NSW Electricity Strategy

Introduction

The NSW Electricity Strategy is the NSW Government's plan for a reliable, affordable and sustainable electricity future that supports a growing economy. There are numerous challenges to achieving this future. Some arise from the fact that the State's existing fleet of power stations are reaching the end of their technical lives, which is increasing reliability risks to the system. Others arise from congestion in the transmission system which is dampening investment in the new generation required to reduce electricity prices, improve reliability and protect the environment.

The NSW Government's strategy to respond to these challenges and to achieve its objectives is to: *first*, improve the efficiency and competitiveness of the NSW electricity market by reducing risk, cost, process-driven delays and by ensuring investment in new energy saving, demand response and generation technologies.

Second, if the market does not deliver the firm and flexible generation needed to ensure a prudent level of capacity in the electricity system, the NSW Government will take action to address any resulting capacity gaps in a way which also financially protects taxpayers and consumers and does not encourage market participants to delay investment decisions to take advantage of government action. For this purpose, the NSW Government will set an Energy Security Target of capacity sufficient to satisfy a one in ten year peak demand with a buffer equal to the capacity of the State's two largest generating units.

Third, the NSW Government will ensure it has the powers it needs to deal with electricity emergencies, if they arise.

This Strategy will support an estimated $8 billion of private investment in NSW's electricity system over the next decade. For households, the Strategy will lead to estimated bill savings of $40 per year. This Strategy is estimated to result in 1,200 new jobs, most of which are expected to be in regional NSW. Implementing the Strategy will lead to a $3.4 billion net economic benefit and support cleaner air for NSW.

This Strategy is designed to complement the work of the national energy market bodies. NSW is part of a national electricity system and the NSW Government's preference is for national solutions to issues facing the electricity system. This Strategy sets out actions to address the specific needs of NSW while long term national reforms are developed and implemented. Its purpose is to provide certainty to investors and foster community confidence about how the NSW Government will improve the affordability and reliability of the electricity system while also protecting the environment.

The Strategy is set out in six parts: Part 1 explains how the electricity system operates; Part 2 sets out the key trends in the electricity system; Part 3 sets out existing NSW Government and national initiatives and reforms; Part 4 sets out the NSW Government's objectives for the electricity system; Part 5 sets out the NSW Government's plan to achieve them; and Part 6 sets out how the Strategy applies to NSW today.

Part 1: How the electricity system operates

1.1 The structure of the electricity system

NSW is part of the National Electricity Market (**NEM**); a market which was established in accordance with the Australian Energy Market Agreement (**the Agreement**), an intergovernmental agreement between the Commonwealth and the relevant states and territories.

The National Electricity Law (**NEL**), which was legislated by the South Australian Parliament, and the National Electricity Rules (**Rules**) made under it are the main laws that regulate the NEM. They have force in NSW through the *National Electricity (New South Wales) Act 1997.*

The NEL confers power on three national energy market bodies to govern, operate and regulate the NEM: the Australian Energy Market Operator (**AEMO**), which administers and operates the gas and electricity markets and power systems; the Australian Energy Market Commission (**AEMC**), which makes the Rules and advises on the design of the NEM; and the Australian Energy Regulator (**AER**), which enforces the Rules and grants legal authorities on relevant persons participating in the NEM.

In addition to the national market bodies, there is the Energy Security Board (**ESB**). The role of the ESB is to coordinate the implementation of the reform blueprint produced by Australia's Chief Scientist, Dr Alan Finkel AO. The ESB also provides whole of system oversight for energy security and reliability to drive better outcomes for consumers. The ESB is comprised of an Independent Chair, Independent Deputy Chair and the heads of AEMO, the AEMC and the AER.

Despite there being a national market, NSW has a number of schemes and powers that interact with the electricity system. For example, the *Electricity Supply Act 1995* (NSW) confers on the NSW Government a range of powers to deal with an electricity supply emergency. It confers on the Energy Minister information collection powers,[1] which may be used:

(a) "to determine whether the supply of electricity to all or any part of the State has been, or is likely to be, disrupted to a significant degree,
(b) to plan and prepare for the exercise of powers under this Part in the event that the supply of electricity is disrupted to a significant degree."

It also confers on the Minister the power to make directions.[2] This power is only enlivened once the Premier declares an electricity supply emergency and the Premier may only make such a declaration if she is satisfied "that the supply of electricity to all or any part of the State is disrupted to a significant degree" or "that there is a real risk that the supply of electricity to all or any part of the State may be disrupted to a significant degree".[3]

The Minister has the power to issue directions:[4]

(a) "to restrict the use of electricity in order to reduce demand,
(b) to require large users of electricity to wholly or partly turn off or shut down any plant or equipment for a specified period of time,
(c) to impose requirements relating to the carrying out of activities that may affect the production or supply of electricity,

[1] *Electricity Supply Act 1995*, s 94D(1).
[2] *Electricity Supply Act 1995*, s 94B.
[3] *Electricity Supply Act 1995*, s 94A.
[4] *Electricity Supply Act 1995*, s 94B(2).

(d) to impose other requirements that relate directly to the production, use or supply of electricity."

The power is broad: the Minister may give directions to specific persons, the general public or sections of the community.[5] However, the Minister may only make such directions that the Minister "considers are reasonably necessary to respond to the electricity supply emergency."[6]

Another example of a NSW scheme relevant to this Strategy is the Energy Savings Scheme (**ESS**), NSW's largest energy efficiency program. The ESS is a market-based instrument requiring **Scheme Participants** (NSW electricity retailers, certain generators and certain large electricity consumers) to meet energy savings targets by buying certified Energy Savings Certificates (**ESCs**).

Scheme Participants are served by a competitive market to deliver energy savings at least cost. Through the ESS, households and businesses choosing to implement energy savings projects (such as installing energy efficient appliances and equipment) can receive a discount or other financial incentive. The ESS is legislated to operate until 2025 and the current target for each year between 2019 to 2025 is 8.5 per cent of electricity demand.

The ESS reduces electricity demand to deliver affordability, reliability and emissions benefits for everyone in NSW. Since its launch in 2009, the ESS has supported projects that will deliver more than 27,000 gigawatt hours of energy savings. This has reduced the cost of living by saving about $11 a year on energy bills for a typical NSW household. The ESS is also delivering $5.6 billion in direct bill savings for households and businesses implementing energy savings projects.

By reducing demand at peak times, the ESS makes energy in NSW more reliable. In 2018, the ESS reduced peak demand by about 450 megawatts (**MW**) and deferred the need for nearly $510 million of investment in power stations to supply that demand. It is also deferring an estimated $213 million of investment in the distribution network which is driven by peak demand. Energy savings from projects delivered under the ESS to date will avoid approximately 23 million tonnes of greenhouse gas emissions.

1.2 How electricity is generated and transmitted to electricity consumers

The electricity industry has four main levels:

1. **generation** – the production (and storage) of electricity;
2. **transmission** – the high voltage lines and infrastructure used to transmit electricity from generators to substations;
3. **distribution** – the lower voltage electricity lines and other infrastructure which transmits electricity from substations to electricity consumers; and
4. **retail** – how businesses sell electricity to households and businesses, including metering and billing.

1.2.1 Generation

AEMO operates the electricity dispatching system. That system determines which generators dispatch electricity into the system and when. It operates in the following way: each day is segmented into trading intervals of five minutes. Generators submit generation dispatch offers to

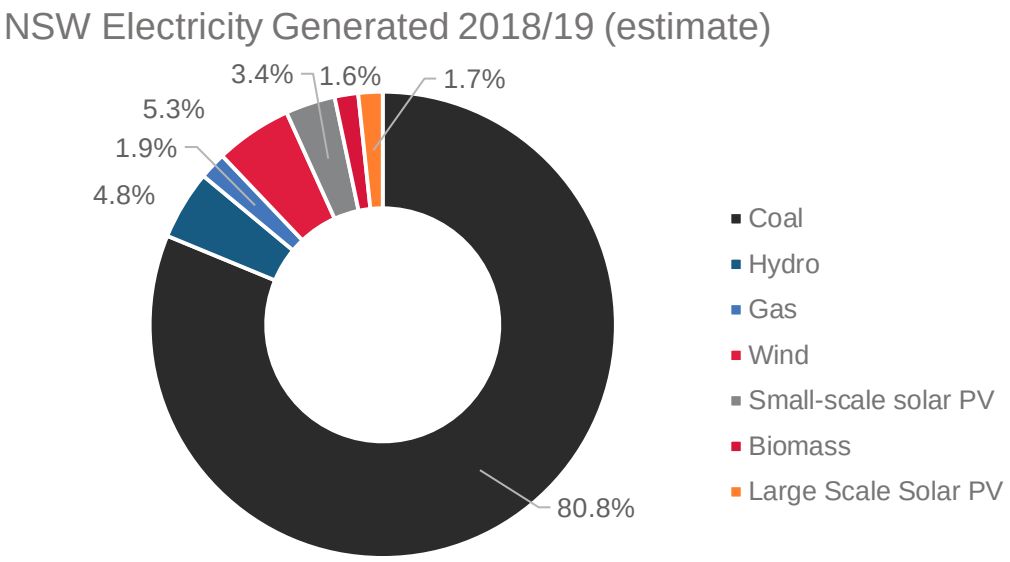
[5] *Electricity Supply Act 1995*, s 94B(3).
[6] *Electricity Supply Act 1995*, s 94B(1).

AEMO, which specify prices at which the generator is willing to dispatch certain amounts of electricity during trading intervals.[7] Ordinarily, for each dispatch interval, each MW offered is ranked from cheapest to most expensive. The spot price is set by the price of the last MW required to satisfy electricity demand.[8]

Generators earn revenue from this process based on how much electricity they sell, the spot market price and transmission loss factors.[9] Loss factors account for the electrical energy that is lost when electricity is transmitted from generators to consumers.[10]

There are a range of generation technologies that have different economic, operating and technical characteristics. Traditionally, the electricity system in NSW has been powered by coal. Coal continues to be the primary fuel source for electricity today, generating almost 80 per cent of the State's electricity.

Figure 1: NSW electricity generated in 2018/19



Source: Estimates by Department of Planning, Industry and Environment 2019

Solar and wind generate electricity at low cost and without emissions. However, the ability of these technologies to dispatch electricity is dependent on the weather and time of day. The share of wind and solar in the NSW electricity generation mix has tripled in the past five years, with just over 7 per cent of the State's electricity coming from wind and solar (including rooftop solar). This share of generation is expected to grow as 14 large-scale renewable energy projects totalling about 2,100 MW currently under construction enter the market and more households install solar panels.

When households or businesses use more electricity at certain times of the day, more electricity supply needs to be available at the same time to match that demand. Times of peak demand represent periods during the day when the State uses the most electricity. In NSW, peak demand

[7] National Electricity Rules, r 3.8.6.
[8] National Electricity Rules, r 3.9.2.
[9] National Electricity Rules, r 3.15.6.
[10] National Electricity Rules, r 3.6.1-3.6.2.

usually happens between mid-afternoon and early evening as people return home from work. These tend to be the times when the system's reliability is most at risk. Extreme conditions, such as a heatwave, can place extra pressure on the system at any time of the day as more households and businesses use energy-intensive equipment like air conditioners.

During periods of peak demand, renewable electricity generation is variable but can crucially help add supply. According to AEMO's 2019 Electricity Statement of Opportunities (**ESOO**), during periods of customer supply shortages, wind is operating (on average) at approximately 16 per cent of its installed capacity, and large-scale solar at 30 per cent. During the heatwave on 10 February 2017, renewable energy generation in NSW delivered 300 MW of electricity between 5pm and 6pm.

Variable renewable energy needs to be complemented by firm and flexible power. Hydroelectricity meets these requirements by generating and storing electricity at scale. Standard hydro power generates electricity by releasing water from an elevated reservoir but does not involve pumping that water up again. Standard hydro is reliant on sufficient water supplies in the upper reservoir, as there is no capability to reuse this water. Pumped hydro involves pumping water into an elevated reservoir and releasing it to generate electricity. NSW has two pumped hydro projects – Shoalhaven (240 MW) and Tumut 3 (1,800 MW) – and numerous smaller, standard hydro projects.

Gas-fired power stations generate electricity on demand with about half the level of emissions from coal but, given the current high input costs of gas, are typically only operated during periods of peak demand or when solar and wind are not generating. Gas generation can ramp up quickly, allowing it to dispatch quickly and currently is used to generate about 5 per cent of NSW's annual electricity.

Batteries, as a form of electrical storage, also provide multiple grid services such as frequency regulation. The cost of batteries has fallen in recent years and is expected to continue to trend downwards making batteries a more feasible, commercial firming option for wind and solar farms.

It is also appropriate to note that the generation of electricity can release substances that are harmful to human health, including but not limited to particulate matter (**PM**), nitrogen oxides (**NOx**) and sulfur oxides (**SOx**). Each year, according to the Health Risk Assessment report 2013[11] overall air pollution leads to 520 premature deaths and 1,180 hospital admissions in Sydney, and an estimated $6.4 billion in health costs in the NSW Greater Metropolitan Region.

The electricity sector contributes 88 per cent of SOx emissions and 53 per cent of NOx emissions, as well as 5 per cent of direct particulate matter (**PM 2.5**) emissions in the Greater Metropolitan Region. SOx from power stations mix in the atmosphere to form secondary particles and produce close to 20 per cent of fine particle pollution at Richmond in Sydney's north-west each year.

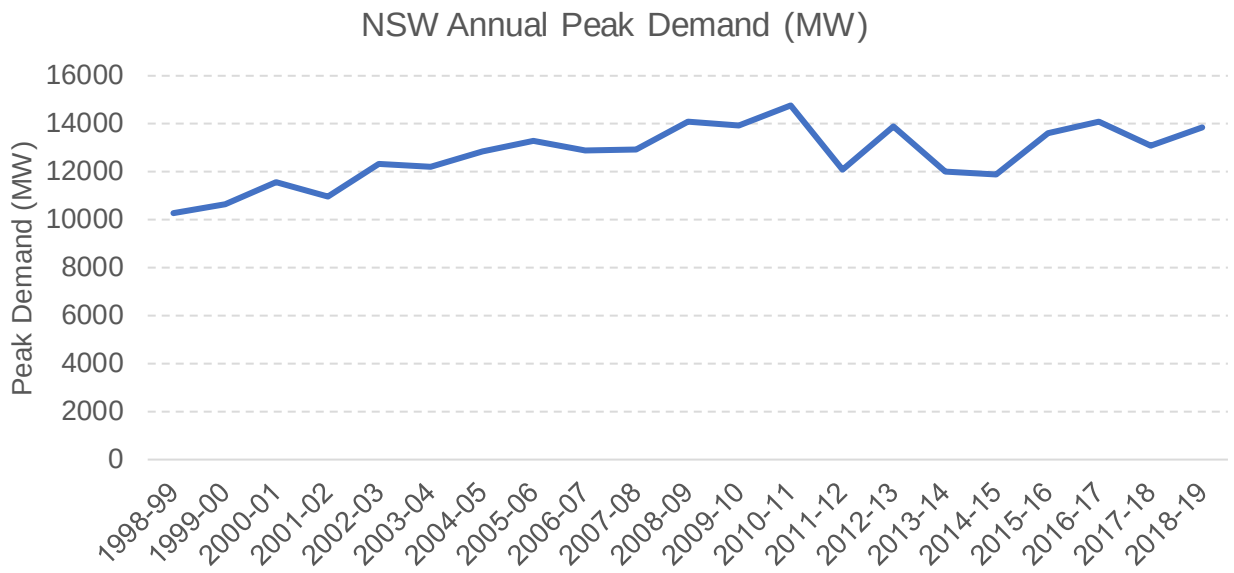
Coal-fired power stations in NSW have controls to filter direct particle pollution under existing regulation but no comparable controls for NOx or SOx. Historically, SOx from power stations has been regulated by limiting sulphur content of the coal burnt, rather than by regulating emission standards. Coal-fired power stations located in all three major generating regions – the Upper

[11] Morgan, G, Broome, R and Jalaludin, B (2013), *Summary for policy makers of the health risk assessment on air pollution in Australia.* Prepared for the National Environment Protection Council, Canberra, https://www.environment.gov.au/system/files/pages/dfe7ed5d-1eaf-4ff2-bfe7-dbb7ebaf21a9/files/summary-policy-makers-hra-air-pollution-australia.pdf

Hunter, Central Coast and Lithgow – are likely contributors to fine particle levels in the Greater Metropolitan Region.[12]

In combination, these different forms of electricity generation need to provide sufficient dispatchable capacity to meet NSW peak demand. The forecast summer maximum peak using 1-in-10 year demand for NSW in 2019-20 is 14,373 MW[13], representing the maximum amount of electricity required for dispatch during extreme conditions experienced every 1-in-10 years.

Figure 2: NSW historical annual peak demand



Source: AER regional peak demand statistics

The NSW Government has adopted a technology neutral approach as to how electricity is generated to meet peak demand. However, both NSW and Commonwealth laws prohibit the development of nuclear power stations.[14]

1.2.2 Transmission

In NSW, the transmission system is owned and operated by TransGrid. TransGrid is licensed under the *Electricity Supply Act 1995* as the transmission operator.[15] Under its licence, TransGrid

[12] Scorgie Y, Mazaheri M, Chang L, Ryan L, Fuchs D, Duc H, Monk K and Trieu T (2019), *Air Quality and Public Health Co-benefits of Implementing Energy Efficiency and Clean Energy Measures in New South Wales Final Report*, report prepared by the NSW Office of Environment and Heritage.
[13] AEMO, Electricity Statement of Opportunities (2019), https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/NEM_ESOO/2019/2019-Electricity-Statement-of-Opportunities.pdf
[14] *Uranium Mining and Nuclear Facilities (Prohibitions) Act 1986* (NSW), s 8(2); *Environment Protection and Biodiversity Conservation Act 1999* (Cth), s 21 with s 140A.
[15] *Electricity Supply Act 1995 NSW*, s 93A and 'Transmission Operator's Licence' under the *Electricity Supply Act 1995 (NSW)* granted to NSW Electricity Networks Operations Pty Limited (ACN 609 169 959) as trustee for the NSW Electricity Networks Operations Trust' (2015) available at: https://www.ipart.nsw.gov.au/files/sharedassets/website/shared-files/licensing-administrative-licence-transmission-operator-transgrid/transgrid-operating-license-consolidated-licence-conditions-from-november-2017.pdf

must ensure that its transmission system complies with reliability and performance standards issued by the NSW Minister for Energy from time to time.[16] The current standard sets out the maximum allowable amount of expected Unserved Energy (**USE**) arising from various elements of the transmission system each year.[17]

In lieu of a competitive transmission market, TransGrid earns a regulated return on its investment in transmission infrastructure and services. There are two key regulatory tests that apply to TransGrid: first, a 5-yearly revenue determination to determine its regulated return on existing transmission infrastructure and proposed transmission infrastructure required to meet identified transmission needs.[18]

Secondly, the Regulatory Investment Test for Transmission (**RIT-T**), which is a cost-benefit analysis undertaken to approve new, major transmission infrastructure projects.[19] The RIT-T involves a series of reporting, consultation and dispute processes[20] that typically takes at least one year to progress, in addition to the time required to undergo other planning and environmental assessments.[21] TransGrid's revenue determination may include contingent projects that, if certain trigger events are satisfied (including typically a successful RIT-T), can be added to its revenue determination.[22]

In April 2019, the Rules were amended to streamline the RIT-T process for three of AEMO's 2018 Integrated System Plan (**ISP**) projects – the Queensland-NSW interconnector (**QNI**), the Victoria-NSW Interconnector (**VNI**) and the South Australia-NSW interconnector (**EnergyConnect**) – to allow some of the RIT-T steps to run concurrently for these three projects.[23]

1.2.3 Distribution

As part of its revenue determination, the AER approves the amount that TransGrid can recover from distributors for the provision of transmission services.[24] Distributors are subject to similar regulated revenue tests to recover the cost of the distribution services they provide.[25] The AER approves the tariffs distributors can charge retail customers, including transmission and distribution costs.[26]

1.2.4 Retail and household bills

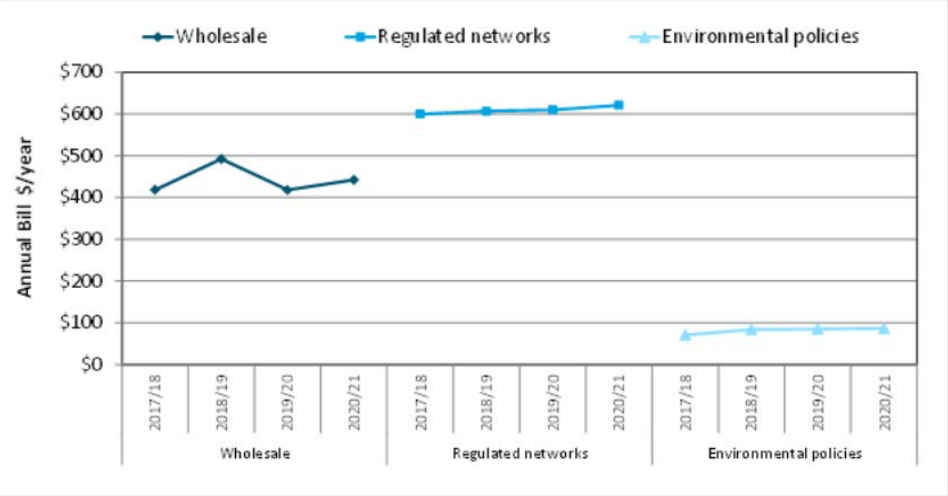
Households and small businesses buy electricity from a retailer, not the wholesale market. Retailers offer households and small businesses a retail contract for supplying electricity. A typical retail bill in 2018-19 comprised of:

1. **wholesale costs** (38 per cent), being the cost of electricity generation
2. **network costs** (47 per cent), being the cost of transmission, distribution and metering

[16] *Ibid*, Transmission Operator's Licence, Condition 3.
[17] NSW Transmission Reliability and Performance Standard 2017, Schedule 1, cl 4.
[18] National Electricity Rules, r 6A.3.1.
[19] National Electricity Rules, r 5.16.1, see also r 5.15.2 and definition of *identified need.*
[20] National Electricity Rules, r 5.16.4.
[21] COAG Energy Council (2017), *Review of the Regulatory Investment Test for Transmission*, available at: http://www.coagenergycouncil.gov.au/sites/prod.energycouncil/files/publications/documents/RIT-T%20Review%20report%20%28final%206%20February%202017%29.pdf.
[22] National Electricity Rules, r 6A.8.1(b)(4).
[23] National Electricity Rules, Part ZZZP.
[24] National Electricity Rules, r 6A.24.1(4).
[25] National Electricity Rules, Chapter 6.
[26] National Electricity Rules, r 6.18.1A, r 6.18.2.

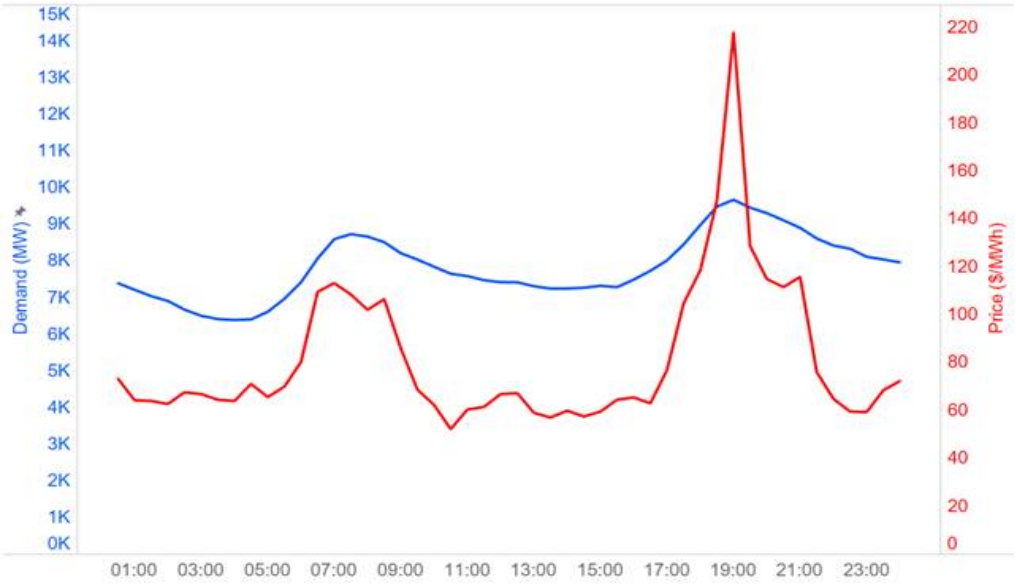
3. **environmental costs** (7 per cent), being direct costs of government schemes like the renewable energy target
4. **retailer and residual costs** (9 per cent), being the cost of the retailer services and other residual costs.[27]

Figure 3: Price trends in NSW supply chain components



Retailers can purchase electricity on behalf of their customers through the spot market, which is subject to significant volatility. Figure 4 below gives an example of price fluctuations in the spot market over the course of a day.

Figure 4: NSW demand and price on 18th September 2018



Source: AEMC website: https://www.aemc.gov.au/energy-system/electricity/electricity-market/spot-and-contract-markets.

To manage their financial risks and have more certainty over wholesale energy costs, however, retailers (and large energy users) typically enter into wholesale hedging contracts with generators.

[27] AEMC, 2018 Residential Electricity Price Trends, Final report, 21 December 2018.

These contracts fix the wholesale price retailers pay for electricity over the course of a year, or several years. This reduces retailers' exposure to the highs and lows of the spot market - which can go as low as minus $1,000 per megawatt hour (**MWh**), and as high as $14,500/MWh - and smooths their costs.[28]

There are two key types of wholesale hedging contracts. *First,* a swap contract where a fixed volume of electricity is traded during a defined period for a fixed price, regardless of the spot price. The contract is settled through payments between the buyer and the seller based on the difference between the spot price and the fixed price.

Second, a cap contract where a fixed volume of electricity is traded for a fixed price when the spot price exceeds a specific price (typically $300/MWh). A cap contract provides buyers with insurance against high prices, as the seller must pay the buyer the difference between the spot price and the cap price every time the spot price exceeds the cap price.

1.3 Existing regulations to promote reliability

As with most competitive markets, the NEM relies on price signals and supply/demand imbalance to trigger investment or divestment in generation. The Rules prescribe a "reliability standard" for electricity generation and inter-regional transmission to inform the market of actual or forecast shortfalls in electricity. The reliability standard is described as the maximum expected USE in a region of the total energy demanded in that region each year. It is currently set at 0.002 per cent.[29] In other words, to meet the reliability standard, at least 99.998 per cent of forecast customer demand for a region must be met each year.

Despite the competitive nature of the NEM, the Rules confer additional powers on AEMO and obligations on participants to promote reliability of electricity supply.

1.3.1 The RRO

On 1 July 2019, the Retailer Reliability Obligation (**RRO**) commenced under the NEL. The RRO requires liable entities – mostly retailers and large energy users – to hold sufficient net contracts to meet their share of a 1-in-2 year peak demand forecast for each trading interval.[30] A 1-in-2 year peak demand forecast is peak demand for a region where the likelihood is that the forecast amount will be exceeded once in any two year period.[31]

The RRO operates as follows: each year, AEMO must publish a reliability forecast that sets out whether or not a breach of the reliability standard is forecast to occur in any NEM region (creating a "reliability gap").[32]

If, following AEMO's forecast, the AER is satisfied that there will be a reliability gap in 3 years time, it may make a T-3 reliability instrument. The T-3 reliability instrument sets out the region and trading interval(s) causing the reliability gap. [33] This instrument acts as a market signal for new investment to fill the forecast reliability gap.

[28] AEMC, Spot and contract markets (2019), https://www.aemc.gov.au/energy-system/electricity/electricity-market/spot-and-contract-markets accessed 8 November 2019
[29] National Electricity Rules, r 3.9.3C(a).
[30] *National Electricity (South Australia) Act 1999* (SA) s 14R(2).
[31] *National Electricity (South Australia) Act 1999* s 14C
[32] *National Electricity Rules,* r 4A.B.1, *National Electricity (South Australia) Act 1999 (SA)* s 14F-14G(1).
[33] *National Electricity (South Australia) Act 1999 (SA)* s 14K.

If the forecast reliability gap identified in the T-3 reliability instrument still exists one year out from the forecast reliability gap for that same region and trading interval(s), the AER may issue a T-1 reliability instrument.[34] Following the issue of a T-1 reliability instrument, liable entities must report their net contract positions for the identified reliability gaps to the AER.[35]

Once a T-1 reliability instrument has been issued, AEMO is deemed to be the procurer of last resort and is entitled to enter into contracts to secure electricity reserves under the Reliability and Emergency Reserve Trader (**RERT**) scheme in relation to the reliability gap.[36] Under the procurer of last resort mechanism (due to commence under the Rules on 26 March 2020), the recovery of AEMO's RERT costs is distributed to liable entities in proportion to their share of the total amount of uncontracted MWs that were required to meet their share of the 1-in-2 year peak demand forecast.[37]

1.3.2 The RERT

Under the **RERT** scheme, AEMO may enter into contracts with generators or consumers to ensure the reliability standard is met in each region, and to maintain power system security.[38] These contracts reserve this capacity from bidding into the electricity market for the relevant trading interval except in accordance with the contract.[39] AEMO may dispatch the reserve capacity to ensure the reliability of supply in a region meets the reliability standard "if AEMO considers the latest time for exercising the RERT…has arrived".[40]

AEMO's costs incurred in contracting for reserves are recoverable by fees imposed on market customers – predominantly retailers and large energy users.[41] Where, in AEMO's reasonable opinion, a region would fail to meet the reliability standard or power system security standard without AEMO's intervention, AEMO must recover its net liabilities or profits under the reserve contracts from market customers.[42] Each market customer's liability is calculated according to a formula which distributes the RERT costs in proportion to that market customer's load in the relevant trading interval.[43]

1.3.3 AEMO's power to make directions

Under the Rules, AEMO is responsible for maintaining power system security, monitoring the operating status of the power system and arranging the dispatch of generators, among other things.[44]

AEMO may, if it considers that it is necessary to maintain power system security or for reasons of public safety, direct a registered participant to take one or more relevant actions. Relevant actions include:

- calling equipment into service;

[34] *National Electricity (South Australia) Act 1999 (SA)* s 14K.
[35] *National Electricity (South Australia) Act 1999 (SA)* s 14P.
[36] *National Electricity (South Australia) Act 1999 (SA)* s 14T(2).
[37] National Electricity Amendment (Retailer Reliability Obligation) Rule 2019, r 3.15.9A(g)-(h), r 4A.F.3, r 4A.F.8.
[38] National Electricity Rules, r 3.20.3(a)-(b).
[39] National Electricity Rules, r 3.20.3(j).
[40] National Electricity Rules, r 3.20.7(a).
[41] National Electricity Rules, r 3.15.9(a).
[42] National Electricity Rules, r 3.15.9(d).
[43] National Electricity Rules, r 3.15.9(e).
[44] National Electricity Rules, r 4.3.1.

- taking equipment out of service;
- increasing or reducing power output;
- shutting down or varying operations; and
- load shedding or any other act necessary to maintain power system security or for reasons of public safety.[45]

Registered participants subject to AEMO's direction power include generators, large customers and transmission and distribution providers.[46] AEMO's powers, unlike the Minister's powers under the *Electricity Supply Act 1995*, do not allow it to make directions to non-market participants.

Part 2: Change in the electricity system

There are five major changes underway in the electricity market:

- **Increasing electricity prices.** Average electricity bills have increased over the past five years putting pressure on household and business budgets.
- **Power stations are reaching the end of their technical lives.** The State's aging coal-fired power stations are giving rise to replacement and risk management imperatives. Replacement, to ensure that there is adequate capacity in the system to address peak demand events and to ensure price competition in electricity markets. Risk management, because, as power stations age, they have a greater risk of part failure and therefore decreasing the reliability of the electricity system.
- **Improving economics of renewables.** Renewables are now the most economic form of new generation, with a mix of wind and solar firmed with gas, batteries and pumped hydro expected to be the most economic form of reliable electricity.[47] This means that the replacement of existing equipment should result in lower carbon emissions from the electricity sector and cleaner air in NSW. It also means that electricity costs can be reduced by developing more firmed renewable generation.
- **Congestion in the electricity system.** The requirements of the transmission network are changing. Historically, the electricity system has relied on large generators for its electricity. However, renewables are often best located at the remote edges of the grid and new transmission needs to be built to connect these generators into the system.

  Congestion in the electricity system has been increasing, driven by these new generators connecting to the grid. This is undermining (and in some cases preventing) the development of further new generation because congestion in the electricity system reduces scope for new generation to connect to the electricity grid. It also increases transmission loss factors resulting in reductions in the remuneration generators earn from electricity.
- **Changing patterns in the use of electricity.** The energy sector has been moving from a centralised power system to a decentralised power system as more small-scale resources connect. This corresponds to a move away from a fleet of a few large generators to numerous small ones. Traditional consumers are now becoming suppliers as businesses and households change how they manage energy. With the electricity network evolving from a one-way grid to a two-way grid these changes have created local network challenges that need to be managed.

[45] *National Electricity (South Australia) Act 1999 (SA)* s 116.
[46] National Electricity Rules, definition of *Registered Participant*.
[47] Graham, P.W., Hayward, J, Foster, J., Story, O. and Havas, L. 2018, GenCost 2018. CSIRO, Australia.

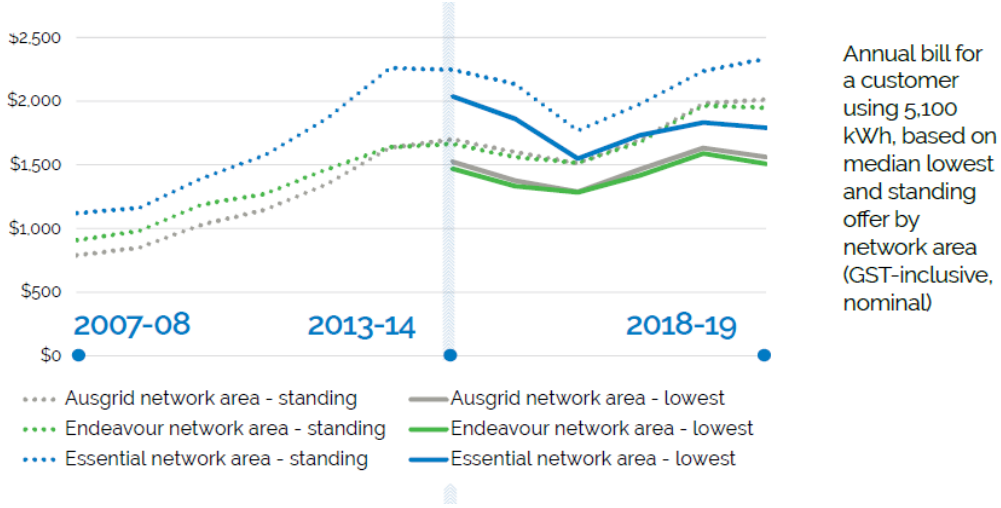
These trends are developed below.

2.1 Household bill increases

According to the Independent Pricing and Regulatory Tribunal's (**IPART**) draft market monitoring report, average household electricity bills have increased slightly in real terms since price deregulation in 2014.[48] However, the lowest market offers have increased by less than the cost of living, showing the value for customers in switching to the best deal.

Customers who have used the NSW Government comparison site, Energy Switch, have saved an average of $442 over a year.

Figure 5: Estimated average NSW household electricity bills

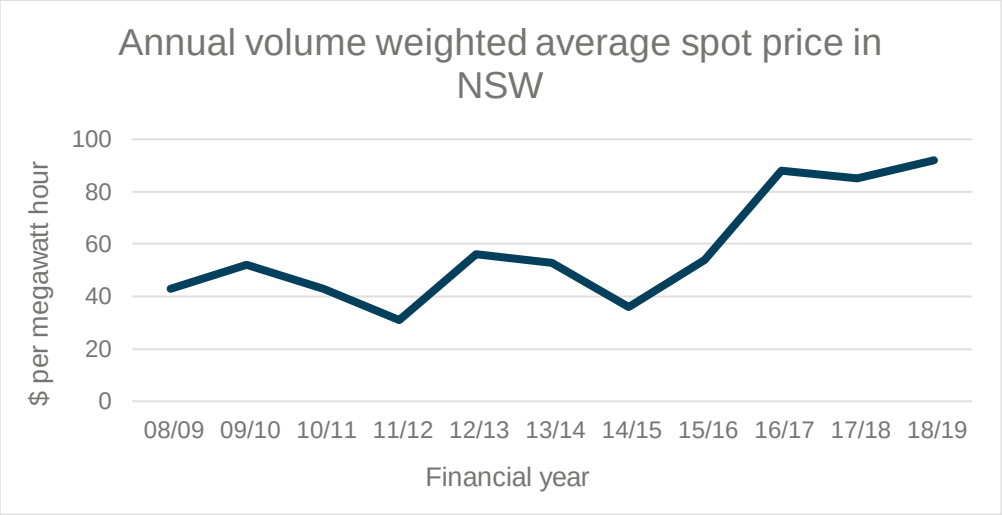


Source: IPART, "Review of the performance and competitiveness of the NSW electricity market 2018-19 (Draft)", October 2019

The wholesale cost of electricity in NSW has increased significantly in the past five years. However, residential customers have been protected from large bill increases as retailers have smoothed the impact. As shown in figure 6 below, the wholesale cost of electricity has more than doubled in the last five years in NSW.

48 IPART, "Review of the performance and competitiveness of the NSW electricity market 2018-19 (Draft)", October 2019.

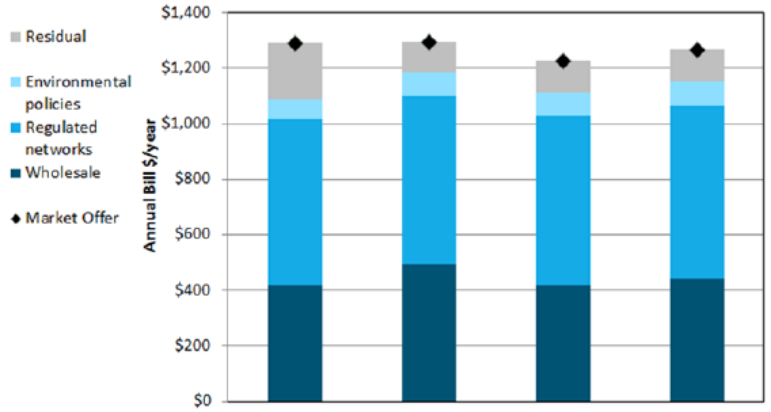
Figure 6: Annual volume weighted average spot price of electricity in NSW



Source: AER Wholesale market statistics

The wholesale cost of generating electricity accounted for 38 per cent of the typical bill in 2018/19. Regulated network costs accounted for 47 per cent and are expected to increase slightly over the next two years mainly due to rising transmission network costs.[49]

Figure 7: Expected trends in NSW supply chain components from 2017/18 to 2020/21



	2017/18 Base Year		2018/19 Current Year		2019/20		2020/21	
	c/kwh	$/year	c/kwh	$/year	c/kwh	$/year	c/kwh	$/year
Environmental policies	**1.67**	**$70**	**1.99**	**$84**	**2.02**	**$85**	**2.05**	**$87**
LRET - LGC cost	0.74	$31	0.83	$35	0.78	$33	0.82	$34
SRES - STC cost	0.34	$14	0.65	$27	0.73	$31	0.74	$31
Climate Change Fund	0.41	$17	0.34	$14	0.33	$14	0.32	$14
Energy Saving Scheme	0.17	$7	0.17	$7	0.18	$7	0.18	$7
Regulated networks	**14.23**	**$600**	**14.40**	**$607**	**14.47**	**$610**	**14.73**	**$621**
Transmission	3.03	$128	3.15	$133	3.27	$138	3.42	$144
Distribution	10.54	$444	10.59	$446	10.59	$446	10.71	$451
ACS Metering	0.65	$27	0.66	$28	0.61	$26	0.61	$26
Wholesale	**9.93**	**$418**	**11.68**	**$492**	**9.92**	**$418**	**10.50**	**$442**
Residual	**4.77**	**$201**	**2.64**	**$111**	**2.71**	**$114**	**2.78**	**$117**
Market Offer	**30.59**	**$1,290**	**30.71**	**$1,294**	**29.12**	**$1,227**	**30.06**	**$1,267**

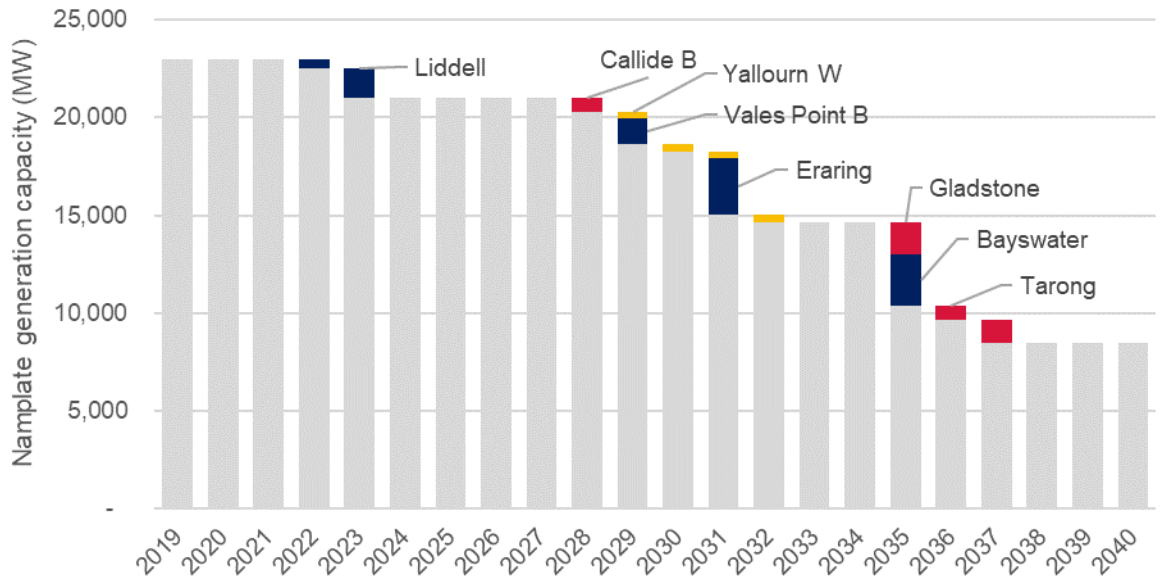
Source: AEMC. Note: The electricity prices and bills are based on a weighted average of retailer's lowest market offers for the representative consumer in NSW.

[49] AEMC, 2018 Residential Electricity Price Trends, Final report, 21 December 2018 https://www.aemc.gov.au/market-reviews-advice/residential-electricity-price-trends-2018

2.2 Coal-fired power stations are reaching the end of their technical lives

All five operating NSW coal-fired power stations are scheduled for retirement between 2022 and 2043 (based on assumed 50-year technical life), beginning with Liddell Power Station in April 2023, followed by Vales Point B in 2029, Eraring in 2031, Bayswater in 2035 and Mount Piper in 2043.[50]

Figure 8: NEM coal-fired generation fleet operating life



Source: AEMO, Integrated System Plan 2019-20 Assumptions Book as at 8 August 2019. Note: Operating life based on 50th year from full operation or announced retirement.

As electricity generators reach the end of their technical lives, their parts become more fragile and liable to failure. This increases the risk of unplanned outages, reducing available capacity and adversely impacting the reliability of the electricity system.

For example, in Victoria at AGL's Loy Yang A power station, one generating unit (550 MW) is currently offline for long term repairs until December 2019.[51] In July 2019, it was reported that approximately 2,130 MW of thermal power was offline in Victoria resulting in concerns of having sufficient supply in Victoria for summer 2019-20.[52]

To illustrate a NSW example, the 10 February 2017 heatwave was exacerbated due to issues with thermal generators.[53] Coincident with the peak of demand for the day, the following issues

[50] AEMO Integrated System Plan 2019-20 Assumptions Book as at August 2019.
[51] AGL, July 2019, Repairs underway to bring Loy Yang Unit 2 back to Service, media release, 11 July, https://www.agl.com.au/about-agl/media-centre/asx-and-media-releases/2019/july/repairs-underway-to-bring-loy-yang-unit-2-back-to-service
[52] Renew Economy, Another coal unit breakdown in Victoria with five thermal units now offline (2019): https://reneweconomy.com.au/another-coal-unit-breakdown-in-victoria-with-five-thermal-units-now-offline-37313/, accessed 8 November 2019
[53] AEMO, System event report New South Wales 10 February 2017 (2017): https://www.aemo.com.au/-/media/Files/Electricity/NEM/Market_Notices_and_Events/Power_System_Incident_Reports/2017/Incident-report-NSW-10-February-2017.pdf

occurred which combined to overload the system and resulted in the load shedding of the Tomago aluminium smelter:

- Tallawarra gas power station (435 MW) was offline due to a fault in the gas turbine;
- Colongra gas power station was offline and unable to start (600 MW) due to low gas pressure in the fuel supply lines; and
- Two units at the Liddell Power Station (500 MW each) were offline due to forced outages.

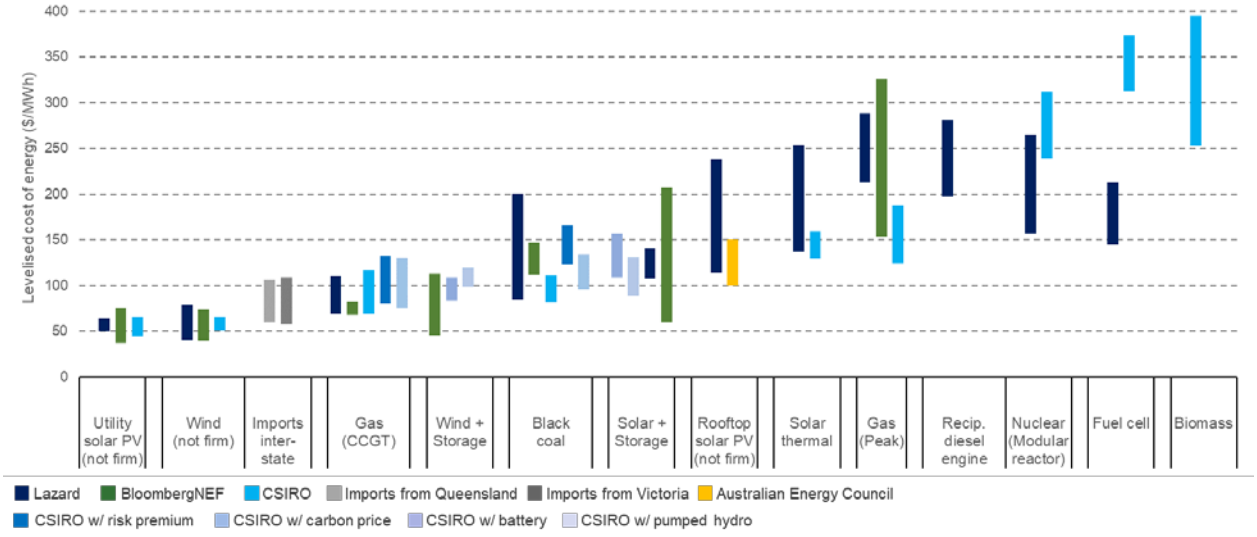
2.3 The changing economics of generation

According to the AER's State of the Energy Market 2018 report, in the five years from 2012 to 2017, over 90 per cent of investment in new generation capacity in the NEM was in wind and solar. Investment in renewable energy generation was, in the first instance, largely driven by the Commonwealth Government's Large-scale Renewable Energy Target (**LRET**) which is expected to be met before 2020. Despite the end of the LRET, the investment trend in renewable energy generation is expected to continue due to improved project economics.

Wind and solar generation are variable in their output and need to be complemented with firm and flexible technologies, such as pumped hydro, bioenergy, concentrated solar power, demand management and gas-fired generators. A portfolio of firmed renewables operates in the following way: because variable renewables generate electricity at a lower marginal cost than other technologies, they produce electricity when they can (i.e. when the sun is shining, or the wind is blowing). When variable generators are unable to satisfy demand, other technologies which can provide electricity on demand (**firm generation**), including gas and other storage, dispatch electricity. Such a system is able to satisfy electricity demand so long as there is sufficient firm generation capacity to meet the system's electricity demand.

As shown below, wind and solar are cheaper than new coal and gas based on a levelised cost of electricity generated. Wind and solar generation are also competitive when complemented with firm generation.

Figure 9: Levelised cost of electricity by type



Source: DPIE estimates based on various reports

The ISP, a whole-of-system roadmap for the efficient development of the NEM over the next 20 years, found that the least-cost transition plan is to retain existing generators for as long as they can be economically relied on, followed by a replacement portfolio of solar (28 gigawatts (**GW**)),

wind (10.5 GW) and storage (17 GW), complemented by 500 MW of gas plant and transmission investment.[54]

As at October 2019, there are 17,700 MW of large-scale renewable energy projects that have received planning approval or are progressing through the NSW planning system, which represents about $24 billion in investment. This includes approximately 11,400 MW from 81 solar farms worth around $13.4 billion in investment, 3,800 MW from 15 wind farms worth approximately $4.7 billion and 325 MW from two biogas and cogeneration projects worth approximately $1.1 billion. It also includes the Snowy 2.0 Stage 2 Main Works, with potential to deliver 2,000 MW of capacity worth $4.5 billion investment, and the Shoalhaven Scheme expansion, with 235 MW of capacity at $300 million.

In addition to these renewable projects, there are 1,410 MW of large-scale non-renewable energy projects with planning approval, worth around $1.5 billion. This includes 1,250 MW of gas projects, worth $1.25 billion, and 160 MW of coal efficiency upgrades, worth $209 million.

2.4 A congested grid

The existing network in NSW is running out of capacity, representing a significant barrier to the State's 48 GW of generation connection enquiries in the pipeline.[55] Market research indicates that grid connection is the highest concern for Australian energy CEOs[56] and it is estimated that there is only sufficient capacity to connect 1 in 20 private sector generation proposals in NSW.

[54] AEMO, Integrated System Plan for the National Electricity Market (2018), page 5.
[55] TransGrid, *Submission in the Inquiry into the sustainability of energy supply and resources in NSW (2019).*
[56] *Clean Energy Outlook 2019* (2019): https://assets.cleanenergycouncil.org.au/documents/resources/reports/clean-energy-outlook/Clean-Energy-Outlook-Confidence-Index-July-2019.pdf

Figure 10: Capacity of the NSW shared transmission network

Source: TransGrid, June 2019. Note: The existing shared transmission capacity between southern NSW (including the Snowy Mountains) and major load centres of Sydney, Newcastle and Wollongong is heavily utilised at times of peak demand. The peak utilisation has ranged between 90 per cent and 110 per cent over the last three years, and transmission constraints are expected to become more frequent as new renewable generation connects in southern NSW.

In addition, as more projects connect to the grid, congestion on the network impacts generator revenue and results in an inefficient market and ultimately higher wholesale energy prices. When the network is congested, generators are less likely to have all of their available energy dispatched into the market. Further, marginal loss factors (which account for the losses in transporting energy between generators and demand centres and impact the revenue paid to generators) worsen as congestion increases. For the 2019-20 financial year, AEMO significantly revised down marginal loss factors for some generators, creating major uncertainty for generation investment.

Further, while NSW benefits from world-class energy resources, many of the areas with the strongest renewable resource potential are located far away from the existing network, which was primarily designed to connect coal-fired generators and the Snowy Hydro Scheme. To connect the scale of new generation required to meet NSW's future energy needs, it will be critical to efficiently develop transmission to these new locations.

2.5 Changing patterns in the use of electricity

As increasing numbers of customers purchase systems like rooftop solar and home batteries and install the digital meters required to support those systems, the electricity system is becoming more digitised, interactive and decentralised. Many customers are now producers as well as consumers of electricity, allowing them to engage with electricity businesses in new ways.

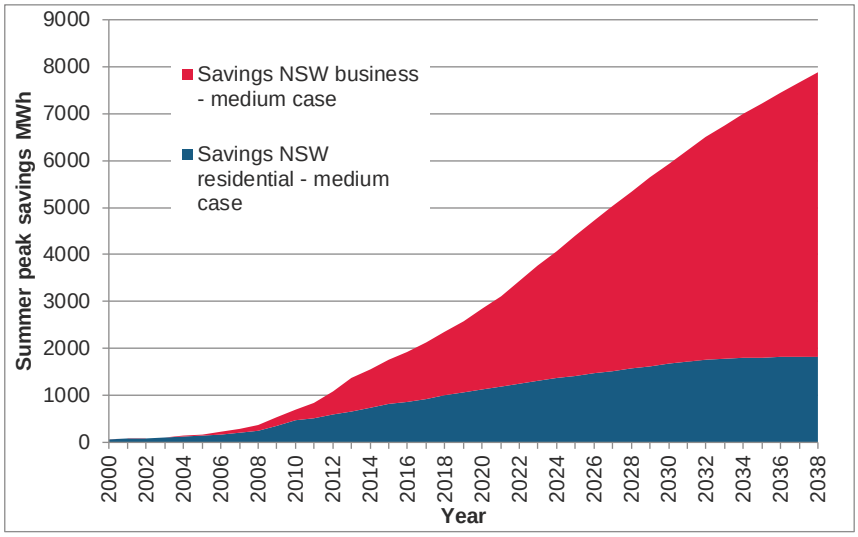
Households and businesses with rooftop solar systems are increasingly able to sell excess electricity back into the grid. Electric vehicles are also forecast to increasingly enter the mix and change the profile for electricity use and the way battery storage is used. An electricity system that

was once linear and based on centralised generation must transition to effectively incorporate distributed energy resources.

Energy efficiency measures can also reduce the need for additional investment in generation, transmission and distribution assets and place downward pressure on energy customers' bills. Energy efficiency measures reduce energy consumption and maximum demand, even though these savings can be difficult to measure given that they represent energy use forgone.

Modelling undertaken for TransGrid's Transmission Annual Planning Report 2019 estimates that NSW summer peak energy efficiency savings are expected to reach almost 8,000 MW by 2038 as a result of energy efficiency policies (not including programs funded by the Climate Change Fund).

Figure 11: Projected efficiency savings in NSW summer peak



Source: Energy Efficient Strategies, May 2019, 'Impact of energy efficiency programs on electricity consumption in NSW and the ACT from 2000 to 2038'.

Distributed energy resources impact the power system in several ways. One is that they shift the demand profile. During the daytime when demand is moderate, rooftop generation is at its highest, reducing demand from the grid. In the evening at peak demand, rooftop generation has tapered off, meaning that rooftop solar has relatively less impact at reducing peak demand pressures on the system.

Distributed energy resources can also result in distribution network congestion, as power is exported back to networks that were not designed for two-way power flow. There are also issues with voltage and frequency control and the ways in which distributed energy responds to system disturbances. Compounding these issues, AEMO does not have 'visibility' of distributed energy resources, making it difficult to measure the consumption and export from rooftop solar and balance supply and demand in the system. These impacts make coordinating the integration of distributed energy resources a major challenge in managing the energy transformation.

Part 3: Work underway

3.1 Regulatory reform

3.1.1 Coordination of generation and transmission investment

In 2016, the Council of Australian Governments (**COAG**) Energy Council asked the AEMC to undertake biennial reporting on when the transmission planning and investment decision-making framework needs to change, and what needs changing. The inaugural Coordination of Generation and Transmission Investment review (**COGATI**), completed in December 2018, made recommendations for comprehensive reform to the way investment in generation and transmission is coordinated.

In February 2019, the AEMC started the second COGATI review. Two of the key recommendations from the inaugural COGATI final report will be progressed through this second review (COGATI implementation - access and charging review). They are:

- reforms to the way generators access and use the transmission network; and
- a review of the charging arrangements which enable transmission businesses to recover the costs of building and maintaining transmission infrastructure, both within and between regions.

The AEMC has published two discussion papers on 14 October 2019 which:

- outline key design features of the proposed access model including dynamic regional pricing and transmission hedging contracts; and
- discuss renewable energy zones.

The AEMC will release a final report in December 2019. The proposed COGATI reforms will be subject to detailed impact analysis and modelling, with rule changes expected to be introduced in 2020. The AEMC is targeting implementation of the reforms by June 2022.

3.1.2 The future of the electricity market

The NSW Government continues to participate in national forums including the COAG Energy Council, to advocate for clear, national, long-term energy policy that will benefit NSW customers and support investment in new generation.

The COAG Energy Council has tasked the ESB with developing advice on a long-term, fit-for-purpose market framework to support reliability that could apply from the mid-2020s. By the end of 2020, the ESB needs to recommend any changes to the existing market design or recommend an alternative market design to enable the provision of the full range of services to customers necessary to deliver a secure, reliable and lower emissions electricity system at least-cost.

In addition to the post-2025 market design for the NEM, the ESB has also published the Converting the ISP into Action Consultation Paper on 17 May 2019 and released its revised Rules to give effect to the RRO on 5 June 2019.

3.2 Government programs

3.2.1 The NSW Government's Climate Change Fund programs

Through the Climate Change Fund (**CCF**), the NSW Government is investing $1.4 billion between 2017 and 2022 to help households and businesses save energy and money, improve energy reliability and affordability, and improve the resilience of communities across NSW to climate

change. Key programs under the CCF that contribute to a reliable, affordable and sustainable electricity system include the:

- *Emerging Energy Program*

  The $75 million Emerging Energy Program to accelerate the development of large scale, low emissions, dispatchable electricity supply. The program provides grants to support a mixture of technologies that will help diversify the NSW energy mix and drive more competition in the market, ultimately lowering prices for consumers.

- *Empowering Homes Program*

  The $50 million Empowering Homes Program to support the installation of up to 300,000 battery and solar battery system across NSW over the next 10 years. The program will provide access to no-interest loans to enable NSW homeowners to purchase the systems.

- *Regional Community Energy Program*

  The $30 million Regional Community Energy Program to address challenges and improve energy reliability, and the integration of renewables, in regional communities. The program supports regional communities in the transition to a modern electricity market.

- *Smart Batteries for Key Government Buildings Program*

  The $20 million Smart Batteries for Key Government Buildings Program to encourage NSW Government agencies to increase investment in solar and batteries for their facilities. This program will enable agencies to reduce their operating costs while also helping to improve grid security and reliability, particularly during peak demand periods.

- *Solar for Low Income Households*

  The $15 million Solar for Low Income Households Program to deliver increased electricity bill savings to low income households. The program will install up to 9 MW of rooftop solar in NSW, providing cleaner and cheaper electricity for up to 3,000 families.

3.2.2 The NSW Transmission Infrastructure Strategy

The NSW Transmission Infrastructure Strategy is the NSW Government's plan to unlock private sector investment in priority energy infrastructure projects, which can deliver least-cost energy to customers to 2040 and beyond. New regional infrastructure could support up to 17,700 MW of new energy projects, $23 billion in regional investment and 2,000 construction jobs.

The Strategy has three aims: *first*, boost the State's interconnection with Victoria, South Australia and Queensland, and unlock more power from the Snowy Hydro Scheme.

Secondly, increase NSW's energy capacity by prioritising Renewable Energy Zones in the Central-West, South West and New England regions of NSW, which will become a driving force to deliver affordable energy into the future. Unlocking the NSW Renewable Energy Zones will diversify the State's energy mix and expand its transmission capabilities, opening new parts of the NEM for energy generation in locations that can benefit from diverse weather patterns. Strategic infrastructure upgrades to unlock these priority Renewable Energy Zones will leverage substantial private sector investment, boost regional economies and build the State's electricity resilience by ensuring there are new generation projects coming online to replace retiring power stations over the next two decades.

Thirdly, work with other States and regulators to streamline regulation and improve conditions for investment.

3.2.3 The Commonwealth's Underwriting New Generation Investments program

The Commonwealth Government has established the Underwriting New Generation Investments program to support targeted investment in new generation that will lower prices, increase competition and increase reliability in the system.

The program will provide financial support to firm generation capacity as part of the Commonwealth Government's commitment to lowering electricity prices and increasing reliability in the system. It will be technology neutral, providing a level playing field to enable the best and lowest cost generation options to be supported. The program's objectives are to:

- reduce wholesale electricity prices by increasing competition and supply;
- assist commercial and industrial customers, and smaller retailers to access affordable energy supply arrangements; and
- improve reliability by increasing the level of firm and firmed capacity in the system.

During December 2018 and January 2019, the Commonwealth Government called for registrations of interest (**ROI**) for projects under the program. The Commonwealth Government has shortlisted 12 projects representing a range of fuel types, including:

- six pumped hydro projects;
- five gas projects; and
- one coal plant upgrade project.

Three of the 12 projects are in NSW:

- Australian Industrial Energy - Port Kembla, New South Wales - Gas
- UPC Renewables - Armidale, New South Wales - Renewable Pumped Hydro
- Delta - Lake Macquarie, New South Wales - Coal Upgrade

The multi-phased program will be open over four years to June 2023.

3.2.4 Snowy 2.0

The Commonwealth Government has committed to developing Snowy 2.0 to deliver 2,000 MW of on-demand generation, up to 175 hours of storage, and keep downward pressure on prices.

The project links two existing Snowy Scheme dams, Tantangara and Talbingo, through tunnels and an underground power station with pumping capabilities. Hydro-power will be generated by falling water spinning Snowy 2.0's reversible turbines, which can also pump water in the opposite direction. Snowy 2.0's pumping capabilities work in a 'closed' system – water is recycled between the upper dam (Tantangara) and lower dam (Talbingo) so the same water can be used to generate power more than once, making the most of available water.

The project is undergoing exploratory works and environmental and planning assessment processes.

The first power produced from Snowy 2.0 is expected in late 2024-25, with progressive commissioning of the six units. Snowy 2.0's operating life is expected to be consistent with the Snowy Scheme's existing assets, which continue to operate reliably many decades after installation.

Part 4: The NSW Government's objectives

The NSW Government has three objectives for the electricity system: reliability, affordability and sustainability.

4.1 Reliability

4.1.1 The role of Government as the ultimate guarantor of reliability

All electricity market participants have an obligation to their customers and consumers to ensure that the electricity system remains reliable. However, electricity is an essential service. It is vital for the provision of essential public services, including transport, health and utilities ranging from lifts to traffic lights. Accordingly, Governments are the ultimate guarantors of the electricity system's reliability. This means that it is the ultimate responsibility of Government to ensure that the market is designed to reliably supply electricity. It also means that it is the Government's responsibility to take action (in a manner consistent with other policy objectives) to address the system's reliability when its reliability is improperly risked.

4.1.2 Reliability standards in electricity systems – striking a balance between reliability and cost

While the electricity system's reliability is important, it needs to be balanced against the need to keep costs down. The need to strike this balance reflects that plant, equipment and network failures happen from time to time, that these failures can coincide, and that it is not possible to guard against every eventuality. It would, for example, be too costly to back up every generator in the electricity system, notwithstanding that it is theoretically possible that all of them could suffer reliability failures at the same time. This balance is struck and crystallised through the reliability standards and targets required of the system.

4.1.3 Energy Security Target – the NSW Government's approach to ensuring reliability

The primary risk to NSW's electricity reliability is a capacity shortfall. A capacity shortfall might occur either because a generator has exited the market without having been sufficiently replaced, or because one or more generators have experienced an unplanned outage (which they are more likely to do as they age). Accordingly, the Strategy's approach to reliability is to set a long-term Energy Security Target (**EST**) that conveys a clear message to the market about the NSW Government's reliability expectations and what action the NSW Government will take to avoid an electricity supply shortfall.

Three additional points should be made regarding the purpose of the EST. *First*, the Government "action" being contemplated here is action to *avoid* a long-term risk of an electricity emergency arising from a shortfall in capacity. Different actions are required to avert an immediate risk of an electricity emergency.

Second, the EST addresses the threshold question of *whether* additional Government action is required. It does not address the *nature* of the Government action. The latter will vary depending on the scale of the breach. A larger breach not only increases the probability of insufficient capacity, it also increases the severity of the electricity emergencies that could arise. There are material differences between capacity emergencies which require AEMO to:

- engage the RERT (and therefore increase bills);

- direct market participant consumers to load shed (and adversely impact those businesses); and
- direct load shedding (which involves blackouts for the public generally).

Accordingly, the scale of NSW Government action will increase in line with the scale of the breach.

Third, the EST is not intended to substitute or interfere with the existing reliability framework that exists in the Rules. The reliability standard, and the regulatory framework that underpins and flows from it, is the primary driver of reliability within the NEM. The NSW Government will continue to rely on the national reliability framework, including the existing price signals and the RRO, to ensure the market is delivering the generation, transmission and demand side capacity needed to avoid an electricity supply shortfall. In this regard, the NSW Government supports ongoing national work through the COAG Energy Council to promote reliability and ensure the reliability standard remains fit for purpose.

Instead, the EST must be viewed as a medium to long term objective of the NSW Government that complements and works alongside the national framework. The EST is designed to provide NSW businesses and households with confidence that the Government is closely monitoring electricity supply levels in NSW and, where a breach of the EST is forecast, appropriate action will be taken.

4.1.4 Setting the Energy Security Target

The Strategy sets an EST at an amount equivalent to the peak demand experienced in NSW every 10 years (10 per cent probability of exceedance (**POE**)), which typically occurs under heatwave conditions, plus a reserve margin to cover the credible loss of two of the largest NSW generating units. The reasoning to support this is as follows:

First, climate change is likely to increase the frequency of severe heatwaves. Accordingly, it is appropriate to set the EST so that system can cope with such conditions.

Second, because the EST is designed to ensure the State can deal with unplanned plant outages, it is also appropriate to set the EST having regard to possible plant outages.

Third, once the Liddell Power Station closes, the remaining NSW coal plant sizes will all be of a similar scale. In this respect, the firm supply ratings for NSW's coal generation fleet is as follows:

- Bayswater 2,520 MW (4 x 630 MW)
- Eraring 2,720 MW (4 x 680 MW)
- Mount Piper 1,300 MW (2 x 650 MW)
- Vales Point B 1,320 MW (2 x 660 MW)

This means the difference between being able to cover a contingency of the smallest coal-fired power station unit suffering an unplanned outage and the largest unit suffering an unplanned outage is 50 MW. In those circumstances, it is appropriate to set the buffer so that the system can cope with outages of the largest generating units.

Fourth, while it is not practical to set an EST that canvasses highly unlikely coincidences of *multiple* generator or network contingencies, NSW must have sufficient capacity to address failures which are reasonably foreseeable. Given recent incidents of unplanned outages across the NEM, it is reasonably foreseeable that a failure of the State's two largest generating units may occur at the same time as 1-in-10 year peak demand conditions.

Further details on the EST and its role within the Strategy are described in Part 5.

4.2 Affordability and economic growth

Electricity is an important factor of production, in economic terms, and can be a major cost for households and businesses. Lower electricity prices help reduce pressure on household budgets and improve the competitiveness of the NSW economy, as it means households and businesses spend less on their electricity bills and save or spend more of their income.

As both wholesale and retail prices of electricity have increased, households and businesses are spending a larger share of their income on electricity bills. This presents challenges for household budgets to meet the cost of living and puts pressure on the ability of businesses to be competitive.

Importantly, consumers with lower incomes are more sensitive to electricity price changes than those on higher incomes as the costs of electricity bills make up a greater proportion of expenditure for those on lower incomes. As electricity is an essential service, households and businesses are constrained to the extent to which they can reduce their electricity usage in response to high prices. This has a greater impact for lower income households, which are likely to have less discretionary consumption to reduce.

Retail prices in NSW are at a historical high. While they have stabilised recently, this was preceded by a sustained increase over the past decade where prices more than doubled in some parts of NSW. Wholesale electricity prices in NSW have also increased to an annual volume weighted average spot price of $92 per megawatt hour in 2018-19 (compared to $85 in 2017-18, and as low as $36 in 2014-15).

To address this, the NSW Government is focusing on ensuring that, subject to maintaining the energy system's reliability, NSW households and businesses have the lowest electricity prices possible.

4.3 Sustainability

How we manage our electricity system can lead to significant environmental impacts. The electricity generation sector is the largest source of carbon emissions in the NSW economy, constituting 39 per cent of NSW's total emissions. The NSW Climate Change Policy Framework includes a policy for NSW to achieve net-zero carbon emissions by 2050. The framework aims to maximise the economic, social and environmental wellbeing of NSW in the context of a changing climate, and current and emerging international and national policy settings to address climate change.

As noted above, the generation of electricity can also release substances that are harmful to human health, including but not limited to PM 2.5, NOx and SOx.

The NSW Government is committed to reducing the emission of substances that are harmful to human health and improving the air quality of the State more generally. The Government is committed to a sustainable electricity system for the future of the State, and through this Strategy, will support investment into affordable generation technologies that help protect the environment, support clean air in NSW and contribute to improved health outcomes.

Part 5: The NSW Government's Electricity Strategy

The NSW Government's Electricity Strategy will:

1. improve the efficiency and competitiveness of the NSW electricity market by reducing risk, cost, Government caused delays and by encouraging investment in new price-reducing generation and energy saving technology;

2. prompt Government to act if there is a forecast breach of the EST which private sector projects are unlikely to address. This should be done in a way that minimises costs to consumers and taxpayers and does not give rise to moral hazard risk; and
3. ensure that there are appropriate powers available for Government to analyse and respond to electricity supply emergencies, if they arise.

This Strategy and the principles which have guided its development are developed below.

5.1 Strategic propositions

Four propositions underpin the NSW Government's Electricity Strategy:

Principle 1: New generation, delivered by competitive markets, should reduce electricity prices and protect the environment

Renewables, firmed by dispatchable technologies such as gas and storage, are the lowest cost form of new reliable electricity generation. Accordingly, a good investment environment will deliver new generation, reduce electricity prices and ensure reliability while protecting the environment.

Principle 2: Governments remain ultimately accountable for electricity reliability

Electricity market participants have strong commercial incentives to provide a reliable service. However, because electricity is an essential service, Governments, both state and federal, remain *ultimately* accountable for ensuring that the electricity system provides NSW with a reliable supply of electricity.

There will always be risks to the electricity system, which Governments cannot always address without cost to taxpayers and consumers. For example, heatwaves or multiple equipment failures at power stations pose risks which cannot be entirely mitigated. However, Governments are *ultimately* accountable for ensuring that the physical power system is prepared for reasonably foreseeable disruptions to supply.

Principle 3: Government action should limit costs to taxpayers and consumers

Any intervention by Government to ensure system reliability should limit the financial exposure to taxpayers and consumers. Three considerations regarding costs, in addition to the direct cost to taxpayers, are appropriate to highlight: *first,* the time at which Government takes action bears upon cost. Take action too soon, and the action could crowd out private sector investment which may have addressed the issue. Take action too late, and low cost options may no longer be capable of being feasibly implemented. Accordingly, Government action should not be taken until it is reasonably necessary to proceed with a low cost approach.

Second, the predictability of Government action impacts costs. Policy uncertainty can increase risks to investors and therefore the returns they require to invest. For this reason, providing a coherent policy framework, as detailed in this Strategy, creates a climate that supports private sector investment. This helps to reduce investment risk and improves the feasibility of new generation projects.

Third, some forms of Government intervention can also give rise to moral hazard. Government intervention may lead to a deferral of investment until Government assistance becomes available, increasing costs to taxpayers by leading to more Government intervention than would otherwise be necessary.

Principle 4: Government action should be consistent with NSW's other policy objectives, including its commitment to the NEM

Government measures to improve reliability and address affordability and protect the environment should be compatible with other policy objectives. The Government strongly supports the proper functioning of a *national* electricity market. Accordingly, the Government's first preference is for power system reliability and security issues to be managed by the national bodies that operate (AEMO), regulate (AER) and develop the rules (AEMC) underpinning the NEM.

In particular, AEMO is responsible for monitoring electricity consumption and the flow of energy across the power system. AEMO also monitors electricity voltage and frequency to make sure the system stays secure. AEMO's electricity emergency arrangements provide a framework for the coordination of emergencies across the NEM.

However, where the timeframes for the reforms required to address power system reliability issues do not align with the State's ability to meet its energy policy objectives or issues arise unique to NSW, the NSW Government may act unilaterally.

5.2 Ten actions to secure the State's electricity future

This Strategy sets out actions that will support a competitive and low-cost energy market and deliver more resilient electricity supplies. There are ten actions that make up the NSW Government's Electricity Strategy.

5.2.1 Supporting an efficient, competitive and low cost electricity market

The NSW Government's preference is for the market to deliver the investment required to ensure reliable and affordable electricity. Once it is accepted that a good investment environment for competitively delivered new generation will provide affordable and reliable electricity and protect the environment, it follows that the Government should, in the first instance, focus on reducing barriers to entry, cost, approval processing times and investment risk and uncertainty while ensuring that the market is designed to encourage investment in new generation and other price reducing technologies. To support that, the NSW Government will:

- make it easier to invest in generation and other technologies which support reliability, affordability and sustainability;
- reduce risk for investors in utility scale generation; and
- incentivise the deployment of technologies that reduce peak demand and save consumers money on their electricity bills.

Making it easier to invest

Action 1: A case management approach for reliability critical infrastructure

The NSW Government will provide a case management service for reliability critical infrastructure. This service will provide a central point of contact for proponents of transmission or firm supply generation projects that will improve the reliability of the NSW electricity system. This case management service will:

- be responsible for co-ordinating processes across the NSW Government to ensure a whole of Government approach to reliability critical infrastructure;
- ensure that Government processes deliver timely decision-making;

- liaise with other levels of Government to ensure information flows between decision-makers and proponents, so that issues can be properly addressed as early as possible;
- interact with the market bodies and market participants critical to enabling new capacity enhancements;
- identify risks to proposed transmission or generation projects; and
- provide the NSW Government with accurate and timely information to inform other policy decisions.

Action 2: Project funding through the Emerging Energy Program

Technological change has been a major driver of changes to the generation mix as the cost of renewables have fallen. Once integrated into the network, virtual power plants, digital meters, rooftop solar and battery technologies may improve system reliability and security in a low-cost manner.

In commercialising these emerging technologies, there are often costs that more established technologies do not encounter. These include system integration issues, establishing new infrastructure within the existing planning framework, and dealing with untested regulatory issues.

Through the existing Emerging Energy Program, the NSW Government is providing financial support to proponents of new technologies which provide, clean dispatchable electricity. This supports early movers in new and emerging technologies and ensures that the insights from these projects are shared. This enables the NSW Government to help bring down the cost of these technologies and support the efficient operation of the electricity market.

The NSW Government will award the next round of grants under the Emerging Energy Program for new technologies that provide sustainable and on-demand electricity. By ensuring that insights from these projects are shared, the NSW Government is helping to bring down the costs of new technologies and support an innovative and competitive market.

Action 3: Making it easier to do business

The NSW Government will continue to work with industry to identify processes, regulations and systems that can be improved, streamlined or removed to make it easier for business to invest in the NSW electricity sector.

As well as reducing red tape, this complements the case management service (describe above in Action 1) that will encourage the investment needed to replace retiring large-scale generation.

The Minister for Energy and Environment will also work with the COAG Energy Council and the ESB to review the NEL and Rules to identify national regulatory burdens that could be removed, streamlined or clarified.

Reducing risk

As noted above, amongst the biggest risks for investors in new generation are challenges in connecting to the congested transmission network and volatility associated with marginal loss factors. The AEMC's COGATI review proposes access reforms that may address these issues once initiated. However, it is appropriate for the NSW Government to take targeted action to address this issue in the interim.

Action 4: Rolling out NSW Renewable Energy Zones

The NSW Government will support the development of new transmission to connect low-cost generation to the electricity system by developing its Renewable Energy Zones. To support the development of the Renewable Energy Zones, the NSW Government will:

- support transmission upgrades for a pilot 3,000 MW Renewable Energy Zone in the Central-West of NSW;
- approach the market for competitive generation proposals in the Renewable Energy Zone and facilitate generator contributions to transmission costs;
- ensure necessary regulatory changes are made to ensure Renewable Energy Zones can be developed in a timely and efficient way, whilst facilitating grid connections for generators at the lowest cost to consumers;
- use a dedicated Renewable Energy Zone body to coordinate transmission and generation investment, including land acquisition and grid connections;
- implement strategic master planning and community engagement in Renewable Energy Zone locations, to streamline planning approval processes for investors and support social licence;
- provide value to generators through a connection right and streamlined planning in return for generator financial contributions to the cost of the Renewable Energy Zone; and
- provide $9 million in seed funding for the strategic planning and set up of the dedicated Renewable Energy Zone body.

This approach will unlock regional investment and new energy generation infrastructure within the pilot Renewable Energy Zone in the Central-West of NSW, with the delivery model to be used to inform the development of other Renewable Energy Zones.

Developing the three Renewable Energy Zones will support $23 billion of investment in regional NSW and is expected to reduce annual NSW electricity bills by around $10. This is equivalent to about $2.4 billion in savings for all NSW consumers.

Encouraging reliable, affordable and clean technologies to take pressure off the grid

Action 5: The ESS will be reconstituted as the Energy Security Safeguard

There are a range of technologies that support a more reliable, affordable and sustainable electricity system by impacting when and how much electricity is drawn from the grid. As noted above, these technologies include energy efficient appliances, systems which allow consumers to reduce their electricity demand at times of peak demand (and receive bill savings as a result), and systems which allow electricity consumers to shift demand to times of higher supply and lower prices (such as when the sun is shining and solar generators are producing electricity).

To support the efficient rollout of these technologies, the ESS will be reconstituted as the Energy Security Safeguard (**the Safeguard**) with the objective of accelerating the deployment of:

- energy efficiency technologies which reduce demand on the electricity or gas networks (putting downward pressure on prices and reducing network pressures); and
- peak demand reduction technologies, such as household batteries, smart pool pumps and electric vehicle infrastructure (reducing market volatility, electricity prices and deferring investments in network infrastructure).

The first component of the Safeguard will involve expanding the existing Energy Savings Scheme to 2050, with targets increasing gradually up to 13 per cent by 2030 and participants able to receive certificates for an expanded set of activities which reduce demand on electricity and gas networks, including substituting gas for biomass.

The second component of the Safeguard will involve establishing a new certificate scheme for the deployment of peak demand reduction technologies, such as batteries, smart pool pumps and electric vehicle chargers that enable electricity demand to be shifted away from peak periods.

These technologies will provide a critical mass of demand reduction capacity to help manage wholesale market volatility and defer investments in network infrastructure.

The target trajectory and detailed scheme design of the Safeguard will be subject to further consultation and detailed analysis. The Safeguard's primary purpose is to reduce electricity prices by driving investment in price reducing technologies, saving households up to $40 per year. It will also support the electricity system's reliability and, as discussed below, provides a tool to avoid electricity emergencies, if risks emerge.

Action 6: Supporting the deployment of utility scale generation in NSW

New generation is also essential to improve the affordability and reliability of the electricity system and to protect the environment.

The NSW Government will support the development of an energy regulatory framework that ensures further deployment of utility scale generation in NSW in accordance with the Government's three primary objectives of:

1. reducing electricity prices for NSW consumers by bringing new, competitively priced generation into the market;
2. ensuring minimum investments in new generation capacity in the NSW NEM region ahead of the closure of existing power stations; and
3. maintaining a technology neutral approach to new generation investment subject to minimum environmental standards (for example air pollution, such as NOx, SOx and PM standards).

This energy regulatory framework could be implemented through reforms currently being developed through the COAG Energy Council (e.g. reforms to the RRO and the post 2025 market design work).

The energy regulatory framework will be designed in a manner that optimises bill savings for NSW consumers and provides a long term investment signal for new generation within NSW. The detailed scheme design of the framework will be subject to consultation with stakeholders and detailed analysis.

5.2.2 Avoiding electricity emergencies caused by capacity constraints

If there is a risk to system reliability caused by a forecast capacity shortfall, both State and Federal Governments should be ultimately accountable to address that shortfall. However, Government should only intervene as a last resort, and with as little imposition on consumers and taxpayers as possible.

While market participants have the primary responsibility to ensure system reliability, the NSW Government will take appropriate action to avoid reasonably foreseeable reliability disruptions.

Action 7: Setting an Energy Security Target

A reliable power system has enough generation, network capacity and demand response to match customer demand with a high degree of confidence. The EST is set at a level where sufficient supply is expected to meet customer demand, plus an appropriate reserve margin.

The EST will send a clear market signal about how much new electricity is needed to deliver a reliable energy system over the medium to long-term. The EST will be set at an amount equivalent to the maximum demand experienced in NSW every 10 years (typically under heatwave conditions) plus a reserve margin to cover the loss of the State's two largest generating units.

A shortfall on the EST can by met by:

- building electricity generation;
- removing capacity constraints in the transmission system preventing existing generation from being accessed; and
- reducing demand.

While these options can deliver up to its respective maximum capacities, only the firm capacities (the actual capacity that is delivered under conditions such as during peak demand periods), will be considered. The firm capacity is determined by assessing the capacity delivered by that source during the previous three peak periods.

The EST will serve as an additional framework that complements the existing national reliability measures, while boosting electricity resilience in NSW.

Three questions arise from the setting of an EST:

1. When will the Government take emergency avoidance action?
2. How will the Government determine when the EST has been breached?
3. What action will the Government take to avoid a capacity gap?

Each of these questions is addressed below in the context of the reliability challenges arising from the upcoming closure of existing power stations.

When will the Government take emergency avoidance action?

The NSW Government will only intervene if:

- there is a forecast breach of the EST; and
- there is a real risk that the private sector (and existing Government initiatives) will not deliver the projects required to address the capacity shortfall before a breach of the EST.

How will the Government determine when the EST has been breached?

In consultation with AEMO, the NSW Government will closely monitor the market for any forecast breaches of the EST. As part of this, the NSW Government will maintain a confidential register of key projects which, if delivered, would contribute to the EST. The register will include information regarding key decision dates, critical path delivery timeframes and other information required to properly assess the project against the criteria set out below.

To ensure the NSW Government has sufficient and accurate information to conduct these assessments, the information gathering powers described below will provide the power to issue notices to produce documents or require industry participants to answer questions. All information produced under these provisions will be subject to strict secrecy provisions to protect commercially sensitive information.

What action will the Government take to avoid a capacity gap?

An anticipated capacity shortfall may be addressed by delivering one or a combination of:

- transmission projects, which remove constraints on accessing existing generation;
- firm generation projects; or
- projects which reduce peak demand such as energy efficiency measures or demand response measures that allow energy consumers to shift their demand to non-peak times.

The NSW Government may consider different actions that lead to investments that will avoid breaches of the EST. For example, the Government may develop the project itself; underwrite or provide some other financial support for the project to proceed; or exercise its legal powers, for example by expanding the Safeguard.

Consistent with the strategic principles set out above, NSW Government action would need to satisfy the following criteria:

- minimise costs to taxpayers and consumers;
- not incentivising market participants to delay commercially justifiable investments in order to profit from any intervention; and
- be consistent with other NSW Government objectives, including protecting the environment.

Action 8: Ensuring there are actionable options to address a capacity shortfall

To ensure the NSW Government has options to address a capacity shortfall, which minimise the financial exposure of taxpayers, the NSW Government will:

A: Modify the RIT-T and the economic regulatory process for capacity shortfall transmission projects

The NSW Government will seek to legislate a power to declare a transmission project recorded in the ISP as a priority project. The effect of a priority transmission project declaration will be to require the transmission network service provider (**TNSP**) to proceed with the project and to allow an independently determined efficient cost of construction of the project to be included in the TNSP's regulated asset base. The Minister's power would only be engaged if he or she was reasonably satisfied that there is a real risk that the EST would not be satisfied (having regard to committed private sector projects) and that it is in the public interest to declare the project having regard to the extent the project may address any capacity shortfall, the financial implications of making the declaration (or not) for consumers and taxpayers, and moral hazard risk.

This amendment would require the TNSP to commence construction at an earlier date without the risk that they will not be able to earn a regulated return on the project. In so doing, the amendment will avoid the commencement of transmission projects being delayed by the RIT-T where the project is needed to avoid a forecast capacity shortfall. It will also avoid Governments having to underwrite transmission projects during the RIT-T assessment, which the Commonwealth and NSW Governments have already been required to do. By limiting this power to projects identified in the ISP, the NSW Government will ensure that the projects have nevertheless undergone a cost-benefit analysis.

B: Have the power to increase targets in the Safeguard

The NSW Government will also seek to legislate to confer additional powers on the Minister to increase the Safeguard's energy saving or peak demand reduction targets to assist the State in avoiding an energy emergency, if there is a forecast breach of the EST.

Action 9: Powers to gather information

The Government has clear existing legislative powers under the *Electricity Supply Act 1995* that, if there is a significant actual or real risk of an electricity supply interruption, the Premier may declare an electricity supply emergency. If a Premier's order is in force, the Minister is able to give directions that are 'reasonably necessary' to respond to the electricity supply emergency.

Outside of an emergency context, it is proposed to confer the Secretary of the Department of Planning, Industry and Environment with information gathering powers, within the context of the NSW Government being required to set targets as part of the Energy Security Safeguard. This information will be used to set Safeguard targets, identify possible capacity shortfalls, and assess options to address such shortfalls, including to assess whether Government action may give rise to unintended consequences. Commercially sensitive information will be subject to strict confidentiality provisions.

A significant volume of information about NSW's electricity demand and generation capacity is already provided by industry to AEMO. The NSW Government will work to ensure that AEMO shares this information with the NSW Government. This will ensure that industry does not need to provide the same information to multiple organisations, and that the data and evidence being relied upon is consistent between the NSW Government and energy market bodies.

5.2.3 Strong emergency response

While this Strategy sets out a plan to avoid reliability failures in the electricity system due to unplanned plant outages, emergencies can still occur, including because of natural disasters. Accordingly, it is necessary that the State is able to respond to electricity supply emergencies, if they arise.

Action 10: Robust emergency response powers and processes

NSW has robust emergency response powers. These will be maintained and strengthened as required. To ensure they remain fit for purpose, the NSW Government will continue to review them in light of market conditions and run emergency simulations to ensure they are supported by the right systems and processes.

Part 6: Applying the Energy Security Target to NSW

6.1 The Energy Security Target today

AEMO forecasts the 1-in-10 year peak demand for the summer of 2019-20 to be 14,373 MW.[57] The firm supply rating for each of the two largest generating units in the State is 680 MW. Accordingly, the EST is 15,733 MW. NSW's firm capacity for 2019-20 is estimated at 15,545 MW. Therefore, this places NSW 188 MW short of its EST.

In this respect, the State's capacity shortfall on its EST is expected to be addressed by the summer of 2021, with additional projects providing further capacity increases through to 2022-23 including:

1. **The Queensland/NSW Interconnector Transmission Project (QNI)**: this project will upgrade the existing interconnector between NSW and Queensland, allowing the State to import an additional 190 MW from Queensland, helping in peak demand periods and putting downward pressure on prices. To accelerate this project the NSW Government is underwriting TransGrid's early planning works and, together with the Commonwealth, is jointly underwriting up to $102 million of procurement and construction costs, while the project goes through the RIT-T. Because of the work of the Commonwealth and NSW Governments, QNI is expected to be ready by December 2021.
2. **The Victoria/NSW Interconnector Transmission Project (VNI)**: this project will upgrade the existing interconnector between NSW and Victoria, allowing the State to import an additional 170 MW from Victoria. The NSW Government is underwriting TransGrid's early planning works for VNI, helping to deliver the project in 2021.
3. **The Emerging Energy Program**: the NSW Government's Emerging Energy Program, which is primarily designed to support innovation, is expected to deliver around 200 MW of additional firm capacity.
4. **Private sector generation investments**: the private sector has announced investments in existing power stations which will see an additional 60 MW of capacity at the Mount Piper

[57] AEMO, Electricity Statement of Opportunities (2019).

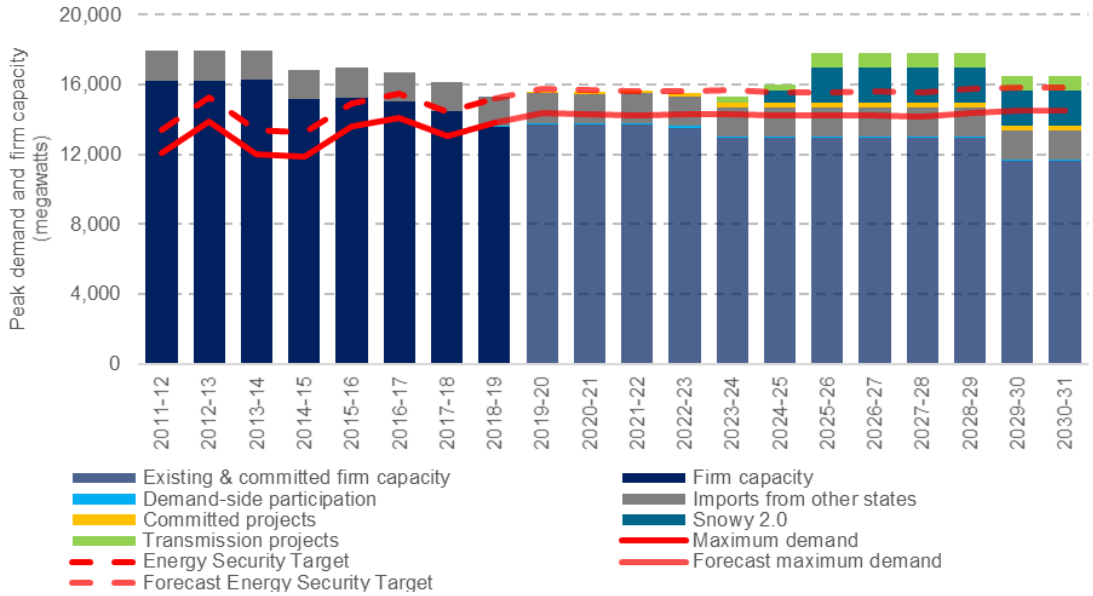
Power Station by December 2021 and 100 MW at the Bayswater Power Station by December 2022. The private sector has also committed to new wind and solar farms with firmed capacity of 115 MW by 2023.

If required, AEMO can also use the RERT scheme or its direction powers to ensure sufficient capacity is available to avoid electricity supply emergencies.

6.2 The EST 2020-2030

Over the course of the 2020s, NSW is projected to experience its tightest reserve conditions in 2023-24 after the Liddell Power Station closes in April 2023. This tight reserve condition is partially mitigated by the QNI and VNI upgrades. Other committed projects that will increase supply by 2023-24 include Mount Piper power station upgrades (60 MW by December 2021), Bayswater power station upgrades (100 MW by December 2022), and firmed capacity from committed wind and solar farms (115 MW by 2023). Figure 12, below, provides the projected outlook for the EST out to 2030-31.

Figure 12: Outlook for the EST



While there remains a risk of breaching the EST in the summer of 2023-24 without further investment, there are more than enough proposed firm generation projects to meet and exceed the EST. These projects include:

- a 250 MW gas peaking plant at Newcastle (AGL);
- a 320 MW gas peaking plant at Tallawarra (Energy Australia);
- four large-scale 50 MW batteries (AGL with Maoneng Group);
- the 50 MW Darlington Point Battery; and
- projects funded under the Emerging Energy Program.

However, without final investment decisions on these projects, there is a risk that they will not proceed. The NSW Government has five options to enhance firm supply or reduce peak demand, if required, to meet the EST:

1. Fast-track the development of HumeLink. This new transmission project is a 2,600 MW upgrade which would allow Snowy 2.0 and existing generators in the Snowy region to send additional electricity to NSW. Prior to Snowy 2.0's construction, HumeLink would unlock

1,200 MW of existing generation capacity, of which 500 MW would be available during periods of peak demand.

2. Accelerate a further upgrade of the Queensland-NSW Transmission Interconnector Upgrade (378 MW).

3. Use the NSW Government's electricity contracts to stimulate private sector investment in firm generation. The NSW Government can procure a portion of general government agency load (up to 200 MW) with new projects which provide dispatchable capacity. This procurement approach may not lead to additional costs for agencies but could secure new investment in capacity. Other options include procuring electricity for specific loads for Sydney Trains, Sydney Metro and other NSW Government entities (such as Sydney Water).

4. Expand the Emerging Energy Program. The existing program has two funding streams. The Capital Projects stream includes grants of approximately $10 million to assist with the construction of a dispatchable energy project. The Pre-investment Studies stream provides grants of approximately $500,000 to fund activities that assist the development of a dispatchable energy project. The program has had more applications for Capital Projects than it can support with the program budget, and the Pre-investment Studies stream will create a longer-term project pipeline.

   Options to expand the Emerging Energy Program could include:

   - increasing the program budget to support more of the projects which applied to the Capital Projects stream; or
   - calling for a second round of applications including from the projects supported in the Pre-investment Studies stream.

5. Increase scheme targets under the Safeguard. This may involve increasing the targets for one or both of the component schemes.

These options will be assessed against the State's objectives, including to limit the financial exposure of taxpayers and consumers. The State will also not intervene in a manner that rewards investors who could have commercially invested without Government intervention but declined to do so.