Fact Sheet

The National Electricity Market

The National Electricity Market (NEM) operates on one of the world's longest interconnected power systems, stretching from Port Douglas in Queensland to Port Lincoln in South Australia and across the Bass Strait to Tasmania – a distance of around 5,000 kilometres.

The NEM spans Australia's eastern and south-eastern coasts and comprises five interconnected states that also act as price regions: Queensland, New South Wales (including the Australian Capital Territory), South Australia, Victoria, and Tasmania.

Western Australia and the Northern Territory are not connected to the NEM, primarily due to the distance between networks.

The NEM's transmission network carries power from electricity generators to large industrial energy users and local electricity distributors across the five states. These assets are owned and operated by state governments, or private businesses. There are over 300 registered participants in the NEM, including market generators, transmission network service providers, distribution network service providers, and market customers.

NEM fast facts

The NEM commenced operation as a wholesale spot market for electricity in December 1998.

The NEM incorporates around 40,000 km of transmission lines and cables.

The NEM supplies about 200 terawatt hours of electricity to businesses and households each year.

$16.6 billion was traded in the NEM in FY2016-17.

The NEM supplies approximately nine million customers.

The NEM has a total electricity generating capacity, including Rooftop solar PV, of almost 54,421 MW (as at December 2017).

Strategic reserves of demand and generation resources of more than 1000 MW for 2017-18.

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The electricity network

To understand the NEM, it's necessary to understand the journey that electricity takes as it travels from generators to customers, and the technology and infrastructure that makes this possible. When an electrical appliance is switched on, power is instantly transmitted from a power station to the appliance. Although this occurs instantaneously, a specific sequence of events takes place to ensure the required electricity is delivered, as illustrated below:

Buying and selling electricity

Transport of electricity

1 GENERATOR
Produces Electricity.

2 GENERATOR TRANSFORMER
Converts low voltage electricity to high voltage for efficient transport.

3 TRANSMISSION LINES
Carry electricity long distances.

4 DISTRIBUTION TRANSFORMER
Converts high voltage electricity to low voltage for distribution.

5 DISTRIBUTION LINES
Carry low voltage electricity to consumers.

6 HOMES, OFFICES AND FACTORIES
Use electricity for lighting and heating and to power appliances.

7 ROOFTOP SOLAR PV AND BATTERIES
Can provide energy back into the grid.

Energy resources

Electricity is produced by converting the energy found in resources, such as black or brown coal, natural gas, or oil. Renewable energy sources like solar and wind are also being used to produce electricity.

Annual generation by fuel type

(2016/17):

100% 196.5 TWh	
77% 150.9 TWh	COAL
9% 17.6 TWh	GAS
8% 15.5 TWh	WATER
5% 10.6 TWh	WIND
0.3% 0.6 TWh	SOLAR
0.7% 1.3 TWh	OTHER

Data does not include generation from rooftop solar PV systems.

The spot market

The NEM is a wholesale commodity exchange for electricity across the five interconnected states. Electricity cannot be stored easily, so the electricity market works as a "pool", or spot market, where power supply and demand is matched instantaneously in real time through a centrally coordinated dispatch process.

Generators offer to supply the market with specified amounts of electricity at specified prices for set time periods, and can re-submit the offered amounts at any time.

From all the bids offered, the Australian Energy Market Operator (AEMO) decides which generators will be deployed to produce electricity, with the cheapest generator put into operation first. NEM operation is designed to meet electricity demand (or consumption) in the most cost-efficient way.

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Electricity production is matched to electricity consumption, and spare generating capacity is always kept in reserve in case it's needed. The current energy price then can be calculated. Electricity production is also subject to transmission limitations so that the network is not overloaded.

In delivering electricity, a dispatch price is determined every five minutes, and six dispatch prices are averaged every half-hour to determine the "spot price" for each NEM region. AEMO uses the spot price as its basis for settling the financial transactions for all electricity traded in the NEM.

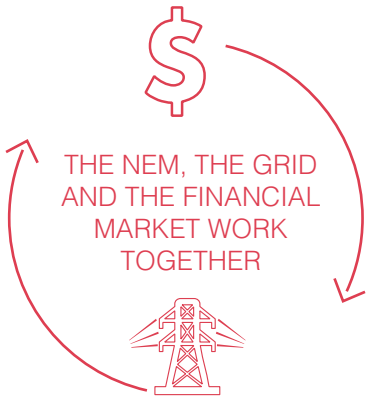
The National Electricity Rules (the Rules) set a maximum spot price, also known as the Market Price Cap. On July 2017, this cap was set at $14,200 per megawatt hour, and is adjusted annually for inflation. The Rules also set a minimum spot price, called the market floor price. The market floor price is -$1,000 per megawatt hour. The Australian Energy Market Commission's Reliability Panel reviews the market price cap and market floor price settings every four years to ensure they align with the NEM reliability standard.

To pay generators, AEMO must recover costs from customers. Most customers don't participate directly in the NEM, so they purchase their electricity through a retailer. Customers pay the retailers a commercial tariff, and retailers manage customers' energy purchases, including paying AEMO the spot price.

NEM participants need to manage the financial risks associated with the significant spot price volatility that occurs during trading periods. They achieve this by using financial contracts that lock in a firm price for electricity that will be produced or consumed at a given time in the future. These arrangements are generally in the form of derivatives, and include swaps or hedges, options and futures contracts.

How the NEM works

The NEM is a wholesale electricity market in which generators sell electricity and retailers buy it to on-sell to consumers. There are over 100 generators and retailers participating in the market, so it's highly competitive and therefore an efficient way of maintaining relatively competitive electricity prices in the wholesale market.



Fluctuating prices

All electricity sales are traded through the NEM. It is a wholesale market and prices fluctuate in response to supply and demand at any point in time.

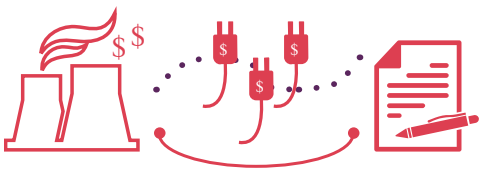
NEM market price

The price of electricity in the NEM is based on:

1. Offers by generators to supply electricity to the market at particular volumes and prices at set times.
2. Demand at any given time.

Financial market price

To manage price volatility, retailers and generators often enter into hedging contracts to fix the price for future electricity sales.



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AEMO's role in the NEM

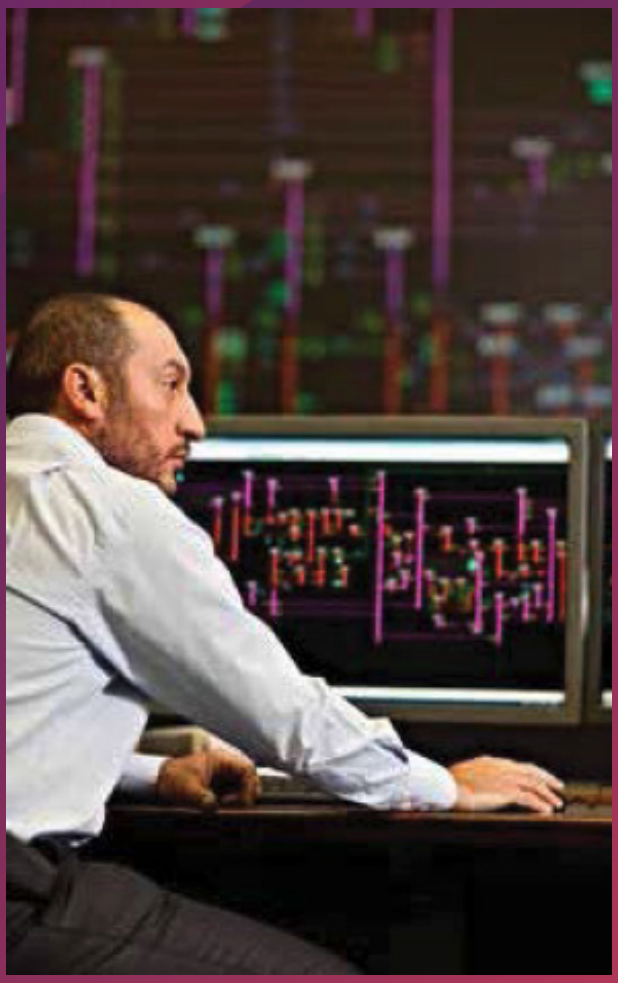
AEMO is responsible for monitoring electricity consumption and the flow of energy across the power system. If there are system limitations or increases in consumption, AEMO makes adjustments and, if supplies are inadequate to meet consumption, AEMO may issue notices to the market for additional generation or directly intervene as a last resort.

AEMO also monitors electricity voltage and frequency to make sure the system stays secure. It monitors the impact of planned power outages to make sure the system can accommodate any subsequent loss of generation or transmission capacity.

AEMO controls the NEM via two identical control centres in different states. Each can seamlessly assume responsibility for the entire NEM if needed.

Should consumption in a NEM region exceed supply, and all other means of meeting that consumption have been exhausted, AEMO can instruct network service providers to temporarily cut off the electricity supply to some customers, usually a large industrial customer. This action is only taken when there is an urgent need to protect the power system by reducing consumption and returning supply and demand in the system to balance.

AEMO also operates the retail electricity markets across the NEM. These markets underpin the wholesale market by facilitating retail competition and enabling all customers to purchase energy from the supplier of their choice.



How electricity is measured

Watt (W)	1 WATT	Often seen on packaging for small household products such as light bulbs		A 40 W light bulb uses 40 watts of electricity.
Kilowatt (KW)	1000 WATTS (1 WATT X 1000)	The output of rooftop solar panels is often described in kilowatts.		A typical residential solar panel system can produce 3.5 KW of electricity.
Megawatt (MW)	1 MILLION WATTS (1 KILOWATT X 1000)	The output of a power station is described in megawatts.		The Tesla battery at Hornsdale, South Australia, can produce 100 MW of electricity.
Gigawatt (GW)	1000 MILLION WATTS (1 MEGAWATT X 1000)	Gigawatts are used to describe large amounts of electricity.		Maximum demand for NSW in 2016/17 was 14.7 GW.

A kilowatt-hour is the amount of electricity produced or consumed in an hour.
A typical Australian home's daily usage is around 17 kWh.

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