensure that these risks are managed, so we can continue to decarbonise supply while maintaining reliability.

MEDIA CONTACTS

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What can households do?

Every household in Australia is in a different part of the electricity network – so only one network supplies electricity to your community. Find out which network business services your suburb. Follow them on social media and bookmark their website to receive timely information in the event of a local fault. This will help you know how long the power will be out so you can plan ahead.

Stay informed during heatwaves. AEMO is in charge of managing the electricity system and will advise of how the system is performing. You can follow AEMO on social media (Twitter; Facebook) and monitor news reports to receive updates on system demand.

Life support customers should register their details with their local energy networks and their electricity retailer who issues their bill. If you rely on a continuous power supply for life support equipment, you are urged to have a back-up plan in case there are any unplanned power outages.

In some situations, governments or regulators may ask households to minimise energy usage to help reduce peak demand and avoid the risk of rolling outages. Simple measures such as increasing the cooling temperature on your air conditioner by a couple of degrees can help everyone and save on your power bill.