Report on the effectiveness of the Wholesale Electricity Market 2020

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Executive summary

The purpose of this report is to assess the effectiveness of the Wholesale Electricity Market (WEM) against the five market objectives. These objectives can be summarised as: promoting safe and reliable electricity supply, encouraging competition among generators and retailers, avoiding discrimination against any energy options and technologies, minimising long-term costs to consumers, and managing electricity demand.

To date, the market objective of providing a safe and reliable electricity supply has been met. The State Government's reform program will help maintain safety and reliability into the future. The reforms aim to better incorporate renewable energy technologies into the WEM and maintain security of the electricity system. The reforms are urgent as the Australian Energy Market Operator has indicated that within three years it may not be able to maintain the security of the system.[1]

Risks to system security are emerging because the WEM was not designed to accommodate the quantity of renewable energy that is expected to enter the market in coming years nor the effect of rooftop solar on system demand. There is as much renewable generation capacity in the market as there is coal-fired generation capacity. Residential and small business customers have also installed 1,329 MW of rooftop solar systems, most of which was added in the last 10 years. Over the same period, about 600 MW of large-scale wind and solar farms have entered the market, supported by the Commonwealth Renewable Energy Target, and falling construction and technology costs.[2] In 2019, wind and solar farms provided 13 per cent of generation sent out in the WEM. The observed renewable generation growth is expected to continue. It is anticipated this will affect the reliability of the South West Interconnected System (SWIS) in two ways: by reducing minimum demand and increasing variability in supply.

Over the past five years, demand for electricity from the network has been steadily decreasing during the middle of the day. When rooftop solar systems are generating, less electricity needs to be supplied from the network.[3] Consequently, fewer thermal generators are needed to meet demand, and it is these generators that also provide services that maintain the security of the power system. In its 2017/18 WEM report, the ERA found that the output of Synergy's coal-fired generators was changing more than it had historically.[4] This variability is expected to place pressure on the operational costs and profitability of these generators. If this pressure forces those generators to exit the market prematurely, this may compromise system security and increase costs for consumers as low-cost generators leave the market.

Output from wind and solar generation is weather-dependent. This output increases the variability of electricity supply, complicates energy forecasting and means that more flexible resources including generators, demand side activity and batteries, are required to balance the demand and supply of electricity in real time. For example, the maximum half-hourly change in the output of solar and wind powered electricity supply in the SWIS increased

1 AEMO, 2019, *Integrating Utility-scale Renewables and Distributed Energy Resources in the SWIS*, p.3, (online).

2 The Renewable Energy Target is an Australian Government scheme designed to reduce greenhouse gas emissions. The scheme works by allowing renewable generators to create generation certificates for every megawatt hour of power they generate. Retailers purchase those certificates and submit to the Clean Energy Regulator to meet the retailers' legal obligations.

3 Surplus generation from rooftop solar systems is spilled into the distribution network. This surplus from rooftop solar systems displaces generation that would have come from market generators, traded through the WEM.

4 ERA, 2019, *Report to the Minister On the Effectiveness of the Wholesale Electricity Market – 2018 Final Report*, ERA, Perth, pp9-10, (online).

15 per cent after the Badgingarra wind farm began operating in January 2019.[5] A further 800 MW of renewable energy projects were under development in the SWIS in 2019. If these projects proceed, variation in supply from renewable generation will increase further.[6]

On a more positive note, the lower operating costs of renewable energy compared to thermal energy is contributing to the market objective to minimise long-term costs to consumers. In 2019, average balancing prices in peak periods were at their lowest levels since the market started. All consumers should benefit as the lower costs of electricity from grid-connected wind and solar farms are eventually passed through to retail prices. Renewable energy is also helping to keep costs down for some households, as consumers with rooftop systems demand less electricity from the network and lower their bills.

While energy prices are tending to be suppressed by renewable generation, the proportional cost of ancillary services has been trending higher and is currently 10 per cent of overall energy costs.[7] Ancillary service costs in the WEM are high when compared to other jurisdictions. The increase in costs does not appear to be the result of the increase in the quantity of renewables.[8] Rather, the level of ancillary service costs appears to be driven by the lack of competition in the balancing market. Providers of these ancillary services forego the opportunity to sell energy in the balancing market and price the balancing revenue forgone into their ancillary service bids.

The market objective of encouraging competition among generators and retailers is not being met. While Synergy's wholesale market share has fallen, largely because of rooftop solar, the WEM remains highly concentrated. Demand cannot be met without generation from the three largest generators: Synergy, Alinta Energy and Summit Southern Cross Power. More than a quarter of the time, demand cannot be met without Synergy's generation, particularly in the afternoons and into the evening when demand peaks. Consequently, the market is always dependent on its market power mitigation mechanisms to prevent the misuse of market power and the resultant higher energy prices.

These three suppliers know their generation is needed to meet demand and they each have the capacity to exercise market power and increase prices and profits. It is complicated and expensive to prove the misuse of market power after a breach has occurred. It takes time to investigate and bring action against a generator. In the meantime, the prohibited activity can continue for an extended period while the legal processes run their course.

Limited competition blunts the incentive to reduce costs and hampers the WEM from meeting the objective of minimising the long-term cost of electricity for consumers. The ERA has found that Synergy is pricing its energy in the WEM at a level that is higher than allowed by the Wholesale Electricity Market Rules, which is contributing to higher than necessary wholesale energy prices. Our compliance action against Synergy is currently before the Electricity Review Board.[9]

There are some opportunities for competition to improve. Rooftop solar systems are directly competing with market generators, particularly in the middle of the day. Once third-party grid-connected storage can participate in the wholesale market, there will be additional competition

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5 Based on 30-minute change in the output of non-scheduled generators occurred between July 2012 and March 2020.

6 AEMO, 2019, *2019 Electricity Statement of Opportunities*, p. 4, (online).

7 Ancillary services include load following, which is used to balance the supply and demand of electricity in real time, spinning reserve and load rejection reserve which cover sudden unexpected drops in supply and demand resulting from generator or network outages, and black start which allows the network to recover from widespread and severe outages.

8 The increasing variability from renewable generation has prompted AEMO to increase its load following ancillary service requirement during the day and decrease this requirement overnight.

9 ERA, (2019), *Investigation into Synergy's Pricing Behaviour: Investigation Conclusion, Notice*, (online).

as excess renewable energy is stored for later use and additional competition in the provision of ancillary services. The growth of large-scale solar and wind generation, and the retirement of ageing coal plants, could allow the WEM to become more diverse and competitive if investment in new generation capacity occurs across a broader set of market participants. However, additional competition will take time to emerge, and market concentration is unlikely to change materially over the medium term.

The market objective of avoiding discrimination against generation technologies is not being met, due to the exclusion of storage technologies, like large batteries, from the WEM. The State Government's reform program is expected to address this problem through government trading enterprise investment in storage technologies and by clarifying how storage can enter the WEM and earn revenue.

The market objective of managing electricity demand has been met only partially to date. There are incentives in the WEM for large customers and retailers to reduce their demand in peak periods with consequent cost savings across the electricity system. However, limited signals exist for residential and small business customers using less than 50 MWh each year. Most of these customers pay retail tariffs that charge the same price for each unit of electricity regardless of when it is used. The State Government's Distributed Energy Roadmap includes actions on customer education and tariff reform to encourage more efficient energy use. The objective of managing energy demand aligns with the State Government's objective to achieve net zero greenhouse gas emissions by 2050, which has been supported by the increasing share of renewables in the WEM.[10]

The reform program has just over two years to run. There are other changes being introduced through the reform program where details are still being developed, such as Western Power and Synergy ownership of batteries, the Whole of System Plan and market power mitigation mechanisms. The ERA considers that these reforms are likely to improve the WEM's ability to meet its market objectives, but it is too early to fully understand all the implications of these changes.

The reform program is broad and is being executed over a short time frame, so not every issue that emerges through the process can or will be addressed. Ideally, the electricity market should have the capability to self-correct and adapt to incremental changes in market conditions and refine and improve market operations, although this will not completely remove the need for major policy reviews of the market architecture.

Once the reforms are implemented, there will need to be an effective process for the WEM to improve incrementally and more expeditiously as issues arise. Operational and regulatory frameworks and decision-making processes in the WEM will need to be flexible to keep pace with operational and technological changes, such as the entry of electric vehicles, and to correct problems as they arise. Keeping the mechanisms free from bias, as the WEM objectives require, will ensure that the interests of any one party do not eclipse the interests of consumers and others.

[10] Government of Western Australia media statement, 28 August 2019 '*State Government details emissions policy for major projects*', (online) [accessed 14 July 2020].

1. Background

The ERA is required to review and prepare a report for the Minister for Energy on how effectively the WEM meets its objectives:

- every three years under the *Electricity Industry Act 2004*[11]
- annually under the Market Rules.[12]

This is an annual review under the Market Rules, and includes observations and commentary covering the period July 2018 to December 2019. The Market Rules require the report to the Minister to contain the following:

- A summary of the information and data listed in Market Rule 2.16.1. This is the data the Australian Energy Market Operator (AEMO) must provide to the ERA in the Market Surveillance Data Catalogue.
- The ERA's assessment of the effectiveness of the market, including how effectively AEMO and System Management carry out their functions. The assessment must include a discussion of the:
  - reserve capacity market
  - market for bilateral contracts for capacity and energy
  - short-term energy market
  - balancing market
  - dispatch processes
  - planning processes
  - administration of the market, including the Market Rule change process
  - ancillary services mechanisms.
- An assessment of any events or behaviour that influenced the effectiveness of the market.
- Any recommendations to increase how effectively the market meets the market objectives for the Minister for Energy to consider.

The ERA may also choose to address other issues not included above.

As detailed in the Market Rules:[13]

> The objectives of the market are:
>
> (a) to promote the economically efficient, safe and reliable production and supply of electricity and electricity-related services in the South West Interconnected System;
>
> (b) to encourage competition among generators and retailers in the South West Interconnected System, including by facilitating the efficient entry of new competitors;

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[11] *Electricity Industry Act 2004* (WA), s128.

[12] Wholesale Electricity Market Rules (WA), 21 July 2020, Rule 2.16.

[13] Ibid. Rule 1.2.1.

(c) to avoid discrimination in that market against particular energy options and technologies, including sustainable energy options and technologies such as those that make use of renewable resources or reduce overall greenhouse gas emissions;

(d) to minimise the long-term cost of electricity supplied to customers from the South West interconnected system; and

(e) to encourage the taking of measures to manage the amount of electricity used and when it is used.

1.1 Report structure

This report comprises two main sections. The first section assesses how effectively the market is achieving its objectives. The second section outlines the areas where the ERA is unsure how the reform process may influence the WEM's ability to meet some of its objectives.

The appendices to this report provide:

- Commentary on the WEM dynamics and the effective operation of main market processes.
- A summary of the submissions received in response to the ERA's issues paper.[14]

1.2 Consultation

On 7 November 2019, the ERA released an issues paper seeking comment from interested parties. In response, the ERA received six public submissions and one confidential submission. Stakeholder comments are addressed throughout this report and are summarised in the appendices. The public submissions are available on the ERA website.[15]

[14] ERA, 2019, *Report to the Minister for Energy on the Effectiveness of the Wholesale Electricity Market 2018/19 – Issues paper*, (online).

[15] These are summarised in Appendix 2

2. Is the Wholesale Electricity Market meeting its objectives?

The WEM objectives can be summarised as: promoting safe and reliable electricity supply, encouraging competition among generators and retailers, avoiding discrimination against any energy options and technologies, minimising long-term costs to consumers, and managing electricity demand. Over the review period the ERA has found that the WEM is meeting some, but not all, of these objectives.

2.1 Economically efficient, safe and reliable

The WEM's first objective is "to promote the economically efficient, safe and reliable production and supply of electricity and electricity-related services" in the SWIS.[16]

Over the review period, electricity has been produced and provided safely, and the WEM has achieved its reliability indicators. AEMO's latest ancillary services report confirmed that the "frequency remained in the normal operating band for 99.992 per cent of the time.[17] This meets the frequency operating standards specified in the technical rules."[18]

The excess accredited capacity in the WEM has contributed to supply adequacy. There have been no periods where electricity supply has been lost because of insufficient generation capacity in the SWIS.

The WEM has not met all aspects of the objective to date and there is a risk the WEM may not meet the objective in the future.

- Early in 2019, AEMO indicated that the WEM is at risk of not providing safe and secure supplies in the future (see section 2.1.1).
- The WEM has not met the objective of providing an economically efficient supply of electricity (see section 2.1.3).

2.1.1 Risks to future system security and reliability

Two risks challenge the future security of the WEM: falling minimum demand and the variability in the output of non-scheduled generators.

2.1.1.1 Falling minimum demand

AEMO has advised that controlling voltage on the network becomes challenging as the level of minimum demand decreases.[19] AEMO has estimated that network voltage in the SWIS becomes uncontrollable below 700 MW of demand. This is because when demand falls, the output of thermal generators, such as coal-fired and gas-fired plants, also decreases to maintain the balance of supply and demand in real time. Thermal generators provide many of the ancillary services that maintain system security, for example by providing stand-by energy

[16] Wholesale Electricity Market Rules (WA), 21 July 2020, Rule 1.2.1(a).

[17] The technical rules are available on the ERA's website (online).

[18] AEMO, 2019, *Ancillary Services Report for the WEM 2019*, p. 6, (online).

[19] AEMO, 2019, *Integrating utility scale renewables and distributed energy resources in the SWIS*, p. 4, (online).

when there is a generator or network equipment failure. During periods of low demand there are fewer of those resources operating to maintain the security of the system.

There is evidence to support a forecast decrease in minimum demand. Since 2014, the level of day-time minimum demand has decreased by 500 MW, bringing the minimum demand during the day below that during night hours.[20] (Refer to Figure 4 in Appendix 1)

Opinions differ on when minimum demand will reach the 700 MW threshold. AEMO's forecasts indicate that, with continued growth in rooftop solar installations, the SWIS would reach the 700 MW demand threshold between 2022 and 2024. AEMO considers that corrective actions or other solutions would be required to ensure secure electricity supplies, before the threshold is reached.[21]

Western Power has expressed a different view. In December 2019, Western Power forecast that minimum system demand in the SWIS would likely not reach 700 MW until well after 2025.[22]

AEMO has acknowledged the limitations of the modelling behind its estimate of the 700 MW threshold for minimum demand. AEMO stated that it did not account for some factors that could influence the estimate of the threshold.[23,24]

2.1.1.2 Variability

Large and unexpected changes in supply and operational demand create challenges for AEMO to manage system security.[25] AEMO must forecast the possible level of supply and operational demand variation and ensure that it has enough flexible resources in reserve for use when needed to maintain the security of the system.[26] Any increase in the variability of supply and demand, and uncertainty in forecasting the level of the possible variation, increases the need for flexible resources.

Output of wind and solar generation is variable and uncertain because it is driven by weather conditions. As the supply of energy from large wind and solar farms increases so does the possible variability of supply. In the SWIS, wind generation has been installed in geographical locations where wind patterns are favourable and tend to be driven by the same weather conditions. The output from wind farms in the same geographical location moves in unison,

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20 AEMO, 2019, *Integrating utility-scale renewables and distributed energy resources in the SWIS*, p. 24, (online).

21 Ibid, p. 3.

22 AEMO, 2019, WA Electricity Consultative Forum, meeting 23, Presentation: *System Low,* (online).

23 AEMO stated that "for the purpose of voltage control analysis, a reduction in network reactive power provision (reactive power losses) due to power flow was not considered accurately". AEMO also stated that "limitations related to transient stability, adequate synchronising torque, system strength, adequacy of UFLS [Under Frequency Load Shedding], detailed analysis of frequency control capability (and implications on ancillary services), and level of variability expected have not yet been studied on a system-wide scale". Under Frequency Load Shedding or UFLS is the automated disconnection of customers when the frequency of the electricity supply falls below pre-determined thresholds.

24 AEMO, 2019*, Integrating utility-scale renewables and distributed energy resources in the SWIS*, p. 52, (online).

25 Operational demand refers to electricity demand supplied by market generators.

26 For example, the Market Rules specify the standard for the load following ancillary service capacity. Clause 3.10.1 of the Market Rules requires flexible capacity in reserve to cover 99.9 per cent of the one-minute variance in the output of scheduled and non-scheduled generators and system load.

which increases output variability.[27] The increase in the generation from rooftop solar systems increases the possible variability of operational demand.

When a storm or cloud front crosses Perth, AEMO has reported that changes in rooftop solar generation can result in 10 per cent swings in demand within a half hour period.[28,29] Wind generation output can swing over 100 MW within a 30 minute trading interval – a quantity that exceeds the maximum load following ancillary services quantity available to the market, which is used to balance supply and demand in real time.[30] At industry events, AEMO has explained its operations to manage supply and demand variability from moment to moment over short time frames given the increasing share of renewable generation in the system.

In its report on the level of ancillary services required in the WEM for 2020/21, AEMO noted that about 520 MW of new intermittent generators would connect to the SWIS in the period.[31] AEMO indicated that it did not have enough information to determine the effect of this additional level of variable generation on the amount of load following capacity required, but expected that the requirement would increase. AEMO considered that the correlation between the output of variable generators was an important factor in determining the level of supply variability in the system, which it considered could only be understood though the observation of changes.

The ERA analysed the historical trend in the variation of the output of wind and solar farms and operational demand. The analysis measured the absolute amount of change in the output of non-scheduled generation and operational demand over different intervals ranging from five minutes to four hours. The main findings of the analysis are summarised below.

The variability of the output of non-scheduled generators has been increasing.[32] The maximum half-hourly change in the output of solar and wind generators increased from 185 MW in 2016 to 235 MW in early 2020 (refer to Figure 11 in Appendix 1). This variability is also apparent in the five-minute data where the maximum change increased from 105 MW in 2016 to 205 MW in 2019 (Figure 15).

The maximum half-hourly change in operational demand has been steady at around 500 MW over the last seven years (Figure 9). The maximum five-minute change in operational demand since 2016 increased by a relatively small amount of around 6 per cent in 2019. (Figure 14). The increase in variation in non-scheduled generation may reflect a lack of geographic diversity of wind farms.

Further analysis is needed to investigate the possible level of supply and operational demand variability in the system. Although observed variability of supply and demand during extreme

[27] Diverse sources will move up or down independently of each other and the net variation will be less than the sum of the individual variation.

[28] AEMO, 2020, *Quarterly energy dynamics Q1 2020, Market insights and WA market operations*, p. 40, (online).

[29] AEMO, 2019, WA Electricity Consultative Forum, meeting 22, Presentation: *Maintaining system security, the challenges faced during severe weather events*, (online).

[30] AEMO, 2019, WA Electricity Consultative Forum, meeting 20, Presentation: *Bad Friday*, (online).

[31] AEMO, 2020, *Ancillary Services Report for the WEM 2020*, p. 16, (online).

[32] Scheduled generators are defined in the market rules as those that can increase or decrease the quantity of electricity generated in response to instructions from System Management. These tend to be conventional thermal (steam) generators such as coal fired boilers, combined heat and power systems, combined cycle gas turbines, biomass boilers, as well as combustion technologies such as open cycle gas turbines, gas or liquid fueled reciprocating engines. Non-scheduled generators are defined in the market rules as those that self-schedule by the operator but can have their output curtailed on instruction from System Management. These tend to be variable output generators with renewable fuels such as wind turbines, solar photovoltaic, wave, and systems fueled by anaerobic digestion such as landfill gas reciprocating engines.
Wholesale Electricity Market Rules (WA), 21 July 2020, Chapter 11

events may indicate possible changes in variability, they do not provide a reliable estimate of possible level of variability, neither for the past nor the future.

AEMO conducted and published a detailed analysis of projected supply and demand variability and uncertainty for the National Electricity Market.[33] This included analysis of the effect of the correlation of the output of intermittent generators on the variability of supply and demand in the system.[34] The WEM can benefit from a similar analysis of variability to ensure the forecasting and operating mechanisms in the WEM are suitable for maintaining the reliability of the system in the future.

2.1.2 *Ensuring future reliability*

The State Government's reform program is implementing measures in response to the expected security and reliability challenges in the WEM.

These measures include:

- Publishing a Distributed Energy Resources (DER) Roadmap that identifies 36 actions necessary to guide the continued integration of DER such as batteries, electric vehicles and rooftop PV.[35]
- Addressing how batteries can operate in the SWIS.
- Identifying and procuring new ancillary services, to be called essential services, to respond to greater variability in supply and demand. The new mechanism to procure essential services will be co-optimised with energy dispatch, with a regulated supplementary mechanism, for when insufficient capacity is available.
- Changing generator performance standards and the technical rules governing network participation and operation to enable AEMO to manage the security of the system.

In the short term, AEMO is making operational improvements to better manage the security of the system. During 2019/20, AEMO reviewed and changed how it planned for the quantity of ancillary services required to help maintain system security.[36] Load following and load rejection ancillary services requirements now better reflect the need for these services at different times over a 24-hour period. AEMO indicated that the quantity of ancillary services identified in 2019/20 would remain unchanged for use in 2020/21, although it intended to use weather forecasting as a guide to increase the amount required on days it anticipated would be subject to greater variation in supply and demand. AEMO indicated it may need to revisit the requirements after the connection of the Yandin and Warradarge wind farms to determine if their connection will trigger an increase in requirement.[37]

2.1.3 *Economic efficiency of the market*

An economically efficient market produces energy at the lowest cost possible. The ERA considers that the WEM is not currently producing energy at least cost. The following examples support this conclusion:

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33 AEMO, 2020, *Renewable integration study stage 1 appendix C: managing variability and uncertainty*, (online).

34 Ibid, p. 22.

35 Energy Transformation Taskforce, 2019, *Distributed Energy Resources Roadmap,* (online).

36 AEMO, 2020, *Ancillary Services Report for the WEM 2020*, p. 16, (online).

37 ERA, 2020, Decision on AEMO's 2020 Ancillary Services Requirements, p. 5 (online)

- Rather than the market optimising the cost of ancillary services simultaneously, the market optimises energy, then schedules ancillary services through separate processes: some manually and some through a market. AEMO derives the costs of the administered mechanisms from modelling that may not fully reflect market conditions at the time costs are accrued.
- The market lacks a way to optimise operational decisions around cost and risk implications for the market. For example, system operators cannot consider the benefits and costs of constraining generators' output versus scheduling additional spinning reserve.[38] This is discussed further in section 3.1.
- Currently, AEMO schedules generators for least-cost dispatch to meet demand. However, AEMO and Western Power must also manually intervene in the dispatch process to maintain power system security. If there is network congestion, Western Power instructs AEMO to constrain the output of some generators through the Generation Interim Access scheme, to maintain network security.[39] This means that, behind a constraint, higher cost generators are preferentially dispatched before lower cost generators that are constrained according to their access contracts, which is not economically efficient.
- AEMO procures the load following ancillary service though a market and uses it to balance the demand and supply for electricity in real time. Although infrequent, there are occasions when the load following requirement changes after the LFAS market has closed. For example, if there is a change in the wind forecast, AEMO may decide it will need additional LFAS. If the market has closed, AEMO must then procure Backup LFAS, which is often priced higher than the market offers. This means the security of the system is managed but at a higher cost because AEMO must utilise backup LFAS ahead of other uncleared lower cost capacity.[40]

In addition, AEMO is limited by the administrative processes in place to procure other ancillary services, such as spinning reserve. These services are not competitively procured and rely on regulatory mechanisms that can only approximate competitive outcomes.

Economic efficiency is linked to the objectives to encourage competition and to minimise long term costs to consumers, which are discussed further in sections 2.2 and 2.5.

2.2 Encouraging competition

The WEM's second objective is "to encourage competition among generators and retailers in the South West Interconnected System, including by facilitating the efficient entry of new competitors".[41] The WEM is not meeting the market objective of encouraging competition.

38 Due to the network topography, the connection of the North Country generators has potential for the collective contingency to exceed that of the largest single generator on the system. The contingency can be mitigated by reinforcing the electricity network or managed by reducing the output of generators to the spinning reserve requirement set by output of the largest generator or by increasing the spinning reserve requirement to meet the larger contingency. However, the decision to constrain generator output or increase the reserve is not based on the least cost means of managing the contingency.

39 In recent years, some renewable generators have entered the WEM through the Generator Interim Access scheme. Generators are made aware when they join through this scheme that their output may be constrained down to maintain system security.

40 Backup LFAS is available to AEMO when it needs to increase LFAS after the LFAS market for a particular trading interval has closed.

41 Wholesale Electricity Market Rules (WA), 21 July 2020, Rule 1.2.1(b).

2.2.1 Competition indicators in the WEM

Market concentration is widely used as an indicator of the competitive status of a market. Over the review period, Synergy was the largest generator by capacity and electricity generated in the WEM, followed by Summit Southern Cross Power and Alinta. These three generators produced around 90 per cent of the electricity generated in the wholesale market, as shown in Figure 16 in Appendix 1.

Since 2010, the level of concentration in the balancing market has trended downwards. The Herfindahl Hirschman Index (HHI) is one measure of market concentration. This is the sum of squares of market share and for the WEM is based on companies' generation into the market. A market with an HHI of less than 1,500 is considered a competitive marketplace; an HHI of 1,500 to 2,500 is a moderately concentrated marketplace, and an HHI of 2,500 or greater is a highly concentrated marketplace. At the end of 2019, the WEM had an HHI of just over 4,500, indicating that it is highly concentrated.[42] (Refer to Figure 17 in Appendix 1)

The HHI changes only when new suppliers enter the market, incumbent suppliers exit the market, or when there are changes in the ownership or output of generation capacity.

Although there has been some redistribution of market share across market participants, this has largely occurred between the largest three generators in the market rather than via the entry of new participants. For example, from 2018 to 2019, Synergy's market share of electricity generated decreased from 44 per cent to 41 per cent. Around two-thirds of that decrease in market share was gained by Alinta, whose market share of electricity generated increased from 17 per cent to 19 per cent. Summit Southern Cross Power and ERM (Newgen Neerabup) picked up around 0.5 per cent of market share each.

There has been investment in new generation, but this has been predominantly made by a few existing participants. The new Badgingarra wind farm is owned by Alinta. Two more wind farms, Yandin and Warradarge, will enter the WEM in 2020. These are owned by Alinta and a Synergy joint venture, respectively. Investment by incumbent generators does not materially change market concentration.

Considering the HHI in combination with other market competition indicators provides a view on the performance of the market and any possible existence of market power. The ERA has considered two additional indicators of competition in the market: the Gini coefficient and the pivotal supplier test.[43]

The Gini coefficient measures the distribution of market share and ranges from zero, being perfect equality, to one, being monopolistic. Typically, a Gini coefficient of 0.35 would represent moderate inequality in a market, whilst a Gini coefficient of 0.60 or higher would signal a very uneven distribution of market share across market participants and concentration of the market in a relatively small number of participants.[44] In the case of the WEM, the Gini coefficients for the different market mechanisms are very large, with values of 0.89 for retail (including the franchise market), and 0.92 for wholesale and the capacity mechanism.

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42 The 4,500 HHI score for the WEM includes bilateral contracts. Accounting for bilateral agreements between generators is important because those bilateral arrangements between generators increase the concentration of the supply of risk management instruments in the market.

43 The Gini coefficient is a ratio of evenness of a distribution derived from a comparison between a Lorentz curve and an even distribution. A Lorentz curve is a cumulative percentage share distribution ranked from smallest to largest.

44 Commission for Regulation of Utilities, 2019, Electricity and Gas Retail Markets Report, Q2 2019, online, P81

This market concentration and inequality, as measured by the HHI and Gini coefficient, is symptomatic of market power.

The ERA also conducted a pivotal supplier test in the SWIS. The test is used to determine which market participants have market power, which is defined as the capacity to influence pricing through economic or physical withholding of capacity. The pivotal supplier test assesses whether a supplier is needed to clear the quantity of demand in a market.

The results of the pivotal supplier test for the SWIS confirmed that the balancing market cannot clear without the three largest generators, and for around a quarter of the time, it cannot clear without Synergy alone. As market power is an ever-present feature, the WEM currently relies on market power mitigation mechanisms to ensure prices in the wholesale market do not increase above the cost of generation.[45,46]

To mitigate the exercise of market power, the WEM is mainly reliant on *ex post* market power mitigation measures. The ERA monitors the market, investigates possible misuse of market power and takes regulatory action if a participant's behaviour is found in breach of the Market Rules. These measures rely on the deterrence provided by enforcement and penalties. Investigations and legal proceedings are costly to both the ERA and the market participant. A market participant can continue to exercise market power, with adverse consequences for market participants and consumers, while an investigation and subsequent legal action is underway.

The ERA's investigation into Synergy's bidding behaviour found that Synergy was not bidding into the balancing market consistent with its reasonable expectations of its short run marginal cost, and that this behaviour was related to Synergy's market power. This matter is before the Electricity Review Board for determination.

2.2.2 *Improving competition*

Growth in electricity demand previously provided the opportunity for diversification of supply in the electricity market by creating room for independent entities to enter. Synergy's scheduled generation capacity was capped to encourage private investment and improve competition by limiting Synergy from expanding its market share.

AEMO is forecasting excess capacity in the WEM, coupled with declining consumption and demand over the next decade.[47] This reduces the opportunities and incentives to enter the market.

Large-scale renewable generation has been encouraged into the market by the Commonwealth Government's Renewable Energy Target scheme. However, the entry of renewables has not materially reduced market concentration, in part because some generation investment was made by incumbent market participants with already substantial market shares. Now that the Renewable Energy Target has been met, there are fewer incentives for new investment in large-scale renewable projects.[48]

Future plant retirements, for example the retirement of Muja Power Station Stage C, remain the best opportunity to improve competition in the WEM. However, changes to the capacity mechanism insulate the capacity revenue of incumbent generators from the effect of new

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45 ERA, (2019), *Investigation into Synergy's Pricing Behaviour: Investigation Conclusion, Notice*, (online).

46 Aside from the case against Synergy, there is no evidence market power is being exercised.

47 AEMO, 2020, *2020 Electricity Statement of Opportunities*, p.3, (online).

48 The Renewable Energy Target quantity will cease increasing from 2020. New projects will create an excess supply under the scheme reducing the value of the subsidy.

entrants to the market for the next 10 years. This may increase the overall cost of capacity to consumers and delay the orderly exit of aging plant from the market when there is a surplus.[49]

2.2.3 Risks to competition

Increasing the diversity of ownership and supply enhances market competition. With declining demand in the electricity market and surplus generation, opportunities for new generation facilities that might increase competition are likely to be limited.

Batteries could help to address low load periods, firm supply from intermittent generation, and increase competitive rivalry in the balancing and ancillary services. In South Australia, the Hornsdale Power Reserve was instrumental in mitigating the market power of the incumbents, which reduced the wholesale price of electricity when interconnector constraints with Victoria were in place.[50]

The DER Roadmap outlines the involvement of Synergy and Western Power in battery installations to understand the possibilities and implications of DER participation in the WEM. However, the way the first batteries will participate may introduce some unintended consequences for competition.

Western Power's ownership of batteries could represent a conflict in the same way it would be conflicted by owning generation. The possible conflict in this expansion of Western Power's responsibilities was recently raised in several submissions to EPWA's consultation on proposed changes to the Access Code.[51] Many submissions expressed concern or reservations about Western Power's move to install batteries, including one from the market operator. Western Power is prohibited from owning generation facilities as this would provide an incentive for it to limit competitors' access to the network. For example, Western Power may have an incentive to make it difficult for third parties to invest in batteries that would compete with its own investment in batteries, by setting onerous technical performance standards or unfavourable network tariffs.

In the same way, Synergy's ownership of batteries may conflict with its commercial relationship with households, who have the option of individually investing in household

49 The effect of insulating incumbent generators from the capacity price signal is to mute the signal to exit the market. Incumbent generators will receive higher revenue streams when there is surplus capacity in the market. This may enable generators to remain in service for longer than would otherwise be the case. The reserve capacity price for the 2021/22 capacity year is $114,000 per MW for transitional or incumbent facilities and $78,573.33 per MW for incoming facilities.
AEMO, 'Reserve Capacity Price', (online) [accessed 4 June 2020].

50 AEMO, 2018, Hornsdale Wind Farm 2 FCAS Trial: Knowledge Sharing Paper, online, p4
AURECON, 2018, Hornsdale Power Reserve – Year 1 Technical and Market Impact Case Study, Aurecon, online, pp2, 21-23
AURECON, 2020, Hornsdale Power Reserve – Year 2 Technical and Market Impact Case Study, Aurecon, online, pp6-11

51 Australian Energy Council, 2020, Proposed Changes to the Electricity Networks Access Code, AEC, online, pp 3-4
AEMO, 2020, AEMO Access Code Submission, AEMO, online, p11
AGL, 2020, Energy Transformation Strategy: Proposed Changes to the Electricity Networks Access Code, online, p2
Alinta, 2020, Proposed Changes to the Electricity Networks Access Code, online, p2-3
Change Energy, 2020, Submission - Energy Transformation Strategy: Proposed Changes to the Access Code, online, p1
EDL, 2020, Proposed Changes to the Electricity Networks Access Code , EDL, online, p2
Perth Energy, 2020, '*Submission on the Proposed Changes to the Electricity Networks Access Code*', Appendix A pp. 1-2, (online) [accessed 16 July 2020].

batteries to achieve greater energy independence. An alternative mechanism for access to batteries could be to seek commercial interest from the market to provide battery services to consumers. This may encourage product innovation that might otherwise not occur and provide a simpler set of incentives on parties providing the services.

2.2.4 *Market power mitigation*

Regulation seeks to limit the opportunity for market participants to exercise market power. However, it cannot apply the same pressure to reduce costs to maintain market share that effective competitive rivalry can provide.

The WEM's market power mitigation mechanisms are largely reactive, and the ERA's investigations are complex, resource intensive, and time-consuming. Therefore, the adverse outcomes for other market participants and ultimately higher costs for energy consumers that flow from the misuse of market power can continue for extended periods before the behaviour is identified and remedied. The ERA's investigation into Synergy's pricing conduct covered the period from April 2016 to July 2017, commenced in late July 2017 and concluded in April 2019.[52] The Electricity Review Board process, which will determine any breach, will likely not be complete until some time in 2021.

Market power mitigation in the WEM remains essential to the orderly operation of the market and delivering its objectives: particularly minimising the long-term cost of electricity for consumers.

2.3 Avoiding discrimination

The WEM's third objectives is "to avoid discrimination against particular energy options and technologies, including sustainable energy options and technologies such as those that make use of renewable resources or that reduce overall greenhouse gas emissions".[53]

The WEM is not currently meeting this objective because:

- not all types of technology, such as batteries, can participate commercially in the WEM
- positive discrimination favours some technologies.

The Market Rules and technical rules discriminate by providing no clear registration path for batteries and there are limited incentives for demand side management participation. However, the State Government's Energy Transformation Strategy:

- Has outlined how storage technologies can participate in the capacity mechanism.[54]
- Is addressing barriers to entry for storage technologies. A new "storage system" facility class will be introduced so batteries can participate in the wholesale and essential service market.[55]
- Has identified barriers to the participation of DER, the risks emerging from the current situation and, through the DER Roadmap, recommended actions to encourage the active participation of distributed energy in the SWIS.

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52 ERA, (2019), *Investigation into Synergy's Pricing Behaviour: Investigation Conclusion, Notice*, (online).

53 Wholesale Electricity Market Rules (WA), 21 July 2020, Rule 1.2.1(c).

54 EPWA, 2020, *Storage Participation in the Reserve Capacity Mechanism*, (online).

55 EPWA, 2020, *Registration and Participation Framework in the Wholesale Electricity Market*, p. 8, (online).

There has been positive discrimination in the WEM for both renewable and thermal generation. Renewable generation has benefitted from incentives created by the Renewable Energy Target. Rooftop solar systems have received subsidies in the form of:

- The Small-scale Renewable Energy Scheme, which creates a financial incentive for individuals and small businesses to install eligible small-scale renewable energy systems such as rooftop solar systems.
- Feed-in-tariffs, which reward rooftop solar generation that is discharged back into the electricity network when not consumed behind the meter.

These incentives encouraged the adoption of rooftop solar technology. The incentives may no longer be needed now that the technology has matured, installation costs have dropped substantially, and there are many installers in the market.

Thermal generation costs are lower than they would be under a greenhouse gas emissions pricing or trading scheme. This may encourage thermal generators to remain operational longer, delaying their replacement with lower cost renewable generation. Policy uncertainty at the national level regarding the Renewable Energy Target and the lack of a mechanism to account for the cost of greenhouse gas emissions is also likely to hinder investment in renewable and non-renewable generation.[56] [57]

2.4 Encouraging measures to manage when and how much electricity is used

The WEM's fifth objective is "to encourage the taking of measures to manage the amount of electricity used and when it is used".[58] This objective is only being partially met.

WEM participants are incentivised by the Individual Reserve Capacity Requirement (IRCR) to manage demand in support of system security. AEMO assigns an IRCR quantity to market retailers based on their usage in peak demand periods. Retailers then must procure capacity credits equivalent to their IRCR quantities. Retailers can reduce their IRCR liability by encouraging their customers to move their load away from peak demand periods.

The IRCR incentive has encouraged larger customers to reduce demand during peak demand periods. Over the last eight years, the IRCR reduction has ranged from 41 MW to 82 MW; reducing peak demand by approximately 2 per cent.[59] However, AEMO's submission to the ERA's issues paper highlighted the limitations of the IRCR in reducing load in support of system security.[60] AEMO stated that a market participant's IRCR response was not transparent and difficult to forecast. Predicting when consumers should lower their demand for IRCR becomes more challenging as more customers respond and reduce demand.

56 For example, the International Energy Agency developed a model using real options analysis to assess risks associated with uncertainty in climate policy. The model's results found that the uncertainty was reflected as a risk premium for power generation investments with carbon exposure. Refer: Blyth W., Bradley E, Bunn D, Clarke C., Wilson T., Yang M., (2007) "Investment Risks under Uncertain Climate Change Policy", In Energy Policy, Vol 35, pp 5766-5773, Elsevier

57 Simpson G., Clifton J., (2013) "Picking Winners and Policy Uncertainty: Stakeholder Perceptions of Australia's Renewable Energy Target", In Renewable Energy, Vol 67, pp128-135, Elsevier

58 Wholesale Electricity Market Rules (WA), 21 July 2020, Rule 1.2.1(e).

59 AEMO, 2019, *2019 Electricity Statement of Opportunities*, p. 44, (online).

60 AEMO, 2019, *Submission to 'Effectiveness of the Wholesale Electricity Market 2018/19 - Issues paper'*, p.4, (*online*).

There is not an equivalent IRCR incentive for residential customers, and businesses that consume less than 50 MWh each year. Although time of use tariffs exist for these customers, they are rarely used. Residential and small business customers are not generally aware of the different costs of providing electricity at different times of the day, and their capacity to respond to price signals may be limited. Households and other small customers have limited information on how to reduce their consumption, and no price signals to move discretional consumption to times when the wholesale cost of electricity is cheaper. Those customers who can afford to install rooftop solar do so to help reduce their electricity bills. Consumers have responded to the price signals available to them which allowed cost shifting to other customers to occur and now has implications for the stability of the wholesale electricity market.

The State Government's DER Roadmap identifies the need to develop new network and retail pricing signals to residential consumers that better reflect the cost of power supply. The proposed programs include tariff pilots, and customer education to encourage behaviours that reduce costs for both households and the electricity system.

2.5 Minimising the long-term cost of electricity supplied to customers

The WEM's fourth objective is to "minimise the long-term cost of electricity supplied to customers from the South West Interconnected System".[61]

Prices in the WEM were relatively low over the latter half of 2018 and through most of 2019 compared to previous years. The uptake of rooftop solar and mild weather conditions reduced demand for electricity and the entry of Badgingarra wind farm introduced new low-cost supply into the market.

Despite lower prices, the WEM is not effectively meeting its objective to minimise long-term costs to consumers. Prices in the WEM are higher than they could be because:

- In the balancing market, the ERA found Synergy was pricing above the levels prescribed in the rules.[62]
- Network and wholesale market costs are not optimised.
- Ancillary service costs are proportionally higher in the WEM than in other jurisdictions.
- The transitional capacity price, paid to incumbents for their capacities, increases the cost of capacity procurement.

Synergy's pricing is discussed in section 2.2 and wholesale and network cost optimisation is covered in section 3.1. The other two bullet points are outlined below.

Ancillary service costs in the WEM are higher than those in other jurisdictions. The ERA commissioned Energy Market Consulting Associates (EMCa) to undertake research and benchmark costs of ancillary services in different jurisdictions.[63,64] Based on data from 2013 to 2018, EMCa normalised the cost and quantity of frequency management ancillary services

61 Wholesale Electricity Market Rules (WA), 21 July 2020, Rule 1.2.1(d).

62 ERA, (2019), *Investigation into Synergy's Pricing Behaviour: Investigation Conclusion, Notice*, (online).

63 EMCa (2020) Report on the benchmarked costs of ancillary services in different jurisdictions, (online).

64 Jurisdictions included in the study were the WEM, the National Electricity Market, the National Electricity Market of Singapore, the New Zealand Electricity Market, and the California, Texas, and the PJM Interconnection in the USA.

in the WEM and benchmarked systems to account for differences in system size and cost of supply of energy. EMCa found that:

- Load Following Ancillary Service (LFAS) normalised costs (both upwards and downwards) were higher than the costs of equivalent services in other jurisdictions:[65]
  - LFAS normalised costs in the WEM were trending upward. This was driven by the prices offered by market participants in the LFAS market rather than any change in demand for these services.[66]
  - In comparison, normalised LFAS costs in the National Electricity Market and markets in New Zealand and Singapore were trending downward.
- LFAS normalised quantities procured (as a percentage of system load) were generally high compared to the other jurisdictions.
- Spinning reserve in the WEM was more expensive compared to equivalent mechanisms in many other jurisdictions, despite the WEM procuring less quantity of spinning reserve than other jurisdictions. Estimated normalised costs of spinning reserve for the WEM were trending upwards.
- System restart ancillary service costs in the WEM were low compared to other jurisdictions.

Ancillary services costs and quantities in different electricity systems can differ for many reasons, including differences in energy supply mix, demand variation and procurement efficiency. It is unclear to what extent the variation between the ancillary service costs observed could, for example, be attributed to inefficiency in the procurement of the services. Instead, the higher ancillary service costs appear to be driven by the lack of competition in the balancing market. Load following ancillary services (the largest element of ancillary services costs) rely on the same short-run marginal cost provisions that apply in the balancing market. Providers of these ancillary services also forego the opportunity to sell energy in the balancing market and price the balancing revenue forgone into their ancillary service bids.

Recently, the pricing of reserve capacity has changed. The new capacity pricing model seeks to better signal the economic value to the market of incremental capacity when supply is tight, as well as when it is in excess. The proposed changes implement a decade-long “transitional” period during which existing capacity assets will receive capacity prices similar to what they would have received before the pricing changes were made.

Electricity, capacity, network and ancillary service costs are ultimately passed through to consumers. If these costs are not efficient then the long-term cost of electricity to consumers is not minimised and the WEM is not meeting the market objective.

The State Government’s reform program is implementing measures to enable more generation to connect in the WEM. Introducing constrained network access will mean low cost and flexible generation can connect to the SWIS.[67] The output of generators in some areas of

[65] Load following ancillary service (LFAS) is used to continuously balance supply and demand. LFAS accounts for the difference between scheduled energy (what has been dispatched), actual load, and intermittent generation. LFAS Upwards requires the provision of additional generation to maintain power quality (frequency) in real time and LFAS Downwards requires the reduction in generation to maintain power quality.

[66] Over the benchmarked period, the required amount of LFAS was constant at 72MW (for both upwards and downwards LFAS). AEMO changed the requirement in late August 2019.

[67] For generators to connect in an unconstrained manner, they may need to pay for network augmentation to ensure they can dispatch at any time. The costs for this can be large. Constrained access allows generators to avoid network augmentation costs on the understanding their output may be reduced when the network becomes fully loaded.

the network may be constrained to protect network and system security. However, new generators will be able to avoid network augmentation connection costs.

The reform program is also opening the provision of many essential services to competition. As part of these changes, the dispatch of energy and essential services will be automated and co-optimised to take account of constraints or congestion on the network. The goal of these amendments is to provide economically efficient procurement and dispatch of energy and essential services.

By opening the provision of many essential services to competition, the reform program will address some aspects of economic efficiency in the market. As part of these changes, the dispatch of energy and essential services will be automated and co-optimised to take account of constraints or congestion on the network. The security constrained economic dispatch "is a set of systems and process that can be used by AEMO to automatically determine the combination of generators that should be dispatched across energy and most essential system services market to achieve the overall least-cost secure and reliable supply in the presence of network constraints."[68]

The goal of these amendments is to provide economically efficient procurement and dispatch of energy and essential services. Energy Policy WA (EPWA) has convened the 'WEM reform implementation group' to identify and work through implementation of a new market dispatch IT system to co-optimise the supply of energy and essential system services in a constrained network.

The introduction of constrained network access by the State Government's reform program will allow generation to continue to connect to the SWIS.[69] The output of generators in some areas of the network may also be constrained to protect network and system security; however, generators will be able to avoid network augmentation connection costs. The current network access arrangements mean that where there is insufficient spare network capacity, generators seeking to connect to the network are required to bear the cost of augmenting the network themselves, the cost of which can create a barrier to investment in new generation capacity.

68 EPWA, 2020, *Energy Transformation Strategy: Proposed Changes to the Electricity Networks Access Code Consultation Paper,* p. 33, (online).

69 For generators to connect in an unconstrained manner, they may need to pay for network augmentation to ensure they can dispatch at any time. The costs for this can be large. Constrained access allows generators to avoid network augmentation costs on the understanding their output may be reduced when the network becomes fully loaded.

3. Emerging challenges

It is too early to fully understand the implications of the reform program. The ERA has identified two emerging challenges to the WEM in meeting its objectives and will monitor these throughout the next review period. These challenges are:

1. Whole of system cost optimisation
2. Decision-making processes in the WEM.

Sections 3.1 and 3.2 provide examples to illustrate the relationship of these challenges to the reform program. Addressing these challenges will support the ongoing market development and coordinated decision-making required to meet the market objectives in coming years.

3.1 Whole-of-system cost optimisation

3.1.1 *Coordination of network outages*

Decisions about network investment and generator connections to the network can have adverse consequences for cost optimisation in the WEM. This is because decisions on network investment, system management and operation can be made in isolation. Without coordination, independent decisions may be made by one entity that do not result in least-cost outcomes for the market as a whole. For example, Western Power plans network outages to manage its network efficiently. At times, network outages can cause connected generators to be unable to supply, partially or fully, into the wholesale market. The market incurs a cost if more expensive generation needs to be dispatched to cover the missing output. In 2013, the Australian Energy Market Commission determined that network outages lead to higher overall costs.[70]

There is currently no mechanism in place to ensure that network outage planning chooses the overall least-cost plan accounting for costs to the network owner, wholesale market and customers directly or indirectly affected by the planned outage.

In its issues paper, the ERA sought feedback on the need for coordination of outages.[71] In its submission, Alinta encouraged greater coordination between AEMO, market participants and Western Power to minimise costs across the market.[72] While Western Power supported planning processes that considered the effect its outages would have on market participants, it suggested that this should be AEMO's responsibility.[73] However, the planning criteria in the Market Rules only allow generation adequacy to be considered in approving outages, not economic outcomes, and AEMO cannot anticipate, propose, or schedule Western Power's maintenance program on its behalf.[74]

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70 Roam Consulting, 2013, *Modelling Transmission Frameworks*, Report EPR0019, p. 53, (online)

71 ERA, 2019, *Report to the Minister for Energy on the Effectiveness of the Wholesale Electricity Market 2018/19 – Issues paper,* (online).

72 Alinta Energy, 2019 Submission to '*Effectiveness of the Wholesale Electricity Market 2018/19 – Issues paper*', (online).

73 Western Power, 2019 Submission to '*Effectiveness of the Wholesale Electricity Market 2018/19 – Issues paper*', p. 1, (online).

74 Wholesale Electricity Market Rules (WA), 2 July 2020, Rule 3.19.6.

3.1.2 Whole of system planning

Other jurisdictions have mechanisms in place to coordinate planning across the transmission network and wholesale sectors. In the National Electricity Market, the Integrated System Plan provides a planning framework to meet power system needs while optimising net market benefits in the long-term interests of consumers.[75]

In the WEM, the Energy Transformation Taskforce is developing a Whole of System Plan. Scheduled to be published later in 2020 the first Plan will consolidate aspects of power system planning to give an overview of how the SWIS is likely to develop between 2020 and 2040.[76]

The ERA considers that three measures would assist to optimise investment across the network and market.

The first is the inclusion of an overarching decision-making framework to identify which network investment options best assist the WEM to meet its objectives. For example, if conflicting alternative paths are available, a principle-based framework would identify which alternative investment path best meets the WEM objectives. Such a framework would address the uncertainly in system variables such as demand, technologies, costs and consumer behaviour, which drive modelling outcomes.

Secondly, non-network solutions, such as demand management programs to reduce peak demand and defer network investments, could lead to lower costs in the long term. The residential sector's widespread adoption of rooftop solar demonstrates the ability of consumers to adopt alternatives to conventional electricity supplies. An effective demand management program in the SWIS could deliver peak demand reductions.[77] Measures to address periods of low demand are an alternative to network and generation capacity augmentations and can be done at lower cost than traditional network and generation capacity augmentation.

Thirdly, the Whole of System Plan should be expanded to consider microgrids. This was identified as an omission in the final report of the Economics and Industry Standing Committee's inquiry into microgrids and associated technologies. The committee acknowledged that microgrids were not considered in the Whole of System Plan. The final report stated:

> Whilst the WOSP [Whole of System Plan] program of work clearly anticipates the impact of DER, such as solar PV and battery technologies, it is not clear on the evidence available to the Committee whether the WOSP will consider the role that microgrids might play in the development of the SWIS.[78]

The inquiry commented on the expansion of Western Power's standalone power system trials "to an additional 60 sites, with scope for up to 15,000 additional sites." This could have a major influence on demand, particularly around the edges of the SWIS, which in turn would have implications for modelling outcomes in the Plan:

[75] AEMO, 2019, *Draft 2020 Integrated System Plan,* p. 8, (online).

[76] Government of Western Australia, 2019, *Whole of System Plan modelling methodology and assumptions. Information paper November 2019,* p.1, (online).

[77] In recommendation three, the ERA noted that costs of supply across the market can be reduced through "retail tariff reforms and/or public education programs". ERA, 2019, *Report to the Minister for Energy on the Effectiveness of the Wholesale Electricity Market 2018 – Final Report,* p.v, (online).

[78] Legislative Assembly Economics and Industry Standing Committee, 2020, *Taking charge: Western Australia's transition to a distributed energy future*, final report, p. 63, (online).

> Much as the large scale generation mix and network development outcomes are likely to have differential cost and technical implications under the different scenarios, so too could the likely emergence and relative efficiencies of microgrid solutions differ. The WOSP should specifically consider the macro-level role that microgrids could play in system development under the selected scenarios. This would complement the work being undertaken in the DER Roadmap program of work.[79]

3.2 Decision-making process in the WEM

Adaptions and improvements to the WEM are made through a decision-making process involving procedure changes, rule changes and policy development. Given the current pace and complexity of technological change, it is increasingly important that the WEM decision-making process is well coordinated, involves relevant stakeholders, promotes WEM objectives and places clear accountabilities on market institutions.

Since the commencement of the WEM, the decision-making process has successfully facilitated some improvements, such as introducing the balancing market.[80] Two complex and inter-related forces are increasingly putting the decision-making process under stress:

- technological change in the supply of electricity
- consumers using partial substitutes to grid-supplied electricity.[81]

In addition, the decision-making process has been challenged by more complex initiatives, such as the constrained access arrangements, where financial stakes are high and the allocation of costs and benefits could change substantially.

The policy changes under way as part of the State Government's reform program were prompted by the threat to future system reliability.[82] The reform program is introducing changes to accommodate the integration of behind-the-meter solar technology and large-scale wind and solar farms.[83] To facilitate the reform process, the Minister for Energy has the power to bypass the rule change process in order to implement improvements recommended in the Energy Transformation Strategy.[84] The decision-making process can be better coordinated to deliver ongoing and incremental changes in the market. However, this may not eliminate the need for large-scale reform programs to address future necessary changes in market structure.

The following three sections outline how the lack of coordination in the decision-making process may limit the ability of the WEM to respond to technological and economic challenges. In summary:

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79 Legislative Assembly Economics and Industry Standing Committee, 2020, *Taking Charge: Western Australia's Transition to a Distributed Energy Future*, p. 64, (online).

80 ERA, 2010, *Annual Wholesale Electricity Market Report for the Minister for Energy 2009,* (online).

80 ERA, 2011, *Annual Wholesale Electricity Market Report for the Minister for Energy 2010,* p. 43, (online).

81 Rooftop solar is considered a partial substitute as it still requires some grid connection to spill surplus generation back into the network or to meet demand when resource is not available or instantaneous demand at a premise exceeds the output of a system.

82 AEMO forecasts that between 2022 and 2024, voltage in the SWIS cannot be controlled within technical limits. AEMO, 2019, *Integrating utility scale renewables and distributed energy resources in the SWIS*, p. 3, (online).

83 Energy Transformation Taskforce, 2019, *Whole of System Plan modelling scenarios* p.3, (online).

84 This power expires on 1 July 2021. *Electricity Industry (Wholesale Electricity Market) Regulations 2004*, (WA) Clause 7(5), (online).

- There is a lack of oversight of changes to market procedures.
- The changes proposed to improve the Rule Change Panel's response to the increasing scope and complexity of rule changes may not have the desired effect.
- Organisations' roles and responsibilities in the future WEM may need to be clarified.

A broad and independent review of the WEM decision-making process would complement the ERA's periodic WEM effectiveness reviews and the work of the reform program to address the roles and responsibilities of market entities.

3.2.1 Oversight of changes to market procedures

The Market Rules and market procedures specify processes for the administration, operation and planning of the WEM. The Market Rules stipulate that any amendments must be consistent with the objectives of the WEM.[85] All amendments require consultation with market participants, but only changes to Market Rules require the approval of the Rule Change Panel. In previous WEM reviews, the ERA has highlighted challenges to prioritisation and timeliness in the rule change process.[86]

In response to the discussion on the rule change process in the ERA's issues paper, stakeholders were supportive of the Market Advisory Committee (MAC) and the role of the Rule Change Panel in the evolution of the market.[87] More recently, Perth Energy has raised concerns that the lower levels of oversight required for procedure changes, compared to rule changes, may inadvertently lead to entities making operational amendments that do not support the reform process, the market objectives or concurrent rule changes.

On 20 April 2020, Perth Energy asked the MAC to provide closer oversight of procedure change proposals, arguing that some proposals had broader market or policy implications. There is a role for the MAC to ensure proposals are necessary and consistent with rule change proposals for the implementation of the Energy Transformation Strategy.[88]

Perth Energy argued that the lack of oversight for the market procedure change process could lead to unintended consequences, stating:

> Under current arrangements, a procedure change raised by the Australian Energy Market Operator (AEMO) can be approved by AEMO with little or no effective oversight. While we are not suggesting AEMO would intentionally misapply its administration of the Procedure Change Process, but the current Procedure Change Working Group arrangements combined with the potential for unilateral decisions on changes to Market Procedures, means some important issues may not receive the level of scrutiny or challenge they merit.[89]

Perth Energy raised concerns that, while AEMO's two proposed procedure changes appeared to be minor and operational, they would adversely affect competition and efficiency in the

[85] Wholesale Electricity Market Rules (WA), 21 July 2020, Rule 2.4.2, Rule 2.9.3 and Rule 2.10.

[86] ERA, 2019, *Report to the Minister for Energy on the Effectiveness of the Wholesale Electricity Market 2019 – Issues paper,* pp.26-27, (online).

[87] Submissions available at ERA, 'Annual Wholesale Electricity Market Effectiveness Reports', (online) [accessed 15 July 2020]. The rule change process is discussed in detail in the ERA, 2019 *Report to the Minister for Energy on the Effectiveness of the Wholesale Electricity Market 2018/19 – Issues paper* pp. 24-26, (online).

[88] Perth Energy, 2020, *Letter to the Market Advisory Committee on the importance of oversight of market procedure changes*, (online).

[89] Ibid.

WEM.[90] Given the ongoing implementation of the Energy Transformation Strategy, Perth Energy suggested that procedure change proposals should be endorsed by the Energy Transformation Taskforce to ensure consistency with the reform program.

Energy Policy WA (EPWA) has proposed several changes to the design, operation and planning of the WEM, to be implemented through both rule and procedure changes. EPWA has indicated that it intends to move prescriptive technical detail from the Market Rules to subsidiary documents such as the procedures.[91] As EPWA and the Energy Transformation Taskforce are not permitted under the Market Rules to make procedure changes, AEMO will develop the procedures to support proposed changes to Market Rules.

The development and amendment process for the Market Rules compared to the market procedures differs in:

- decision-making independence
- cost and practicality.

The Rule Change Panel is responsible for administering the rule change process and deciding on rule change proposals. The Rule Change Panel is independent from market stakeholders and its decisions are not influenced by self-interest. Additionally, the Market Rules state that, when deciding whether to amend the Market Rules, the Rule Change Panel must have regard to the practicality and cost of implementing the rule change proposal.

The procedure change process does not have the same requirements as the rule change process. The parties responsible for the management of market procedures have authority for developing and amending the market procedures and may be influenced by their primary focus on their own operations when developing or amending market procedures. The market procedure change process does not require the responsible entity to have any regard for the practicality and costs of implementing market procedures.

Within the current governance framework, the challenge of procedure changes being made without appropriate oversight can be addressed by supporting entities to develop and consult on changes to further market objectives. Entities can be supported by:

- The MAC and its working groups.
- The Energy Transformation Taskforce providing additional guidance to AEMO to ensure procedures are developed and amended consistently with the intention of the reform program.

3.2.2 *Proposed changes to the membership of the Rule Change Panel*

EPWA has identified that the Rule Change Panel is not adequately resourced to respond to increasing volume and complexity in rule changes due to the Energy Transformation Strategy.[92]

On 28 February 2020, the Minister for Energy endorsed EPWA's proposed changes to extend the membership of the Panel and the Panel's appointment process for the new members. The changes sought to relax the membership requirements in *the Energy Industry (Rule Change*

90 Ibid.

91 EPWA, 2020, *Outage planning and management, Information paper 7 February 2020*, p. 7, (online).

92 EPWA, 2020, *Improving the Rule Change Panel appointments process, Directions Report*, p.1, (online).

Panel) Regulations 2016 (Panel Regulations).[93] EPWA published a draft amendment report and sought feedback from stakeholders on any unintended consequences of the proposed changes.[94,95]

The report recommended:

- An increase from three to five Panel members, with an unchanged quorum.
- Modified eligibility criteria to allow certain qualified public servants and persons employed in the energy industry to be appointed to the Panel.
- Broader disclosure requirements and new procedures for managing both personal and professional conflicts of interest of Panel members.

The changes were proposed to "provide the Panel with a greater range of expertise to assist in progressing an increasing volume and complexity of rule change proposals."[96] EPWA expected that "it will likely become increasingly challenging for the Panel to address issues in a timely manner."[97]

Two possible outcomes of expanding the membership and broadening the conflict of interest disclosure requirements are:

1. Increased conflicts of interest when the Panel considers matters within the scope of the new members' professional interest.

2. A public servant, market participant or a consultant engaged by a market participant appointed to the Panel not being permitted to vote on many rule changes.

Considering the proposed conflict of interest disclosure requirements, the MAC noted that:

> Any Panel member that was employed by AEMO, Synergy or Western Power would have to absent itself from the discussion of the majority of Rule Change Proposals… therefore the aim [of EPWA's proposed changes] was to appoint Panel members that would be as free of conflict of interest as possible.[98]

An alternative approach to increase the pool of possible Panel members is to use virtual meetings to allow members to participate from other jurisdictions.[99] New members with experience from other energy markets can provide diverse and valuable insights to the decision-making process of the Panel.

EPWA noted that "the role, functions and composition of the Panel were always intended to evolve with the development of the energy market."[100] A review of the rule and procedure change process would guide the Panel's evolution. Such a review could occur alongside the

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93 EPWA, 2020, Website: Improving the Rule Change Panel appointments process, (online), [accessed 12 May 2020].

94 EPWA, 2020, *Improving the Rule Change Panel appointments process, Directions Report*, (online).

95 Submissions to the draft amendments were due on 3 April 2020. At the time of writing, EPWA's website had not yet published stakeholder feedback (online) [accessed 1 July 2020].

96 EPWA, 2020, *Improving the Rule Change Panel appointments process, Directions Report*, p. v. (online).

97 Ibid, p. 4.

98 Market Advisory Committee, 2020, *MAC meeting agenda, 5 May 2020*, p. 12, (online).

99 The appointment process and quorum requirements of the Panel Regulations do not require physical presence of panel members. Clause 9 and 14 of the *Energy Industry (Rule Change Panel) Regulations 2016*, (online).

100 EPWA, 2020, *Improving the Rule Change Panel appointments process, Directions Report,* p. 4, (online).

changes proposed to market governance arrangements in the Energy Transformation Strategy.

3.2.3 Market evolution – beyond the Energy Transformation Strategy

Beyond the current reform program, due to end in 2022, the WEM will need to evolve, particularly as technological innovation is changing the industry. These market changes will require new rules or revisions to existing rules. The rule change process must be effective to ensure the market rules keep pace with the dynamic nature of the industry.

Without the current policy intervention from the State Government, the rule change and procedure changes arrangements would probably not have been able to deal with the rapid uptake of distributed energy resources and large-scale renewable energy technologies. However, it is worth considering whether the WEM decision-making process could be changed so that the WEM can evolve incrementally to meet future challenges instead of being reliant on large-scale transformation projects.

In the issues paper the ERA identified that, although different organisations were developing and submitting rule change proposals, no single party is mandated to develop and submit a rule change proposal to address an identified, or emerging, market inefficiency.[101] This gap in the governance structure may limit how effectively the WEM develops after the reform program ends.

To identify the broad structures and challenges that could hinder the effectiveness of the market and its institutions, other jurisdictions have employed independent reviews of governance and decision-making. The explanation box below provides two examples of such reviews and why independence is necessary.

Explanation

Independent reviews of decision-making and stakeholder processes have assisted other jurisdictions to take an overall view of challenges in electricity markets. For instance, in 2015 the Council of Australian Government Energy Council engaged an independent panel to examine the performance of the governance arrangements of Australian energy markets.[102] The panel provided recommendations to the Energy Council on how the Australian Energy Market Commission, Australian Energy Regulator and AEMO could better work together, as well how the Council could better oversee these bodies.

The recommendations included:

- The Energy Council should focus more on determining strategic direction and specifying priorities for energy market reform and institute a structure of delegations to address other responsibilities.
- The Australian Energy Market Commission should improve the timeliness and transparency of rule changes and reviews.

[101] ERA 2019 *Report to the Minister for Energy on the Effectiveness of the Wholesale Electricity Market 2018/19 – Issues paper,* p. 24-27, (online)

[102] COAG Energy Council, 2015, *Review of Governance Arrangements for Australian Energy Markets – Final Report October 2015,* (online) [accessed 4 June 2020].

- The Australian Energy Regulator should be separated from the Australian Competition and Consumer Commission to promote a more responsive, flexible and autonomous organisational culture.
- The Energy Council should clarify AEMO's core responsibilities and ensure that they are not in conflict with AEMO's non-market operator roles.
- The Council should change the management of energy market institutions, appointment processes and funding arrangements to improve organisational capability.

The Energy Council agreed with and implemented many of these recommendations.

The Federal Energy Regulatory Commission, the independent regulator of transmission and wholesale electricity markets in the United States, requires electricity system operators to adopt practices and procedures to ensure their responsiveness to energy market stakeholders. This is important to ensure that energy markets deliver electricity at a just and reasonable cost to consumers, particularly because the evolution of the market is mainly driven by market participants and institutions. The Federal Energy Regulatory Commission assesses system operators' stakeholder processes using four criteria: inclusiveness, fairness in balancing diverse interests, representation of minority positions, and ongoing responsiveness. This provides a blueprint to energy market institutions for developing their decision-making processes.[103]

Although the Federal Energy Regulatory Commission does not require a periodic review of the system operators' stakeholder processes, some operators have chosen to do so. For example, in response to concerns that the PJM Interconnection did not meet the requirements for stakeholder-responsiveness, the PJM formed a governance assessment team to review its stakeholder process.[104]

When making recommendations about how the WEM could evolve in pursuit of market objectives, an independent review of the decision-making process could consider:

- Is the decision-making process in the WEM responsive to changes in electricity supply technologies and consumer behaviour? This would examine whether the decision-making process considers electricity consumers' and other stakeholders' needs as the market environment and design changes over time, and if it evaluates the need for improvements in the management of the system.
- Is the decision-making process in the WEM treating diverse interests fairly? This would examine the fairness from different aspects, for example, by evaluating if the process:
  - Includes enough representation of consumers' interests.
  - Considers the interests of both incumbents and prospective entrants.
  - Considers large entities' and small entities' interests. For example, participation in the decision-making processes requires technical expertise and carries costs. This can disadvantage smaller firms with limited resources.
  - Supports the inclusion of minority positions.

[103] Federal Energy Regulatory Commission, 2008, *Wholesale competition in regions with organised electricity markets* (Docket Nos. RM07-19-000 and AD07-7-000), p. 250–252, (online).

[104] James et al., 2017, How the RTO stakeholder process affects market efficiency, R Street Policy Study No.112, p. 13, (online).

- Does the decision-making framework include a clear and appropriate division of responsibilities among WEM institutions?

Appendix 1 State of the Electricity Market

Main points

- Grid-connected renewables, such as wind and solar farms, increased their share of generation in the WEM from 9.5 per cent in 2018 to 13 per cent in 2019.
- Renewable generation is displacing the thermal generation that helps to maintain the real-time balance of electricity supply and demand.
- In early 2020, the variability of the output from wind and solar farms increased above typical levels. New wind farms commencing operation in 2020 are likely to further increase the variability of electricity supply in the SWIS. Increasing variability of supply increases the need for flexible resources to maintain the security of the system.
- Electricity supplied by the market is reducing as some consumers substitute part of their demand for electricity with output from a rooftop solar system.
- The output from rooftop solar systems is flattening growth in annual maximum demand and changing the time of maximum demand to later in the day while simultaneously reducing minimum demand.
- Very low levels of demand on the network pose challenges to managing system security. With fewer thermal plants generating, those plants are less able to provide system security services.
- The wholesale market remains uncompetitive: demand cannot be met without generation output from the three largest balancing market participants. Plant retirements and new generation investments present opportunities to improve the diversity of supply.
- After investigation, the ERA found Synergy to have exercised market power in its pricing in the balancing market. The matter is now before the Electricity Review Board to determine whether Synergy's pricing is consistent with the Market Rules.
- Prices for ancillary services are higher than necessary as inefficiencies in the balancing market are flowing through to the ancillary services market.

There have been substantial changes in the WEM over the past decade. The entry of renewable energy technologies and the effect of their output on the demand for and supply of electricity has been the most significant change.

When installed behind the meter at a customer's property, renewable energy such as a rooftop solar systems displace the supply of electricity from the network and supply a share of the consumer's demand for electricity.[105] Renewable energy installed on the network, such as large-scale wind and solar farms, displaces the supply of electricity from conventional generators such as coal- and gas-fired generators.

Rooftop solar has expanded rapidly in the WEM in the last ten years. Before rooftop solar systems became available and affordable for residential and small business use, consumers did not have much choice other than to procure electricity from the network. The only way customers could lower their electricity bills was to reduce their consumption of electricity, for

[105] Behind the meter photovoltaic (PV) capacity includes both residential and commercial rooftop solar. Residential PVs have capacity less than 100 kilowatts (kW). Commercial PV systems have capacity ranging between 100 kW and 30 MW.

example by buying efficient energy appliances and insulating their homes or by foregoing energy services.

Now, solar photovoltaic (PV) technology is widely available and installation costs have decreased. Between 2013 and 2018, the average price of PV modules fell by 60 per cent.[106] In the SWIS, it is likely that many consumers have adopted the technology to meet their demand for energy while lowering the cost of electricity.[107]

The uptake of behind-the-meter solar PV has had implications for electricity demand from the network. From 2013 to 2019, annual peak demand decreased by 0.5 per cent per year on average to 3,582 MW. In 2019, AEMO forecast that over the next decade the one-in-10 year peak demand in the SWIS would increase by just 0.4 per cent per year. In 2020, for the first time since the commencement of the market, AEMO forecast that the one-in-10 year peak demand would fall at an average annual rate of 0.2 per cent over the next decade.[108]

From 2013 to 2019, the consumption of energy from the SWIS decreased by 0.6 per cent each year to 17.5 TWh. For the first time since the commencement of the market, AEMO forecast energy consumption from the network would decrease over the next decade by 0.4 per cent per year.[109]

From 2013 to 2019, the profile of electricity demand changed. This is best illustrated by considering the changes in load profile during summer weekends, as shown in Figure 1.

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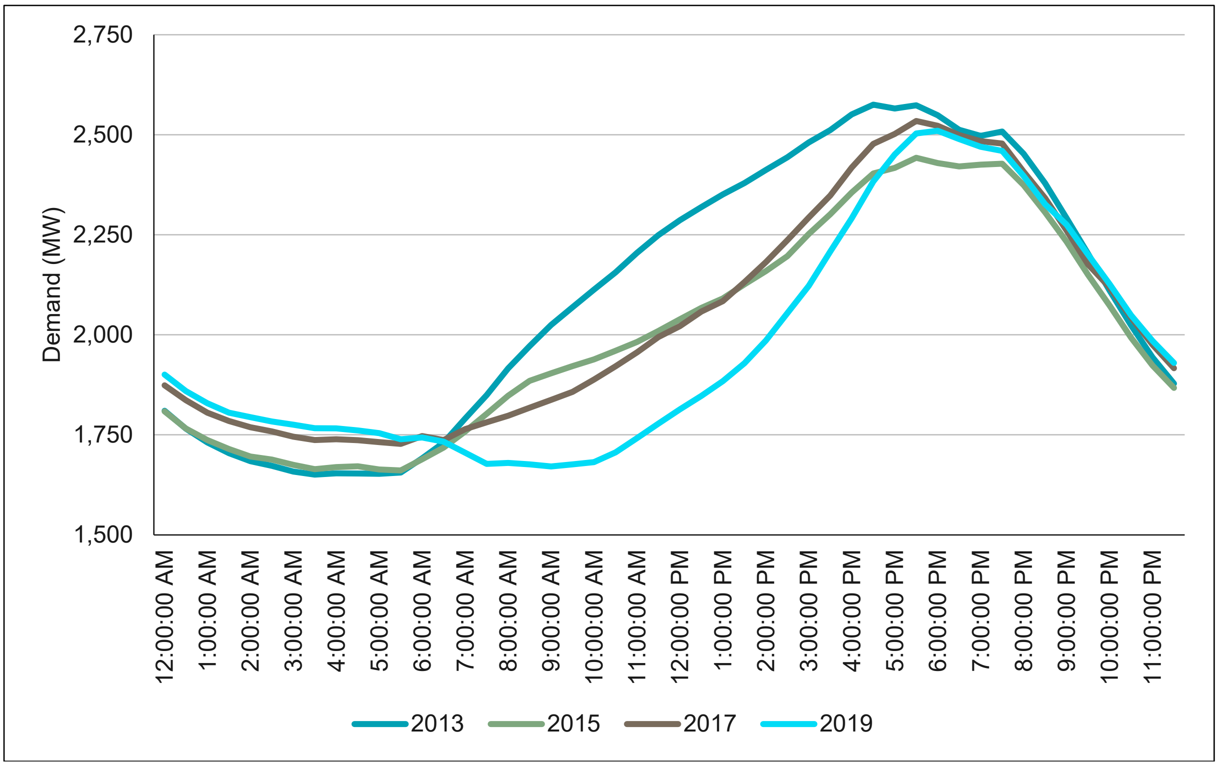
106 IRENA, 2019, *Renewable Power Generation Costs in 2018, International Renewable Energy Agency*, Abu Dhabi, p. 43, (online).

107 Bondio S., Shahnazari M., McHugh A., 2018, *The technology of the middle class: understanding the fulfilment of adoption intentions in Queensland's rapid uptake residential solar photovoltaic market*, Renewable and Sustainable Energy Reviews, Vol. 93, pp. 642–651, (online).

108 AEMO, 2020, 2020 Electricity Statement of Opportunities, AEMO, online, p3

109 Ibid. p3

Figure 1: Average summer weekend load profile by year[110]



Source: ERA analysis of AEMO data.

The output from rooftop solar systems increases with solar irradiance. Typically, in the summer months, output from rooftop solar increases from around 6:00am until just after midday, hollowing out demand through the morning and early afternoon. From then output from rooftop solar generation starts to decline and there is an increase in demand to a maximum that now occurs in the early evening and a shorter period of elevated demand.

As customers have continued to install rooftop solar systems, system output has displaced operational demand from market generators.[111] This change in the pattern of demand is set to continue. Rooftop solar capacity is growing by 122 MW, or 7.6 per cent, per year and AEMO has forecast 2,500 MW of total installed capacity by 2029. Section 2.1.1 explains how the output from rooftop solar systems has affected maximum and minimum demand.

A second major change in the wholesale market has been the entry of large-scale wind and solar farms. Since 2013, approximately 290 MW of solar and wind farms entered the market.[112] In its 2019 annual report, Western Power reported providing access offers to over 900 MW of renewable energy projects were under development in the SWIS.[113] In contrast, there has been no new coal, gas or distillate generation in the WEM since 2012. The output of wind and solar farms has displaced part of the generation from coal-fuelled and gas-fuelled generators. By the end of 2019, renewable generators accounted for about 13 per cent of the total amount of energy delivered through the SWIS.

The installation of renewable generation behind and in front of the meter has created operational challenges for maintaining the reliability of the SWIS. AEMO has stated that the

110 The 2019 summer load profile includes December 2019, January 2020, and February 2020.

111 Operational demand refers to electricity demand supplied by market generators.

112 Based on the installed capacity of registered facilities between 2013 and 2019. AEMO Market data Western Australia, Facilities, (online), [accessed 2 June 2020].

113 Western Power, 2019, Western Power Annual Report – 2019, Western Power, Perth, p15, (online).

increasing variability and uncertainty in both demand and supply was creating challenges for maintaining the reliability of the WEM.[114] Variability in supply and demand is discussed in section 2.1.1.2.

The power system holds flexible reserves available to maintain the security of the system to balance supply and demand in real time. The reserves enable the system operator to manage unexpected changes in supply and demand, network failure, or supply and demand forecast errors. Increasing installation of renewable generators can increase the short-term changes in supply and demand and increase reserve requirements to manage the increased level of variability. Due to the natural variability in wind speeds and solar irradiation, the output of a wind or solar farm cannot be predicted with high levels of certainty. This increases the risk of errors in forecasts and the corresponding level of services required to manage the security of the system.

In the face of decreasing demand, grid-connected renewable generators have increasingly displaced the output of conventional generators that historically have provided flexibility services in the SWIS. This displacement is likely to continue over the coming decade reducing demand in the SWIS.

A second example of this displacement effect in the SWIS has been the substantial decrease in the level of demand in the middle of the day, when output from rooftop solar panels substitutes the relatively low operational demand of the SWIS during the spring months. On sunny days of mild ambient temperature, particularly during weekends and public holidays when underlying demand is low, the demand on the system decreases to its lowest levels. Such low levels of demand mean, there is less room for the output of synchronised generators that provide system security services.

Demand

The level of demand drives investments in generation and network assets. Extremes in electricity demand, and the rate of change, can influence the reliability of the electricity system. Demand also determines the price of electricity in the WEM at any point in time.

The level of maximum demand influences the quantity of generation capacity procured to ensure the energy system provides a reliable supply of electricity when demand for electricity peaks, typically during very hot summers. If demand falls to minimum levels, there may not be sufficient ability to absorb reactive power and maintain electricity voltages within safe levels, which can risk the security of the whole system.[115]

How the electricity system supplies consumer demand is central to how effectively the WEM meets its objectives. The changes in demand can be symptomatic of distortions created by inefficient price signals or flaws in the Market Rules.

The following section summarises how and why demand has changed over the review period. However, demand can be described in several ways as outlined in the box below.

114 AEMO, 2019, *2019 Electricity Statement of Opportunities*, p. 65, (online).

115 The electricity network requires reactive power to ensure power can be transported from where it is produced to where it is required. In addition, some loads require reactive power to function correctly. Reactive power has traditionally been provided by synchronous generators. However, it is also generated by the network elements themselves. A balance in the reactive power generated and that required is essential to manage voltages within limits.

Electricity demand

Electricity demand is the rate at which consumers use electricity. This is measured a point in time, in kilowatts or megawatts.

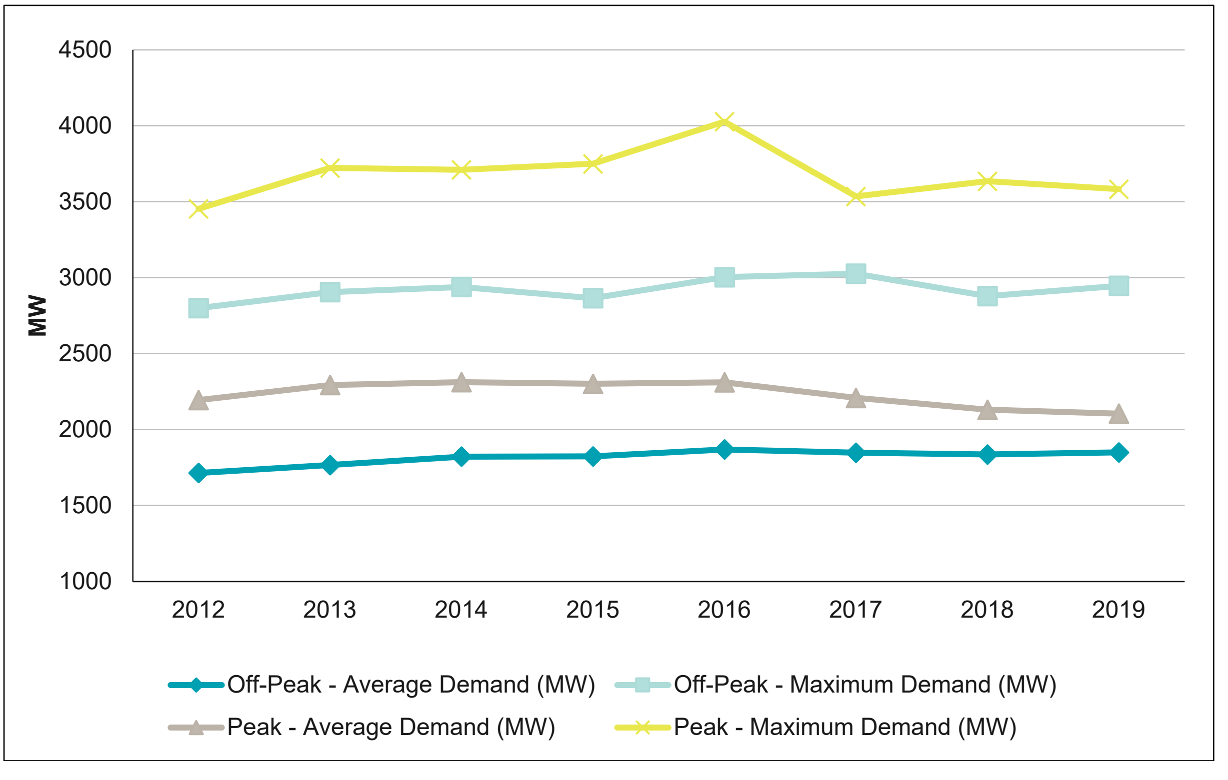
- Total or underlying demand is the rate at which electricity is used by consumers regardless of how that electricity is supplied. This can be through the electricity network or electricity supplied by a consumer's own rooftop photovoltaic system.
- Underlying demand less the quantity of electricity generated by the consumer leaves operational demand, which is the electricity demand met by the supply of electricity from the network.

Unless otherwise stated, this report uses the term demand to refer to operational demand. The measure of demand in this report is the relevant dispatch quantity (RDQ) and represents aggregated generators' output, measured at the generators' gates at the end of each 30-minute trading interval. This measure of operational demand includes the effect of network losses.

Peak hours are defined in the market rules as between 8AM to 10PM seven days per week. Off peak hours are all other hours.

Average demand during off-peak periods is growing but average demand during peak periods is falling. System maximum demand has plateaued since 2017. The time of day at which maximum demand occurs has shifted later in the day. In 2012 and 2013, the peak occurred at 4:00 and 4:30pm respectively. However, since 2017 the peak time of day has occurred between 5:00 and 6:00 pm.

Figure 2: Average and maximum demand



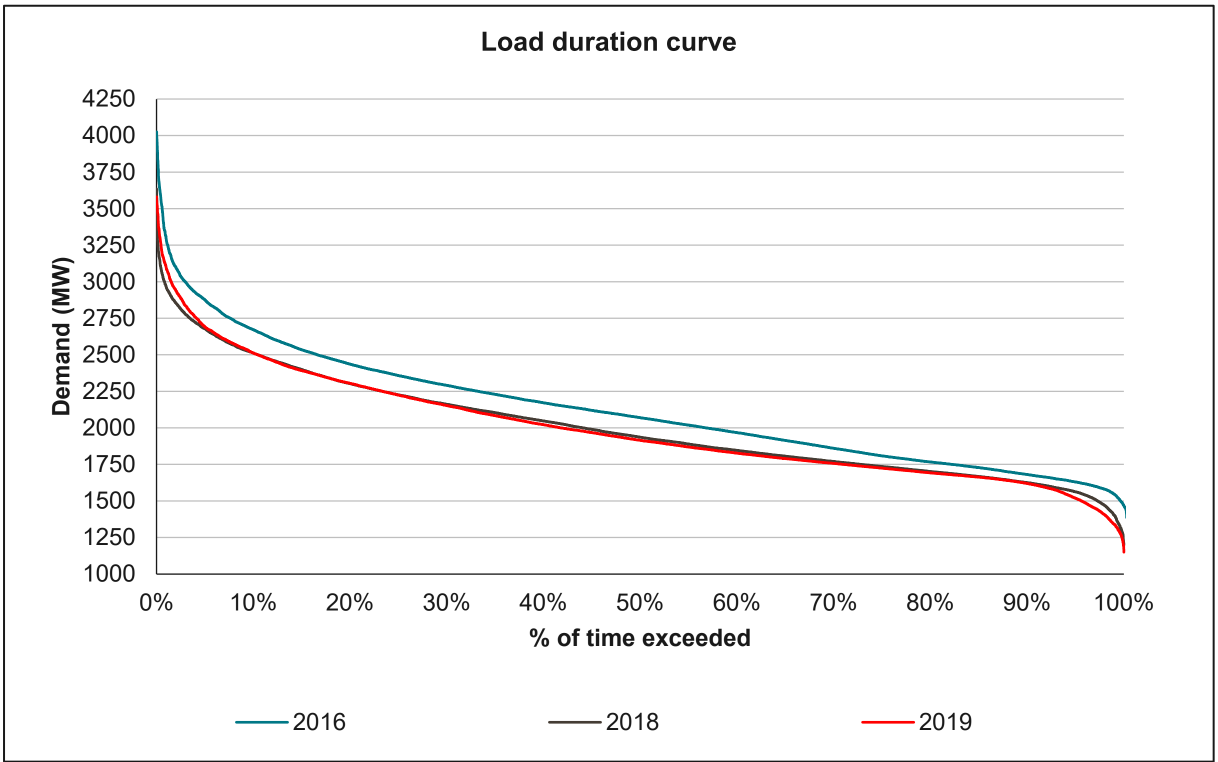
Source: ERA analysis of AEMO data.

The load duration curve is a cumulative frequency distribution plot of electricity demand and explains the proportion of time for which demand exceeded a certain value. The 2019 load duration curve follows a very similar curve to that for 2018. However, it diverges slightly:

- At the upper portion of the curve, most likely because of a warmer summer in 2019.
- At the lower portion of the curve, most likely because of lower electricity demand in 2019 in the middle of the day because of consumers substituting electricity with rooftop solar.

The load duration curves in 2018 and 2019 sit substantially below the 2016 curve. This can be explained by warmer summer in 2016 and lower level of PV installations at the time.

Figure 3: Load duration curve



Source: ERA analysis of AEMO data.

Changes in maximum demand

From 2013 to 2019, annual maximum demand decreased by 0.5 per cent per year to 3,582 MW. The time of day annual maximum demand occurred shifted progressively to later in the day from 4pm in 2012 to 6pm in 2019.

Maximum demand typically occurs during the evening peak between 5:00 and 7:30 pm. Figure A4 illustrates that evening peak demand has decreased between 2013 and 2018. Much of this decrease in maximum demand has been due to the uptake of solar generation and mild weather conditions. For example, in summer 2016/17 and summer 2017/18, the evening peak was lower than the peak in previous summers and persisted after sunset. If the demand reduction was just from the rooftop solar, then demand would have risen after sunset, once the effect of rooftop solar was removed. As the lower evening peak continues after sunset, this indicates that some of the demand reduction at the time was most likely from milder summer weather.

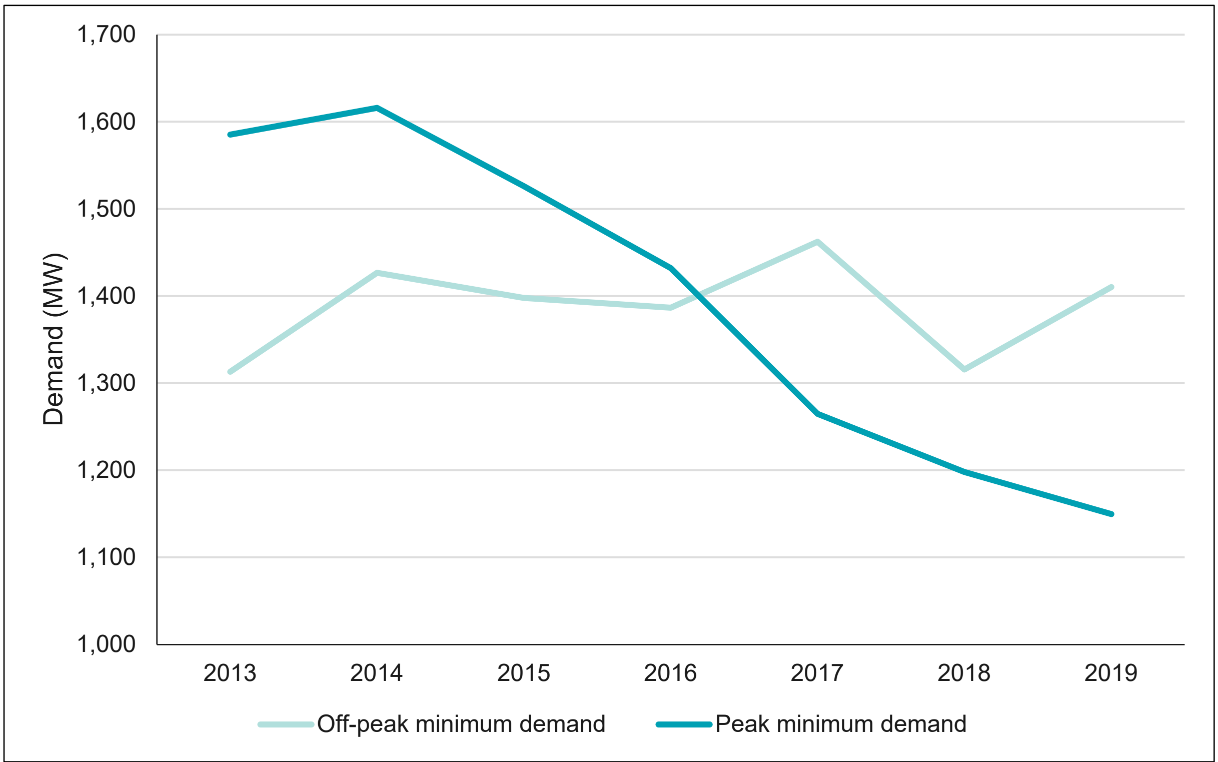
Quarter four in 2019 was warmer than the same quarter in 2017 and 2018. The 2019 load profile from 5:00 to7:00pm illustrates where demand in quarter four 2019 returned to a level consistent with previous hot summers.

The sustained penetration of rooftop solar systems will continue to assist in reducing peak demand during hot summers. However, the output from solar PV generation has also changed when maximum demand occurs, shifting maximum demand to later in the day. Now that the maximum demand has moved to a time of day (6:00pm) when solar output is minimal, future rooftop solar installations will make incrementally less difference to maximum demand in the evening.

Changes in minimum demand

Periods of the lowest operational demand in the system commonly happen when the air temperature is mild, the sun is shining and underlying demand is low; for example, during weekends.[116] The continued uptake of rooftop solar installations in the SWIS has contributed to reducing the amount of demand during day-time periods.[117] Since 2017, minimum system demand has occurred during peak intervals as shown in Figure 4.

Figure 4: Minimum demand during peak and off-peak periods



Source: ERA analysis of AEMO data.

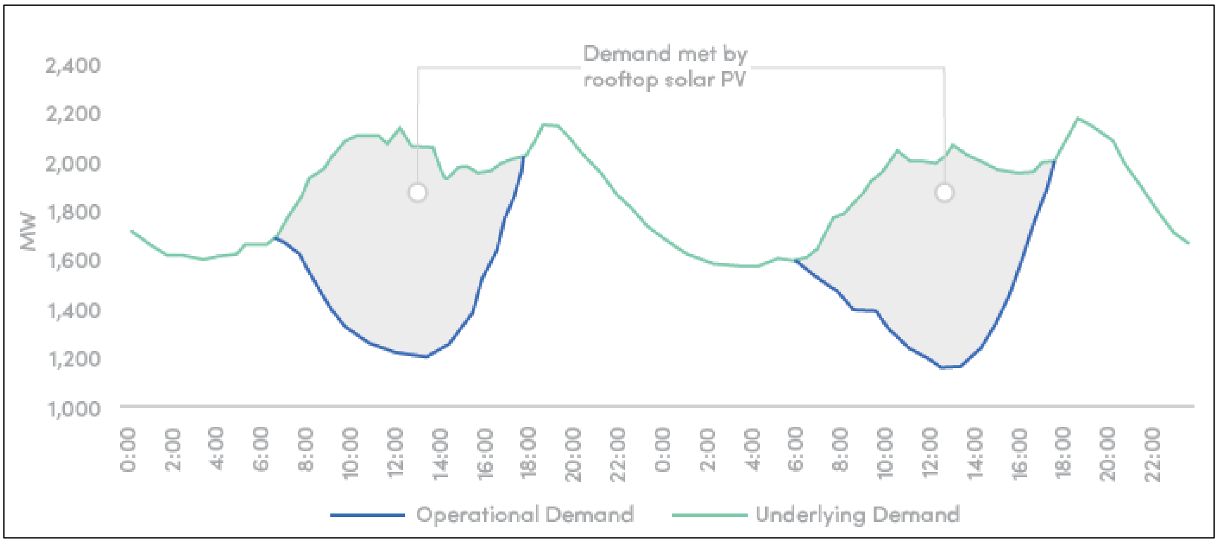
To the end of 2019, the lowest operational demand (1,157 MW) in the SWIS happened on Sunday 13 October 2019 at 12:30pm. Figure 5 depicts how the generation from rooftop solar offset the day-time underlying demand, resulting in very low operational demand on 12 and

116 Underlying demand is the amount of energy needed to satisfy total consumer demand. Operational demand is the underlying demand net of the contribution of behind-the-meter generation, from distributed energy resources as well as generation from some other small wind and gas tri-generation locations.

117 The average load of large industrial consumers in the SWIS is approximately 310 MW and any disturbance in the industrial loads can also have a substantial effect on the operational demand in the SWIS. Western Power, 2019, *WA Electricity Consultative Forum meeting 23, System low presentation*, p. 9, (online).

13 October 2019. During that period, underlying demand was reasonably stable and high during the middle of the day.

Figure 5: Underlying and operational demand during 12 and 13 October 2019



Source: Energy Transformation Taskforce, Distributed Energy Resources Roadmap, p. 29, (online).

On Saturday 12 and Sunday 13 October, when demand was low, wholesale prices reached the price floor (negative $1,000/MWh) in three trading intervals, for the first time since the commencement of the WEM. These negative pricing events are discussed later.

Factors that drive demand

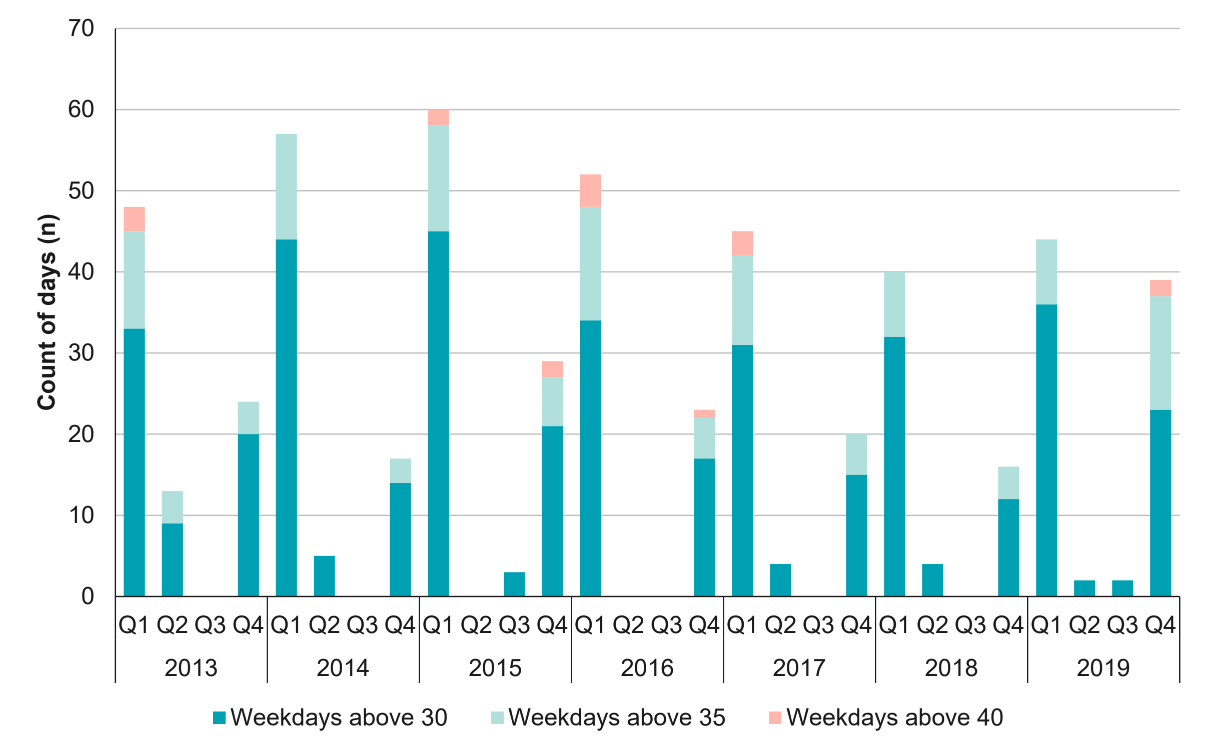
Several factors can influence underlying demand, and therefore operational demand supplied by the market: ambient temperature, economic conditions, and population growth. Each of these demand drivers is summarised below.

Ambient temperature

Air conditioning, refrigeration, heating and cooling loads are all sensitive to ambient temperature. With milder temperatures, the demand for electricity from temperature-sensitive loads decreases. With warmer temperatures, electricity demand generally increases.

Figure 6 shows the count of weekdays where the maximum temperature exceeded 30 degrees, 35 degrees and 40 degrees Celsius by quarter.

Figure 6: Count of hot season weekday maximum temperatures for Perth Metro weather station



Source: ERA analysis of Bureau of Meteorology data.[118]

Temperatures in Perth have been milder than normal for the three summers in 2016/17, 2017/18, and 2018/19.[119,120] This would have contributed to the downward trend in demand.

The 2019/20 summer (in Q4 2019 of Figure 6) shows a substantial increase in the number of hot days compared to the 2018/19 summer. The mean temperature in the 2019/20 summer was the second highest on record and there were more high temperature weekdays to drive up demand.[121]

Economic activity and population growth

Western Australian households and businesses comprise a substantial proportion of the more than one million WEM customers.[122] In the past two years, economic growth in the Western Australian economy has been modest and slowing when compared to the previous ten years.[123]

The recent slower economic growth is mirrored in population growth rates. Over the last couple of years, Western Australia's population grew more slowly than the 10-year average. This was

118 The data set excludes data for weekends when commercial and industrial loads are generally lower or offline and demand is lower.

119 Bureau of Meteorology, 2020, Seasonal Climate Summary for Greater Perth, product code IDCKGC21RO, (online).

120 Bureau of Meteorology, 2019, Seasonal Climate Summary for Greater Perth, product code IDCKGC21LO, (online). Ibid, 2018, (online). Ibid, 2017, (online).

121 Bureau of Meteorology, 2020, Seasonal Climate Summary for Western Australia, Product Code IDCKGC21R0, (online).

122 ERA 2020, Annual data – energy retailers 2018/19, excel workbook, (online).

123 Department of Jobs, Tourism, Science and Innovation, 2020, *Economic profile – March 2020,* (online).

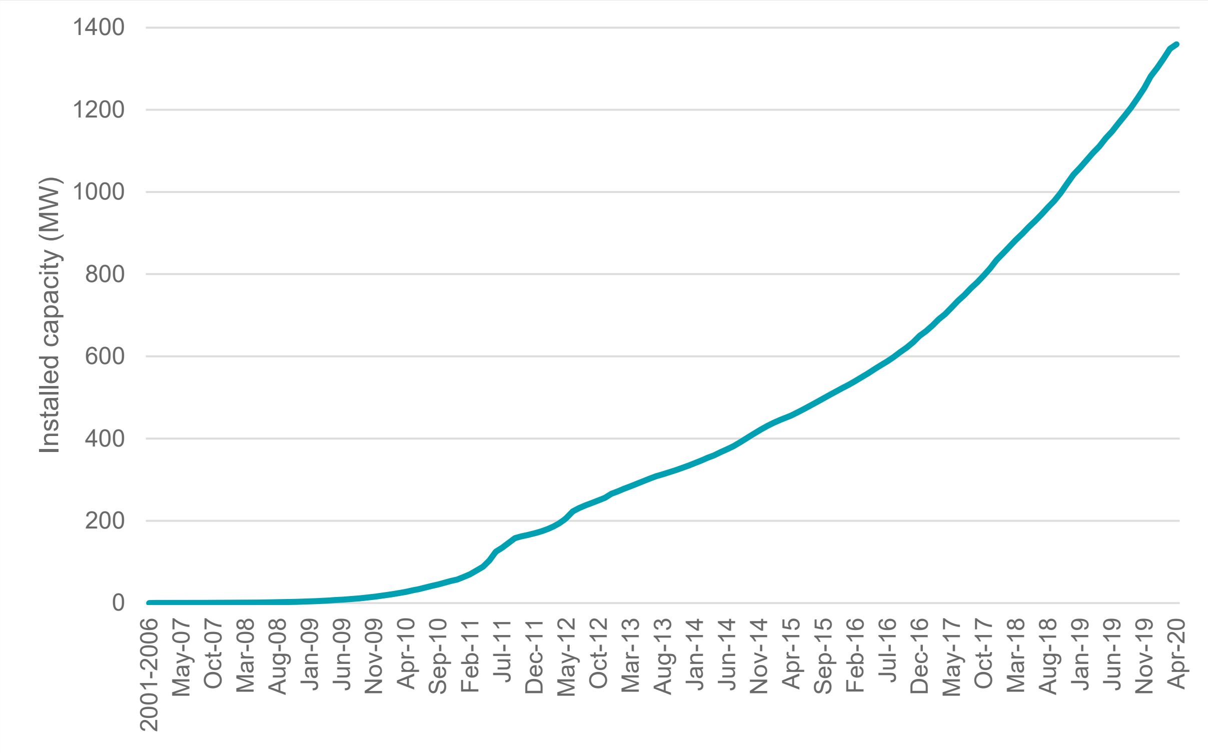
driven by negative net interstate migration and slower net overseas migration. Although subdued, economic activity and population growth is still positive and does not appear to have contributed to the ongoing reduction in demand.

Substitution

Although there has been a slight increase in summer temperature, and economic and population growth remain slightly positive, these drivers of demand have not been sufficiently strong to reverse the downward trend in average demand.

A stronger driver has been the substitution of operational demand by output from rooftop solar systems. As well as contributing to the reduction in demand, rooftop solar has also changed the pattern of demand through the day. Figure 7 shows the rapid increase in installed rooftop solar generation capacity which now exceeds Synergy's coal generation capacity. The change in demand can be seen in the load profiles in Figure 1 and Figure 5.

Figure 7: Cumulative installed PV capacity in the SWIS



Source: ERA analysis of Clean Energy Regulator data

Analysis of variability of demand and the output of non-scheduled generators

To maintain the reliable supply of electricity to consumers AEMO maintains the balance of supply and demand in real time. In the past, sudden interruptions to generation or loss of network equipment created most of the possible imbalance between supply and demand.

With the uptake of the renewable energy technologies the likelihood and magnitude of possible supply-demand imbalances is likely to increase, beyond that observed in the past. The output of wind and solar generators is weather-driven and therefore variable and uncertain. The output of wind generators can rapidly and substantially change with sudden changes in wind speed. The output of solar photovoltaic systems is highly dependent on solar irradiance, which can fluctuate dramatically due to the movement of clouds. Renewable energy project output forecasts therefore carry uncertainties. Collectively, the uptake of solar and wind generators can increase the variability of the possible imbalance between supply and demand.

AEMO reserves flexible resources to restore the balance between supply and demand.[124] This is provided through ancillary services defined in the Market Rules, comprising the load following, spinning reserve and load rejection reserve. AEMO must plan and ensure there would be enough flexible resources available to maintain the supply-demand balance with a reasonable level of certainty.[125] The Market Rules specify standards AEMO must meet when determining the level of ancillary services required.[126]

The increase in the variability of supply and demand can raise the required level of flexible resources to allow AEMO to manage imbalances. AEMO's forecasts of the possible supply-demand imbalances may also carry increasing levels of uncertainty. AEMO would require larger levels of flexible resources in reserve as the uncertainty in the forecast of the possible supply-demand imbalances increases.

Recently, as part of the review of the integration of renewable generators in the National Electricity Market, AEMO stated that there was a limit to the accuracy of forecasts of changes in supply-demand imbalance, even using current best practice forecasting approaches. AEMO considered that forecasting limitations and larger forecasting uncertainty increased the need for greater flexible reserves.[127] To address those observations AEMO proposed to improve its understanding of system uncertainty and imbalance risk. AEMO is planning to trial and implement variability forecasts and deploy additional weather observation infrastructure.

The amplifying effect of renewable generators on the variability of supply-demand imbalance may become dampened by the increasing geographical spread of their installation.[128] Solar output, for example, decreases as clouds pass overhead. However, as some systems go into shadow, others will be coming out of shadow. As the penetration of renewable generators in the SWIS increases, the incremental effect on the variability of demand-supply imbalance resulting from installations may decrease.[129]

To examine possible changes in the variability of demand and the output of intermittent generators (referred to as non-scheduled generators in the Market Rules), the analysis in this section calculates the 5-minute, 30-minute, 1-hour, and 4-hour absolute changes in demand and the total output of non-scheduled generators.[130]

Several percentiles of the distribution of the 5-minute, 30-minute, 1-hour and 4-hour ramps for each month in the period between 2012 and 2019 are depicted in Figure 8 to Figure 103. Results do not show any material change in the maximum level of change in operational demand. The maximum five-minute, half-hourly, hourly and four-hourly demand ramp

124 These resources comprise fast-response generation and demand resources with differing degrees of flexibility

125 For example, for the provision of the load following service AEMO determines the amount of reserve required as the capacity sufficient to cover 99.9 per cent of the short-term fluctuations in load, output of non-scheduled generators and available capacity of scheduled generators. Refer to clause 3.10.1 of the Market Rules.

126 Section 3.10 of the Market Rules and the SWIS Operating Standards specified in section 3.1 of the Market Rules.

127 AEMO, 2020, *Renewable integration study: stage 1 report*, p. 11, (online).

128 Mills A., Wiser R, (2010) Implications of Wide-Area Geographic Diversity for Short-Term Variability of Solar Power, Ernest Orlando Lawrence Berkeley National Laboratory, US Department of Energy, (online).

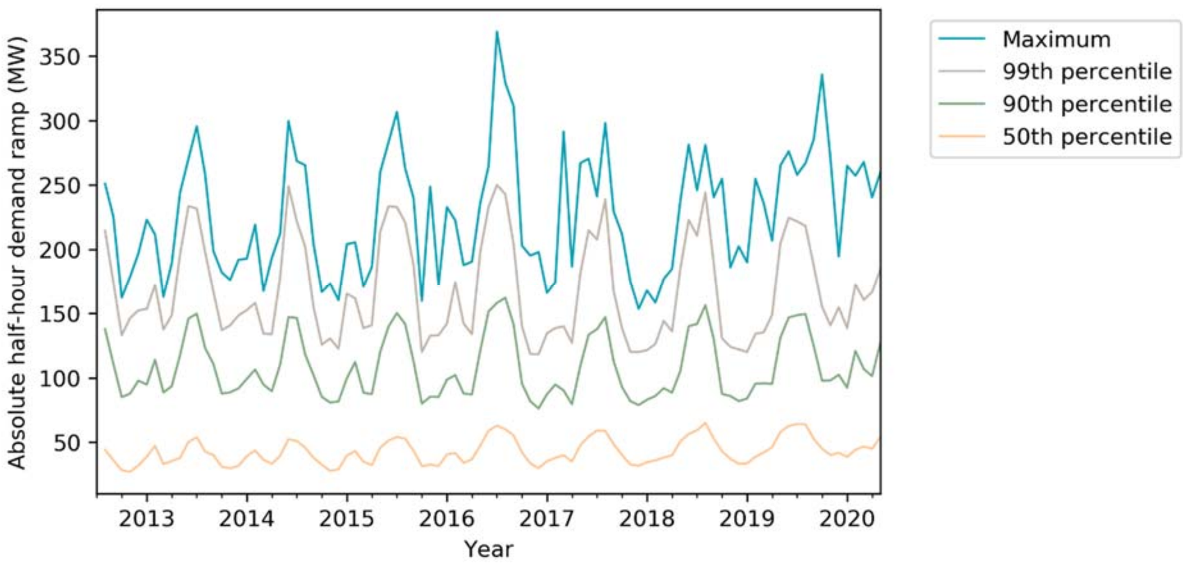
129 Albadi M.H., (2019) Solar PV Power Intermittency and its Impacts on Power Systems – an Overview, In The Journal of Engineering Research, Vol. 16 No 2, pp. 142-150, (online)]

130 The analysis does not account for possible curtailments of the output of intermittent generators. Future reports will account for those effects.

occurred in mid-2016. The shape of the distribution of demand ramp has not changed since mid-2016.

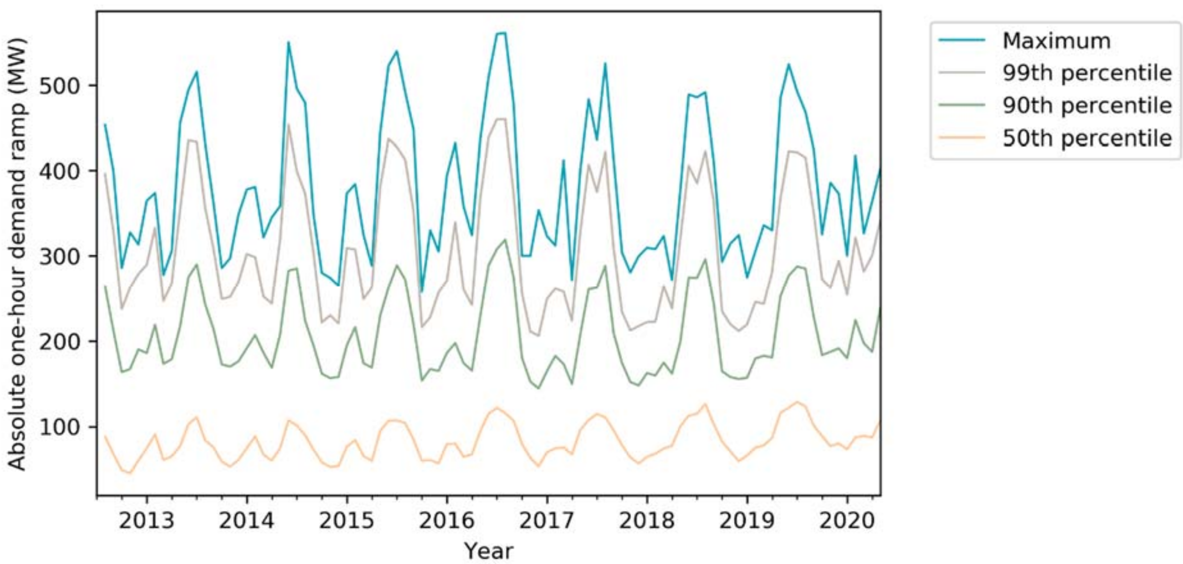
Figure 11 shows the half-hourly change in the output of non-scheduled generators has increased since early 2019. The maximum level of ramp increased from approximately 185 MW observed in 2016 through to 2019 to 235 MW in March 2020.

Figure 8: Monthly half-hour absolute demand ramp (MW) at different percentile thresholds



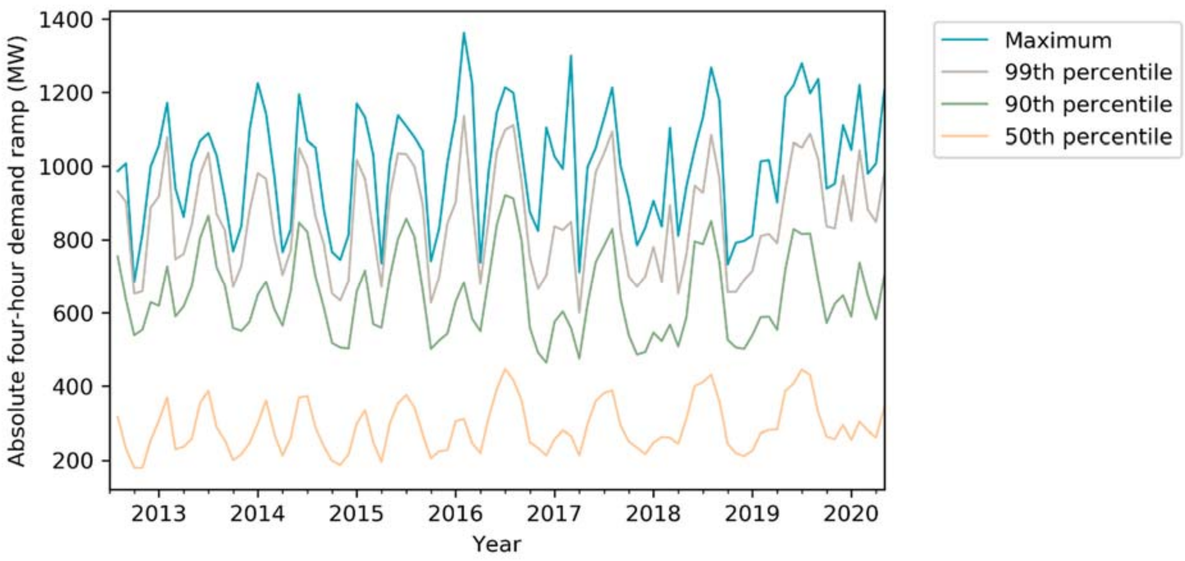
Source: ERA analysis of AEMO data

Figure 9: Monthly one-hour absolute demand ramp (MW) at different percentile thresholds



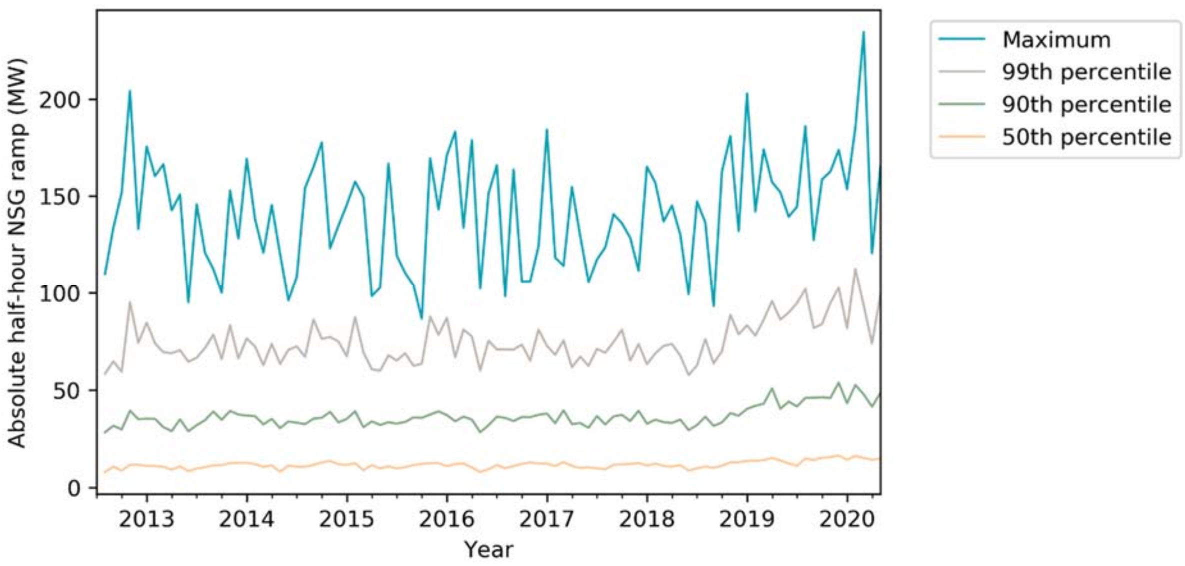
Source: ERA analysis of AEMO data

Figure 10: Monthly four-hour absolute demand ramp (MW) at different percentile thresholds



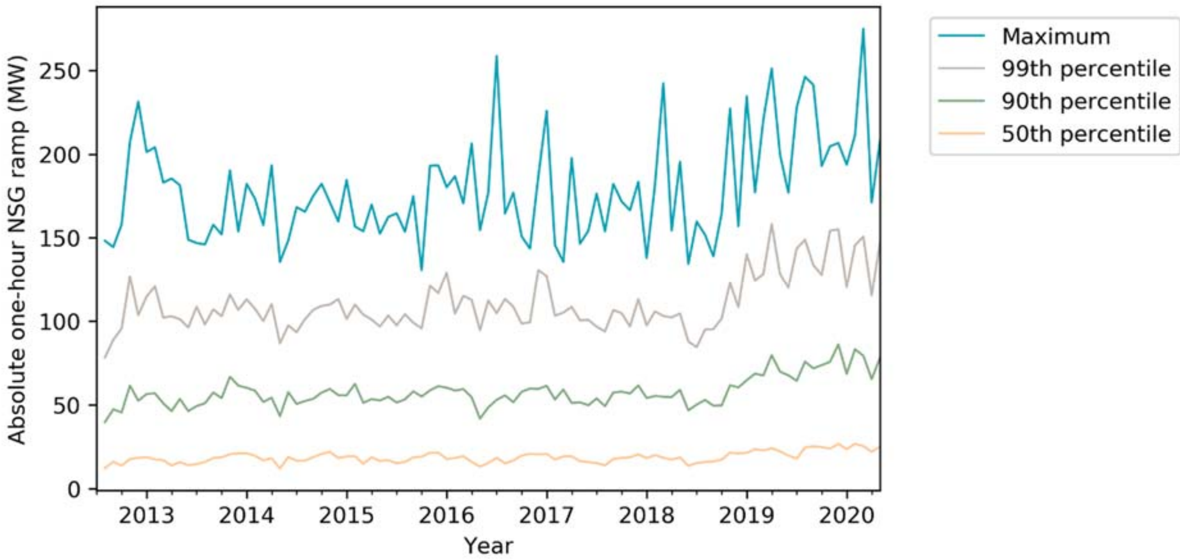
Source: ERA analysis of AEMO data

Figure 11: Monthly half-hour absolute non-scheduled generation ramp (MW) at different percentile thresholds



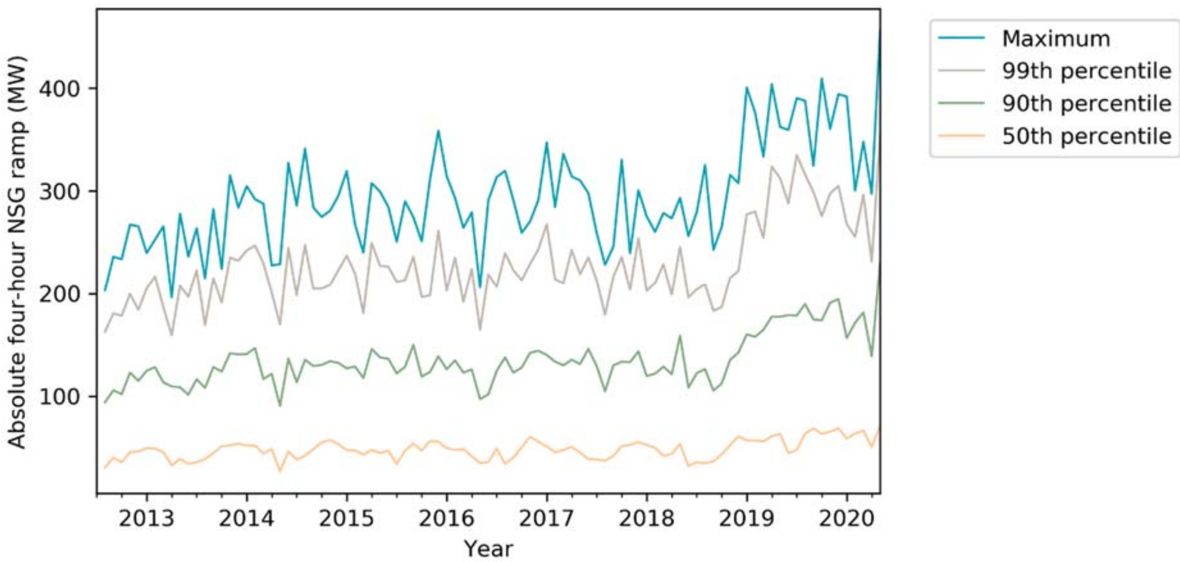
Source: ERA analysis of AEMO data

Figure 12: Monthly one-hour absolute non-scheduled generation ramp (MW) at different percentile thresholds



Source: ERA analysis of AEMO data

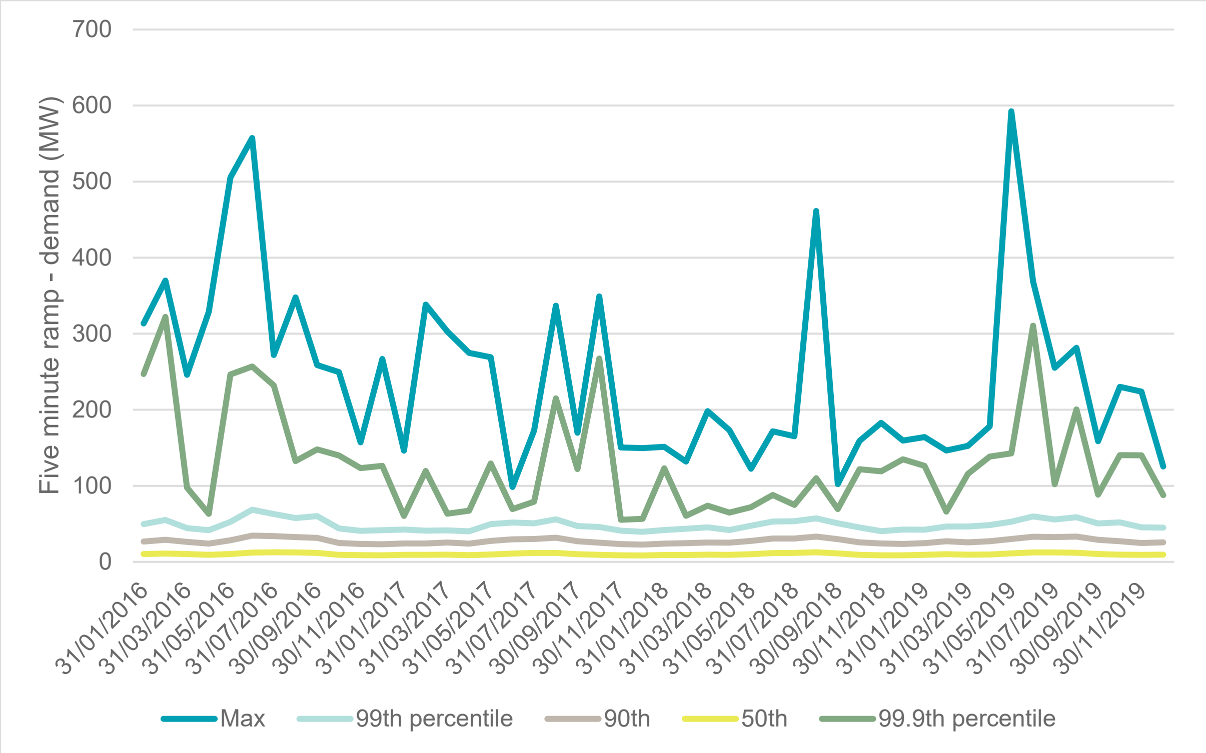
Figure 13: Monthly four-hour absolute non-scheduled generation ramp (MW) at different percentile thresholds



Source: ERA analysis of AEMO data

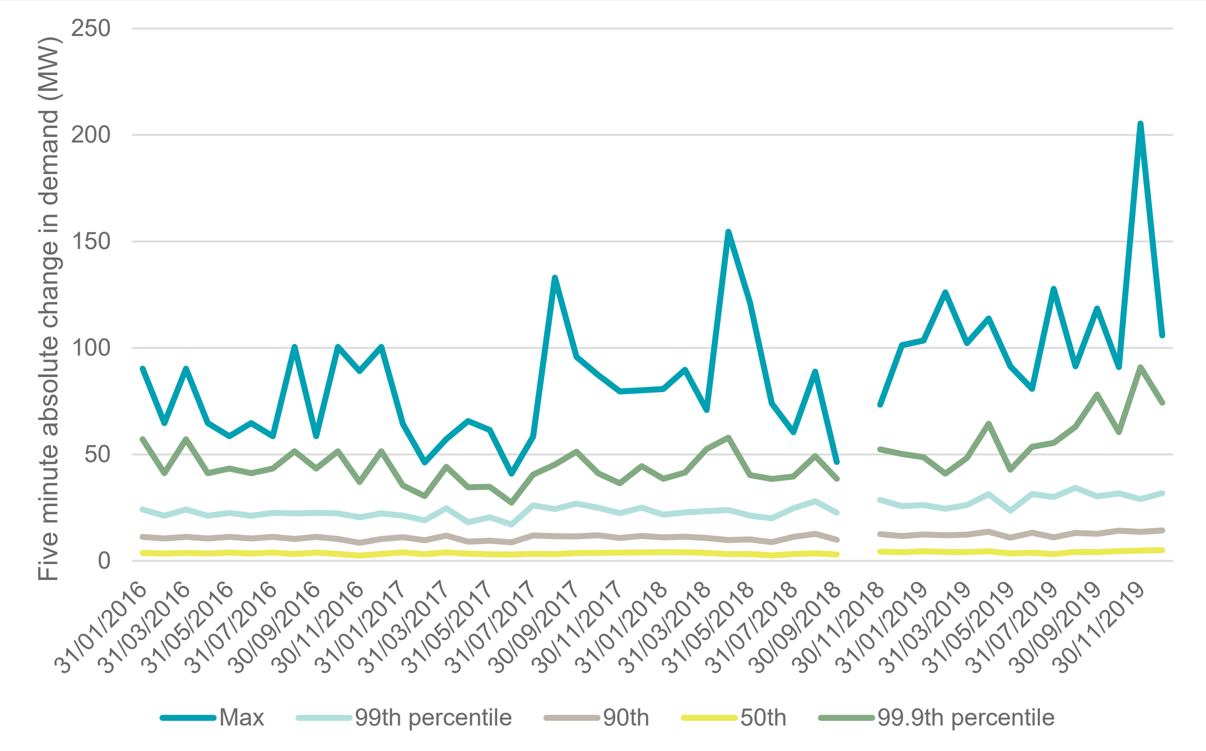
Figure 814 shows the five-minute change in the operational demand. The maximum five-minute ramp variation occurred in 2019 with a value of 592MW and the second highest was 557MW in 2016. No trend in increasing variability was apparent from the data set.

Figure 14: Five-minute absolute change in operational demand by month



Source: ERA analysis of AEMO data

Figure 15: Five minute absolute change in output non-scheduled generators[131]



Source: ERA analysis of AEMO data

Wholesale supply

Generating capacity

Currently, there are 4,888 MW of capacity credits assigned in the market against a requirement of 4,410 MW, leaving excess capacity of 478 MW. Excess generation capacity exists over and above the reserve capacity target for the WEM. The reserve capacity target is set to ensure there is sufficient capacity in the WEM to meet very high levels of demand (one-in-10 year peak demand) plus a reserve capacity margin to cover the sudden loss of generating units in the SWIS.

Of the total generation capacity in the WEM, 793 MW is connected as intermittent non-scheduled generation with an assigned capacity credit of 183 MW.[132]

There have been changes in generation capacity over the review period and future changes announced.

Badgingarra wind farm, with installed capacity of 130 MW, commenced operation in the first quarter of 2019. Badgingarra is the first generator to connect under the Generator Interim Access arrangement, which allows new generators to connect to the network but with the possibility that their output may be constrained to protect system security. Yandin and Warradarge wind farms are scheduled to be fully commissioned and operational in 2020,

131 There is a gap in the data in late 2018.

132 AEMO, 2020, *Market Data Western Australia*, *Facilities*, (online).

adding 394 MW of nameplate capacity to the WEM.[133] Yandin, Warradarge and Badgingarra wind farms collectively provide around 100 MW of accredited capacity.[134]

In August 2019, the Energy Minister announced that Muja Power Station unit five would be retired by 1 October 2022, followed by unit six by 1 October 2024.[135] This will remove 392 MW in combined accredited capacity from the market.

AEMO has advised there is a decline in excess capacity from 443 MW (9.9 per cent) in capacity year 2021/22 to 309 MW (7 per cent) in capacity year 2022/23.[136] AEMO attributed the reduction in excess capacity to the retirement of Muja units five and six.[137] New renewable generation has contributed to the capacity surplus in the market and AEMO is forecasting excess capacity to remain, although declining with plant retirement, in coming years.

Generation sent out

Since 2014, generation has decreased year on year, except for 2016 which had an unusually hot summer. In 2019, the aggregate output of the three largest generators, Alinta, Summit Southern Cross Power, and Synergy, was around 90 per cent of the total generation sent out. This is comparable to previous years.

133 Yandin and Warradarge wind farms will receive 36.2MW and 30.2MW of accredited capacity respectively. Badgingarra wind farm has 35.6MW of accredited capacity.

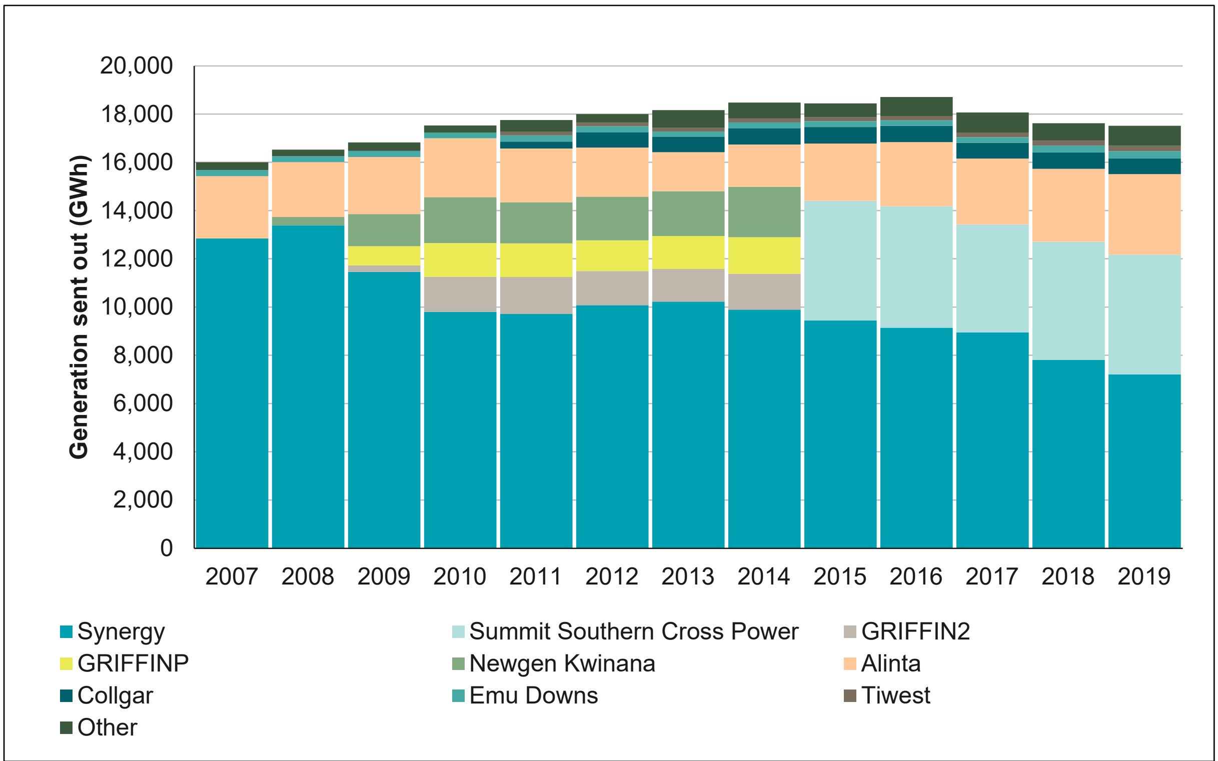
134 Intermittent generators such as wind and solar farms by their nature have variable, weather-dependent output. This variability is taken into account when determining to what extent intermittent generators can be relied upon to have capacity available when needed to meet demand and support reliability in the SWIS. The method AEMO uses to determine the quantity of capacity credits allocated to intermittent generators is called the relevant level method. Intermittent generators tend to receive a proportion of their nameplate capacity as capacity credits. Despite this, if intermittent generation continues to connect to the SWIS it will continue to contribute to overall system capacity and excess capacity.

135 Government of Western Australia media statement, 5 August 2019 ‘Muja Power Station in Collie to be scaled back from 2022’, (online) [accessed 16 July 2020].

136 AEMO, 2020, *2020 Electricity Statement of Opportunities*, pp 4-5, (online).

137 Ibid. P. 62.

Figure 16: Generation by market participant



Source: ERA Analysis of AEMO data

Competition in the WEM

Competition between wholesale electricity suppliers ensures that only efficient wholesale costs are passed through to retail customers. The intended progression to more competitive outcomes is fundamental to the design of the WEM and was noted in the ERA's first report to the Minister on the WEM.[138][139]

The WEM relies on competitive markets to procure some services, such as the balancing and load following markets. The WEM uses administered procurement mechanisms that seek to emulate the outcomes of competitive markets for other services such as the procurement of capacity and some ancillary services.

Effective competition provides two cost-minimising effects. It incentivises market suppliers to improve profits through reducing costs or developing innovative products that consumers desire. Without competition, market participants may not work as diligently on improving the efficiency of their operations or negotiate the best terms in their supply arrangements. Competition also reduces the opportunity for individual market participants to exercise market power and raise supply prices beyond a reasonable cost of supply.

Without intervention, opportunities to improve competition in the wholesale market are limited in the medium term. This is due to reducing demand as rooftop solar competes with retail supply of electricity. The Australian Government's Renewable Energy Target will cease increasing from this year and the incentive it provides to new large-scale renewable generators will diminish from this year on.

[138] ERA, 2007, *Discussion Paper, Annual WEM Report to the Minister for Energy*, p.5 (online).

[139] The market's second objective is to encourage competition.

The remainder of this section examines how competition has evolved in the WEM since the commencement of the market. Section 2.5 discusses how the pricing outcomes in ancillary services are influenced by the level of competition in the balancing market.

The balancing market is a gross pool market, meaning that suppliers must offer their entire supply to the market, including bilateral contracts and self-consumption for vertically integrated entities. Participants' expectation of future balancing prices underpins the price of energy in the short-term energy market (STEM), customised bilateral contracts, and standard products offered by Synergy. Any inefficiency in the balancing market is passed through to the pricing of energy in these derivative markets.

The balancing price also underpins a large part of the price of some ancillary services. This is because the price of those ancillary services is largely determined by energy sale revenues an ancillary service provider foregoes by offering its capacity for the provision of ancillary services.

Competition analysis

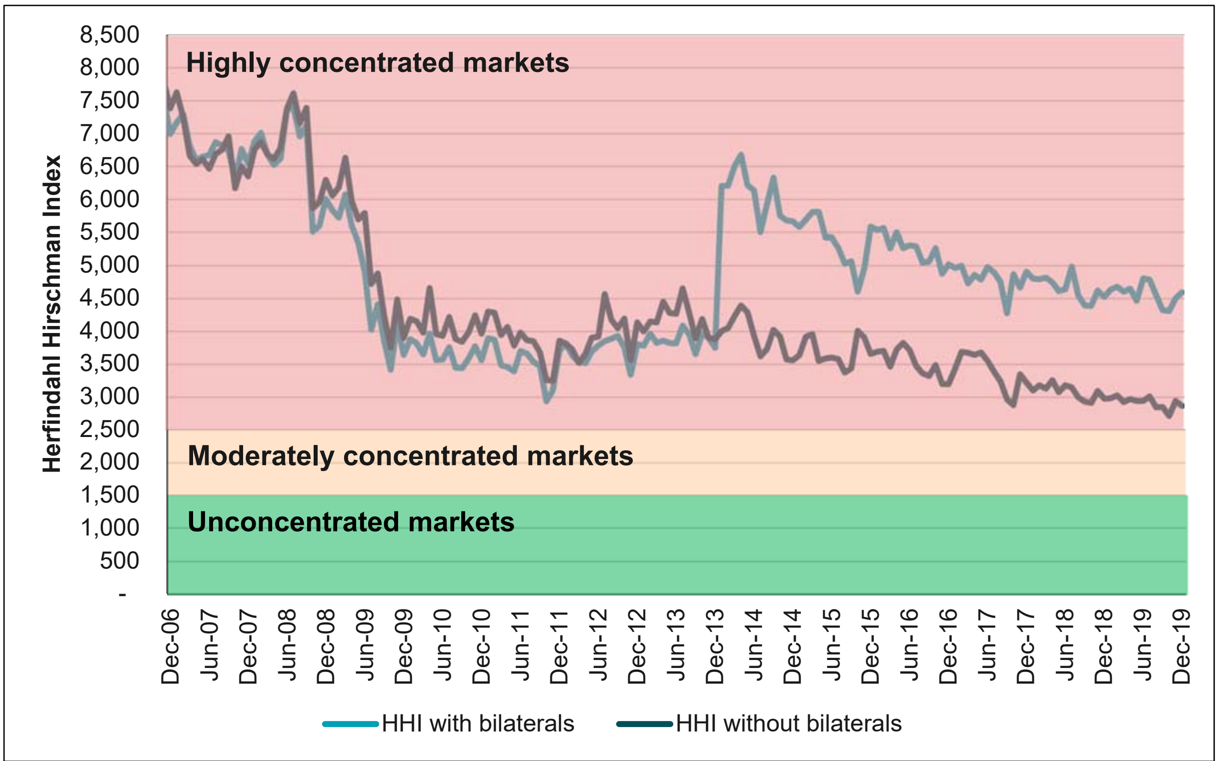
Consistent with the analyses presented in the previous editions of this report, the ERA examined the level of competition using wholesale market shares and the Herfindahl Hirschman Index (HHI), which is a measure of market concentration. The Gini coefficient has also been considered to supplement the HHI analysis.

The HHI is the sum of squares of the individual market share of market participants from a scale of 0 to 10,000. Highly atomised unconcentrated markets yield very low values and highly concentrated markets yield high values. The HHI of the WEM is around 3,000 which sits in the highly concentrated range of the market.

The HHI can only change when new suppliers enter the market, incumbent suppliers exit the market, or there are changes in ownership of generation capacity. In 2019, Synergy was the largest generator by capacity and electricity generated, followed by Summit Southern Cross Power and Alinta. These three generators produced around 90 per cent of the electricity generated in the wholesale market, as illustrated by the HHI shown in Figure .

Once bilateral power purchase agreements are accounted for, the market sits well within the highly concentrated band. Retailers manage the risk of price changes in the balancing market through bilateral contracts with generators. Accounting for bilateral agreements between generators is important because those bilateral arrangements between generators increase the concentration of the supply of risk management instruments in the market.

Figure 17: Monthly Herfindahl Hirschman Index and accredited capacity for the WEM



Source: ERA analysis of AEMO data.

As the HHI is an indicator of concentration, it should be considered with other indicators to provide a view on the performance of the market and any possible existence of market power. This review considers two additional indicators of competition in the market: the Gini coefficient and the pivotal supplier test.[140]

The Gini coefficient provides a measure of the distribution of market share and has been applied in other electricity markets.[141] Markets with equal HHI scores but differing level of distribution, as measured by Gini coefficient, present different competitive outcomes.[142]

The Gini coefficient ranges from 0, being perfect equality, to 1, being monopolistic. Typically, a Gini coefficient of 0.35 would represent moderate inequality in a market, whilst a Gini coefficient of 0.60 or higher would signal strong inequality and oligopolistic competition. The Gini coefficient is derived from the relative area under the Lorentz curve, which maps the ratio of the number of market participants and their corresponding market share against an even distribution.

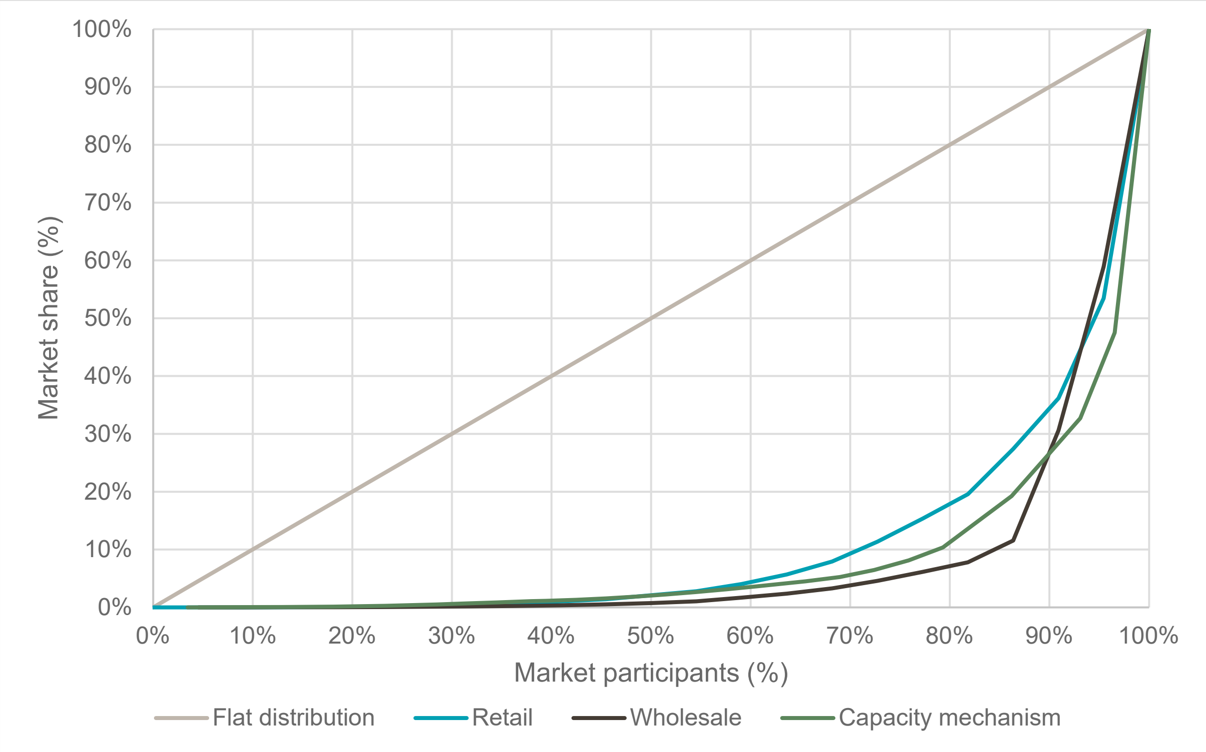
140 The Gini coefficient is a ratio of evenness of a distribution derived from a comparison between a Lorentz curve and an even distribution. A Lorentz curve is a cumulative percentage share distribution ranked from smallest to largest.

141 Commission for Regulation of Utilities, 2019, *Electricity and gas retail markets report Q1 2019*, pp. 81–84, (online).

142 For example, Kwoka 1979 cited in Seaman et. al., argues that concentrated markets will perform much more competitively when the third firm gains market share relative to the largest two firms, even when overall concentration remains relatively high. For example, three firms with roughly equal market share will tend to deliver lower prices than two equally sized firms. Refer to
Seaman B. A., Wilker A. L.., Young D. R., 2014, *Measuring Concentration and Competition in the U.S. Nonprofit Sector*: *Implications for Research and Public Policy*, Nonprofit Policy Forum, Volume 5 (2) pp. 231-259, (online).

The Gini coefficients for the different WEM mechanisms are 0.89 for retail (including the franchise market) and 0.92 for wholesale and the capacity mechanism. Figure shows the Lorentz curves of market share distribution for the retail market, wholesale generation and the capacity mechanism. This corroborates other market concentration indicators discussed in this report. This market concentration and inequality, as measured by HHI and Gini coefficient, is symptomatic of pervasive market power. The Irish Retail Market has a Gini coefficient of between 0.49 to 0.54 for the small, medium, and large business segments.[143]

Figure 18: Lorentz curves for market share distribution in the WEM for 2019



Source: ERA analysis of AEMO data.

Market shares show how large is the supply of one company relative to the rest of the market. Market concentration shows the extent to which a market is dominated by one or more firms. For the first time, this report uses pivotal supplier analysis to assess how important each firm is in meeting electricity demand.

By showing the importance of a generator to meeting electricity demand, the pivotal supplier test reveals the existence of market power in the balancing market. This test examines if a generator's capacity is required to meet demand in a given period and determines whether the generator can exert market power by withholding electricity.

The pivotal supplier test is a common measure of market power in electricity markets.[144] The Pennsylvania New Jersey Maryland (PJM) market, New York and California system operators in the United States, and the Office of Gas and Electricity Markets (the energy market regulator in the United Kingdom) all use the pivotal supplier test to examine the opportunity for the exercise of market power.

[143] Commission for Regulation of Utilities, 2019, *Electricity and gas retail markets report Q2 2019*, pp. 81-83, (online).

[144] HoustonKemp, 2018, *International review of market power mitigation measures in electricity markets*, p. 8, (online).

The pivotal supplier test considers whether market participants tested have the ability to engage in physical or economic withholding without losing market share. It measures the degree to which the supply from one or more suppliers is required to meet system demand, taking account of any network constraints that may be present. Pivotal suppliers can choose not to generate to restrict supplies to increase prices or offer their capacity at higher prices, without the threat of being undercut by competitors. These generators are then often subject to additional ex-ante market power mitigation measures such as cost-based pricing. This is conceptually equivalent to pricing based on short-run marginal cost, where individual facilities cannot price above a facility-specific price. This ex-ante market power mitigation measure avoids costly ex-ante reviews and court cases.

A simple example to illustrate the pivotal supplier test is provided in the explanation box below. Pivotal suppliers are market participants without which the market could not meet demand.[145] The pivotal supplier test aggregates the capacity offered to the market excluding those for the suppliers being tested, which in many markets is three largest suppliers, and calculates a net capacity amount.[146,147] If over a period the net capacity available to the market is insufficient to meet demand, the market participants tested are considered pivotal over the tested period. A simple example to illustrate the pivotal supplier test is provided in the explanation box below.

Simple examples of the pivotal supplier test[148]

The pivotal supplier equation evaluates the capacity of a generator, or capacity of a group of generators, against the quantity of spare capacity in the system at a point in time.

In a sample electricity market with total capacity of 100 MW there is demand of 80 MW. Generator A has capacity of 14 MW and Generator B has capacity of 10 MW.

Spare capacity in the system is measured as total capacity less demand. If a single generator, or group of generators, has a quantity of capacity greater than the quantity of spare capacity in the system, the generator or group of generators are pivotal suppliers.

Generator A capacity = 14 MW and spare capacity is 20 MW (100 MW – 80 MW)

Generator A's capacity is less than the spare capacity (14 MW < 20 MW) and so Generator A is not a pivotal supplier.

The combined capacity of Generators A and B is 24 MW.

Spare capacity is 20 MW so Generators A and B combined are pivotal (24 MW > 20 MW) and would fail the two pivotal supplier test.

In addition to conducting a three pivotal supplier test, the ERA also applied the pivotal supplier test to Synergy alone as the largest generator in the WEM. Figure 19 shows the residual

145 Haas H., Scheidecker P., 2007, *Three Pivotal Supplier Test: Theory and Application*, PJM, (online).

146 The test excludes capacity on outages and capacity reserved for load following ancillary services (LFAS) upwards, because those capacities are not available for trade in the balancing market.

147 The pivotal supplier test does not account for bilateral contracts. There are circumstances where bilateral contracts may be important but not captured by a test if the contracted party, say under a long-term power purchase agreement, would find it difficult to obtain fuel supplies at short notice if it had spare capacity after a bilateral nomination was made. There may be instances where bilateral contracts could increase the extent to which suppliers may be pivotal if their nominations could influence pricing outcomes.

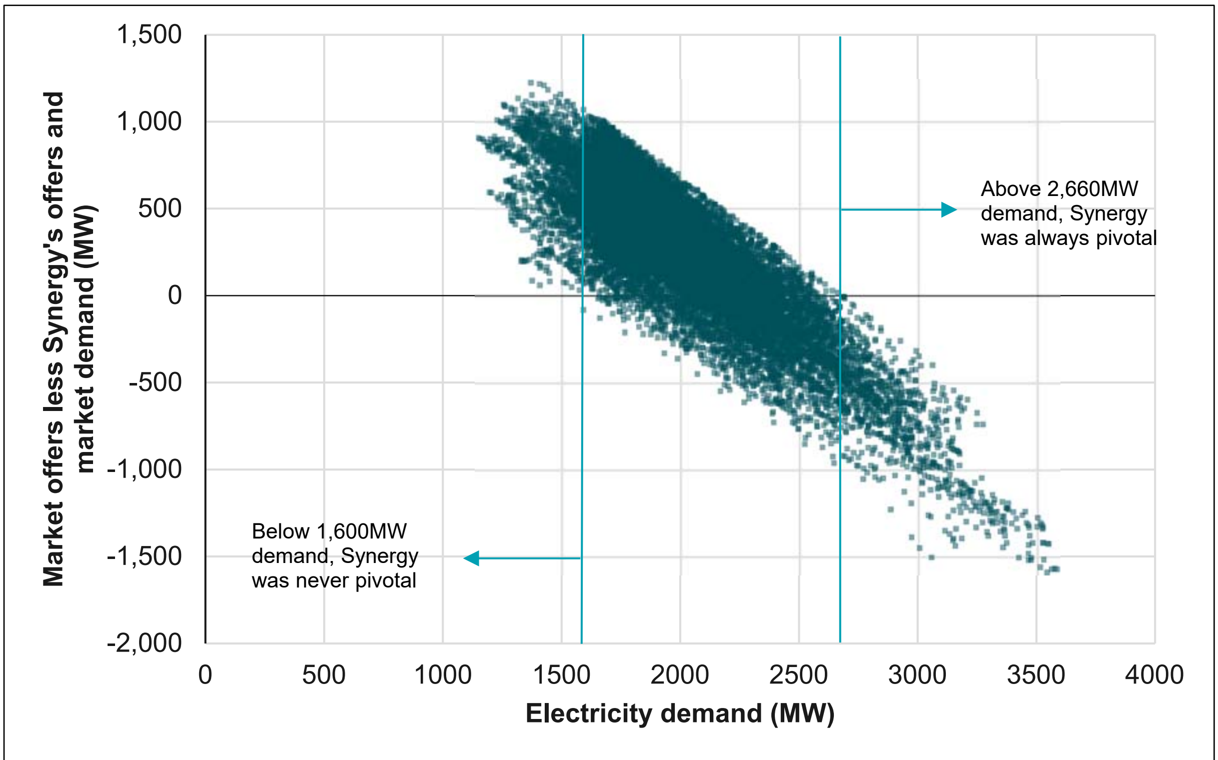
148 Examples drawn from: Penn State, College of Earth and Mineral Sciences, *Measuring Market Power*, (online) [accessed 4 June 2020].

balancing market offer quantities excluding Synergy's offers at different levels of demand through 2019.

Points above zero on the vertical axis show the intervals where there was sufficient generation capacity available to meet demand without Synergy. In these instances, Synergy was still pivotal when its capacity was aggregated across the three largest suppliers in the market but was not solely pivotal. Points below zero on the x-axis show those intervals where there was insufficient capacity to meet demand without Synergy. During these intervals Synergy was pivotal in its own right.

Figure 19 also shows that when demand fell below 1,600 MW in 2019, Synergy alone was not pivotal by itself (although it was pivotal in combination with other suppliers), and demand could be met without Synergy's bids into the market. When demand rose above 2,660 MW, Synergy was always pivotal and demand could not be met without its output.

Figure 19: Residual balancing market offers (excluding demand and Synergy's offered capacity)

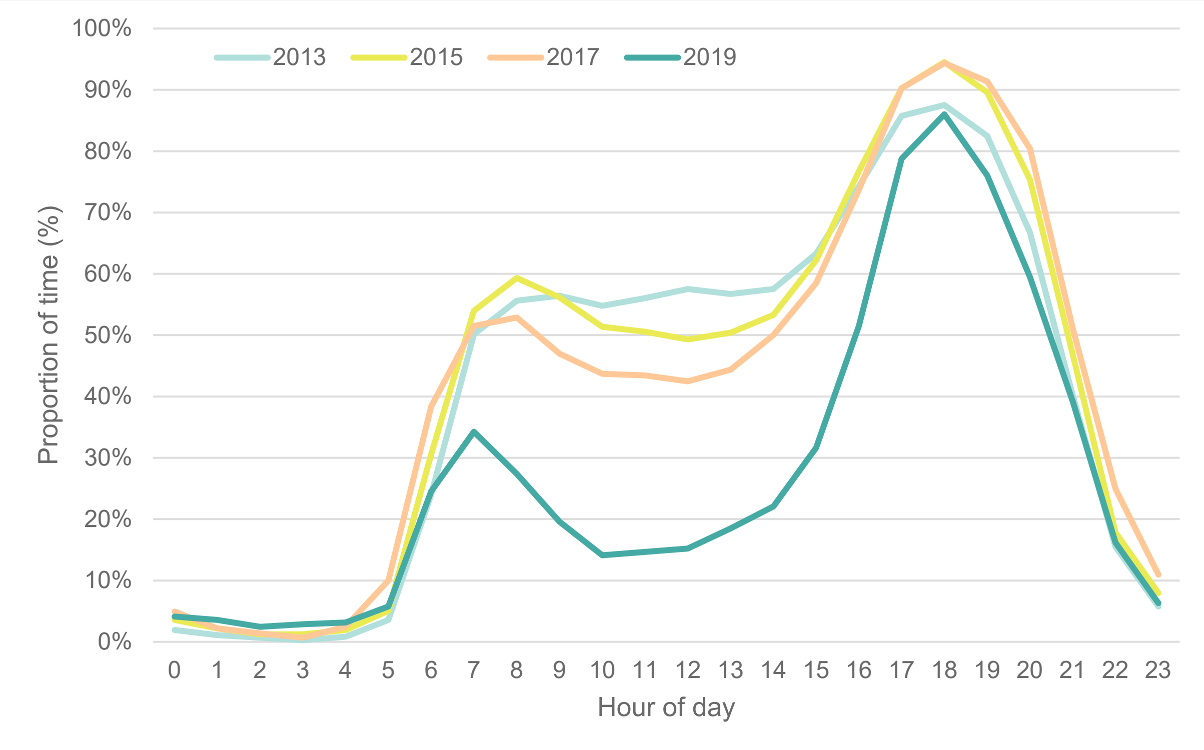


Source: ERA analysis of AEMO data.

In the WEM, Synergy was solely pivotal 28 per cent of the time in 2019. This predictably occurs in the afternoons and evenings when demand is high. In these circumstances Synergy also tends to be the price setter, with the opportunity to raise prices. Section 0 discusses the evidence for this.

The incidence of Synergy being solely pivotal has decreased over time as indicated in Figure 20. The reduction in the frequency of intervals where Synergy is solely pivotal during daytime is mainly due to rooftop solar reducing demand rather than an underlying increase in competition within the electricity market. To a lesser degree, the decrease in how often Synergy is pivotal can also be attributed to the new capacity coming on-line from renewable generation.

Figure 20: Proportion of intervals where Synergy was pivotal



Source: ERA analysis of AEMO data

When Synergy is not solely pivotal, it remains pivotal when its generation is aggregated with other suppliers. The standard form of the test applied in other markets is for the three largest suppliers. Since its start, the balancing market has never been able to clear without the three largest suppliers: Synergy, Alinta, and Summit Southern Cross Power.

In the middle of the day when consumers are substituting electricity from the market with generation from rooftop solar, demand is lower and Synergy is a pivotal supplier less often than during the middle of the day in previous years. However, the market is always subject to pivotal suppliers and consequently reliant on the market power mitigation mechanisms in the market's design. This dampens the incentives provided by competition to increase profits by minimising costs.

Pricing outcomes in the wholesale electricity market

Pricing in the balancing market

In the balancing market, price is determined by the quantity and cost of supply from different generators and the level of demand. An increase in the supply of low-cost capacity decreases the balancing price. An increase in the level of demand increases the balancing price. Market participants exercising market power can also increase balancing prices.

The factors affecting the cost of supply are fuel and maintenance costs. The main factors affecting demand include consumers' consumption patterns, ambient temperature and more recently substitution of network demand by rooftop solar systems.

Table 1 shows the average balancing prices by peak and off-peak intervals. Average balancing prices for peak and off-peak periods are comparable to those in 2018. From 2018 to 2019, there was no significant change in the annual average balancing price. The average balancing price during peak periods in 2019 was $49.4/MWh.[149]

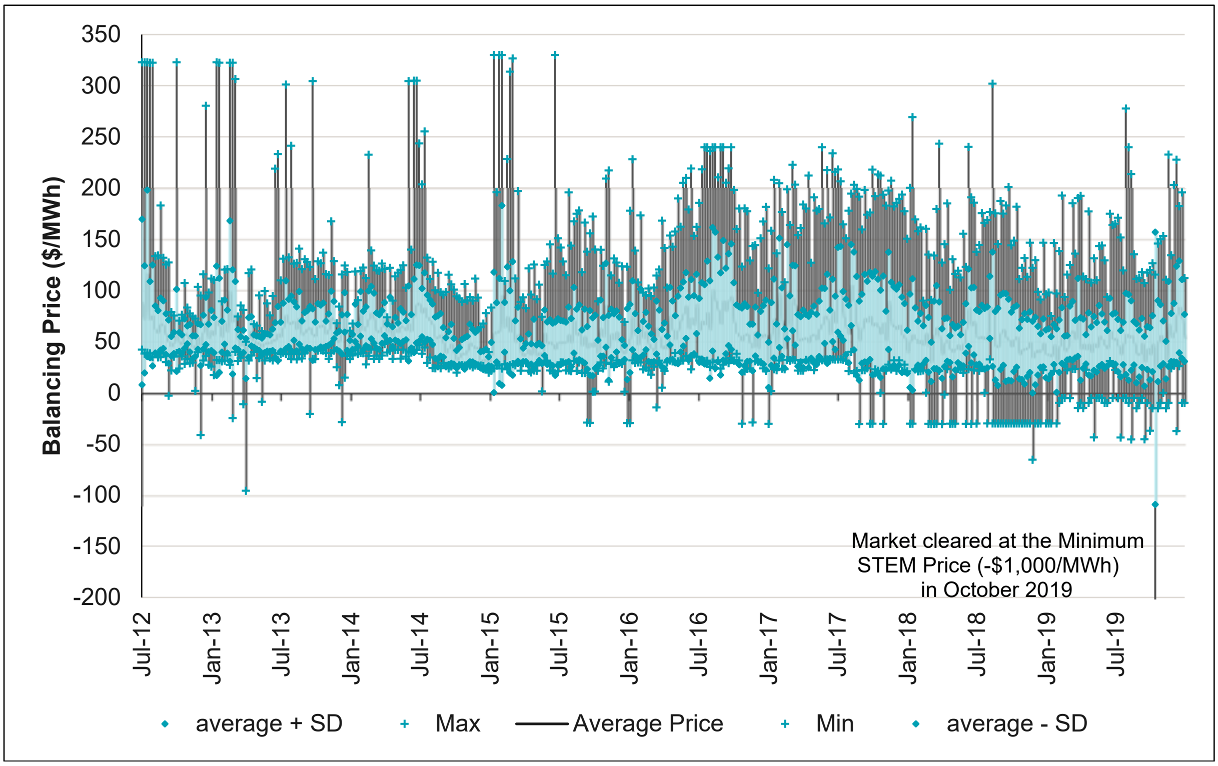
Table 1: Average balancing prices, by peak and off-peak intervals

Calendar year	Peak intervals	Off-peak intervals	All intervals
2013	$ 59.6	$ 37.9	$ 50.6
2014	$ 57.4	$ 42.8	$ 51.3
2015	$ 52.2	$ 32.8	$ 44.1
2016	$ 63.2	$ 41.4	$ 54.1
2017	$ 67.2	$ 46.1	$ 58.4
2018	$ 51.2	$ 40.5	$ 46.8
2019	$ 49.4	$ 41.2	$ 46.0

Source: ERA analysis of AEMO data.

Figures 21 and 22 show the weekly average prices in the balancing market in both peak and off-peak intervals. The maximum and minimum balancing prices and one standard deviation (SD) are also displayed in the charts.

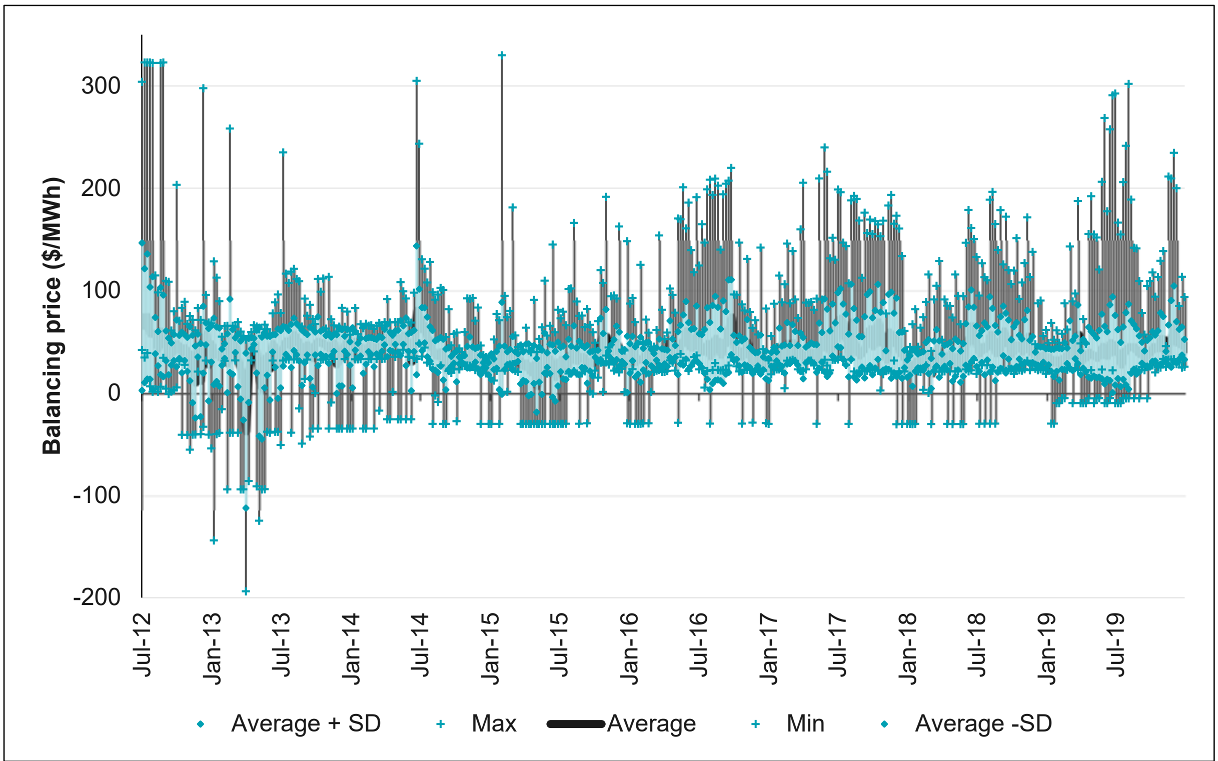
Figure 21: Weekly balancing market prices, peak intervals



Source: ERA analysis of AEMO data.

149 Peak periods are defined as 8:00am to 10:00pm and off-peak periods as 10:00pm to 8:00am in the Wholesale Electricity Market Rules (WA), 21 July 2020, Chapter 11, Glossary, (online).

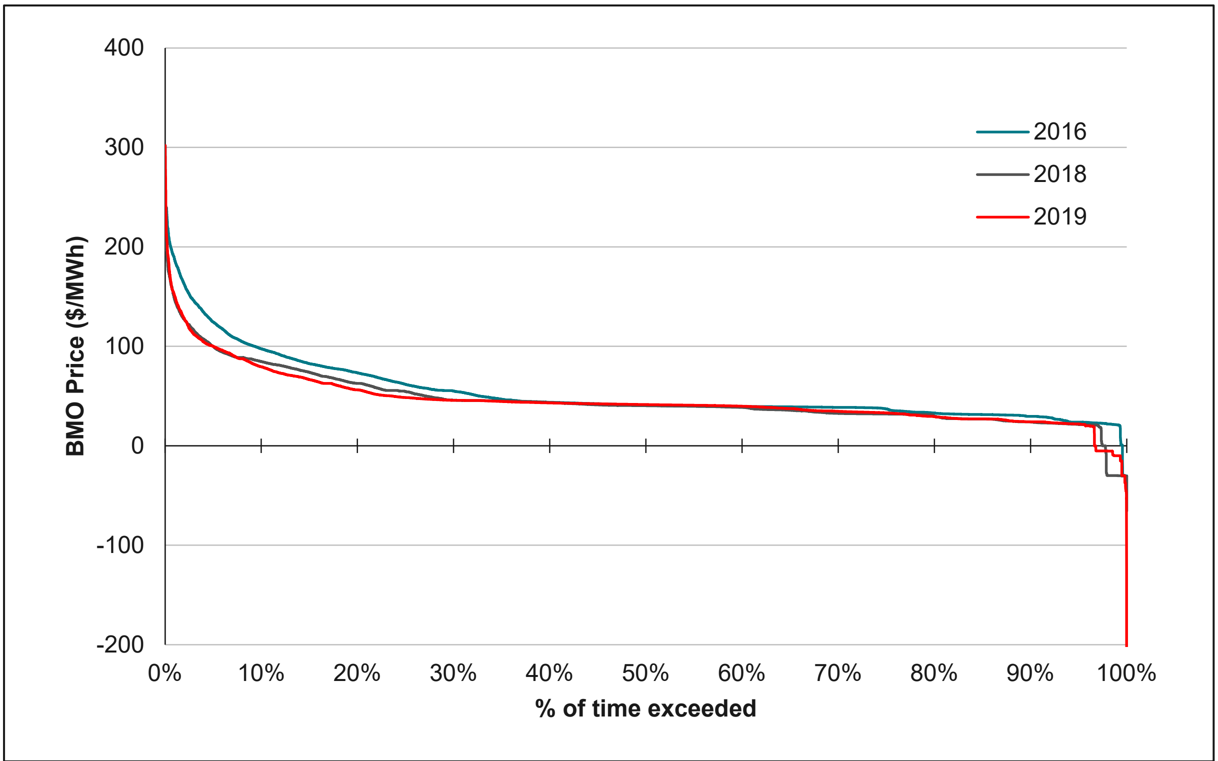
Figure 22: Weekly balancing market prices, off-peak intervals



Source: ERA analysis of AEMO data.

The price duration curve (Figure 23) shows the changing demand distribution in the balancing market and the amount of time (expressed as a percentage) that the balancing price on the vertical axis was exceeded.

Figure 23: Price duration curve



Source: ERA analysis of AEMO data.

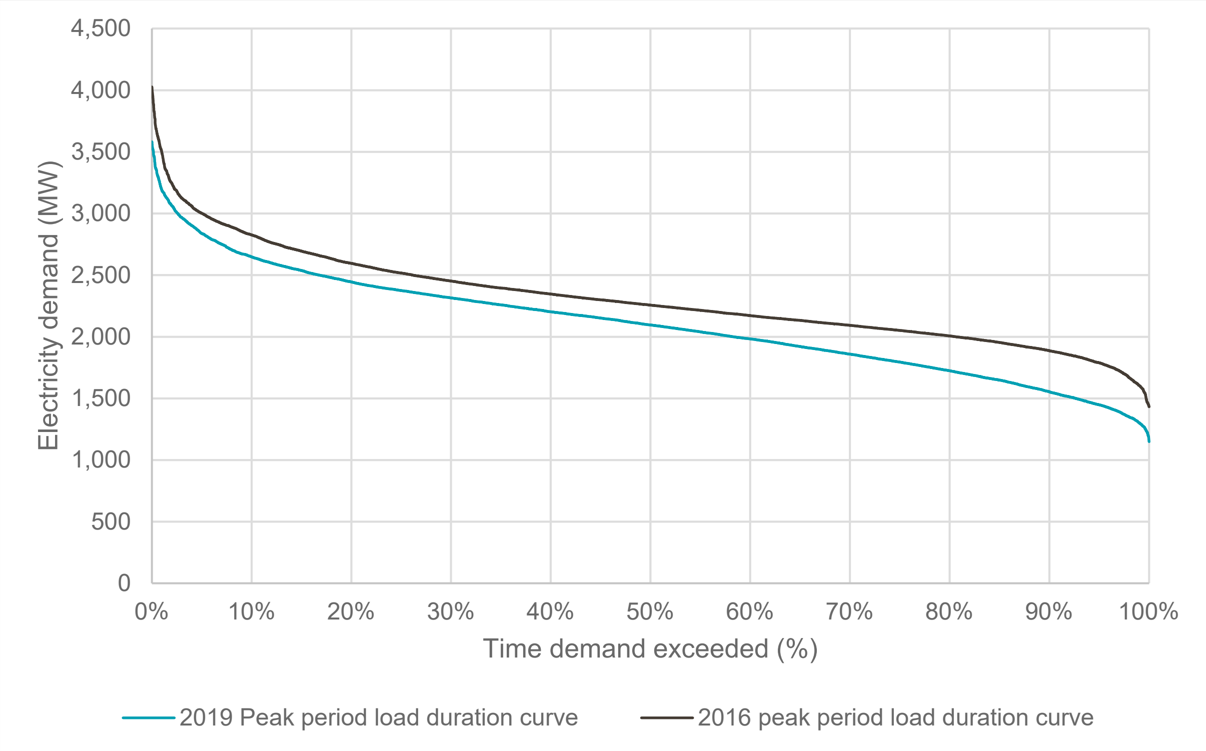
There were only marginal differences in the price duration curves between 2018 and 2019. The top 10 to 30 per cent were slightly lower in 2019 than in 2018. The bottom region of the curve shows more negative pricing incidents occurred in 2019 than occurred in 2018. In 2019, the market cleared at the price floor (of negative $1000/MWh) for three intervals in October 2019.

Most of the price decrease in 2019 occurred during peak periods.[150] Some of the lowest levels of demand and incidences of negative prices, which used to occur in off-peak periods, are now occurring during peak periods. These are predominantly on weekends when non-residential loads, such as those from small industrial businesses and offices, are lower because they are not operating and output of rooftop solar generators is high.

Figure 24 shows the load duration curve for peak periods. This indicates that overall demand has decreased substantially during peak periods since 2016.

150 The Market Rules define peak periods as hours between 8am and 10pm Monday through Sunday. In recent years demand for electricity from the grid has often been low during daylight hours due to the increasing adoption of solar PV. Periods of high demand now tend to occur during the late afternoon, peaking during the early evening and reducing after 8PM.

Figure 24: Peak hours load duration curve 2016 and 2019



Source: ERA analysis of AEMO data.

Prior to 2019/20, summer temperatures in Perth have been milder than normal for the previous three years.[151,152] This would have contributed to the downward trend in demand over the past three years in the SWIS. However, the 2019/20 summer had a much higher number of hot days compared to 2018/19. The mean temperature in Perth in the 2019/20 summer was the second highest on record and there were more high temperature weekdays to drive up demand.[153] Appendix 3 provides a detailed analysis of the effect of ambient temperature on demand.

For completeness, the ERA investigated whether lower electricity prices were due to lower fuel prices. This was not the case. Supplier weighted average domestic gas prices stayed flat at just over $4/GJ throughout 2019 and coal prices increased only marginally.[154]

Renewable energy in the form of wind and solar has very low marginal production cost. Such low marginal cost generators displace more expensive generators in the merit order and reduce the cost of supply. In 2019, the Badgingarra wind farm commenced operation. The wind farm's average output during 2019 was 61 MW. Through 2019, its market offers were

151 Bureau of Meteorology, 2020, Seasonal Climate Summary for Greater Perth, product code IDCKGC21R0, (online).

152 Bureau of Meteorology, 2019, Seasonal Climate Summary for Greater Perth, product code IDCKGC21L0, (online). Ibid, 2018, (online). Ibid, 2017, (online).

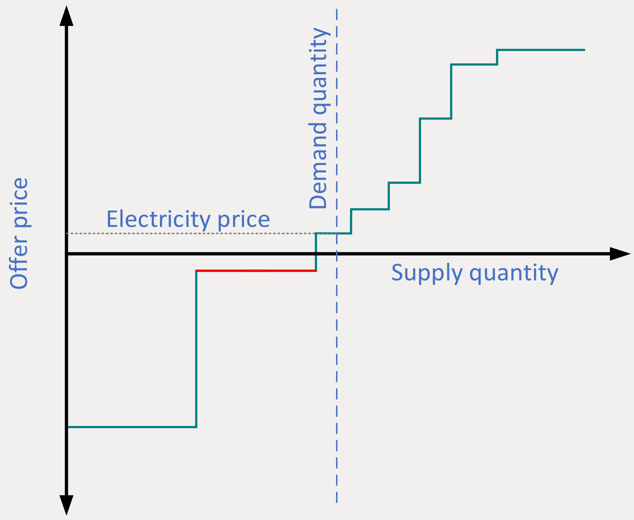
153 Bureau of Meteorology, 2020, Seasonal Climate Summary for Greater Perth, product code IDCKGC21L0, (online).

154 This dataset is compiled from company royalty declarations which collects actual pricing and quantity data from transactions made by suppliers.
DMIRS, 2020, Major Commodities and Resource Data, (online). 'Petroleum – Gas prices' and 'Minor Commodities – Q&V' tabs.

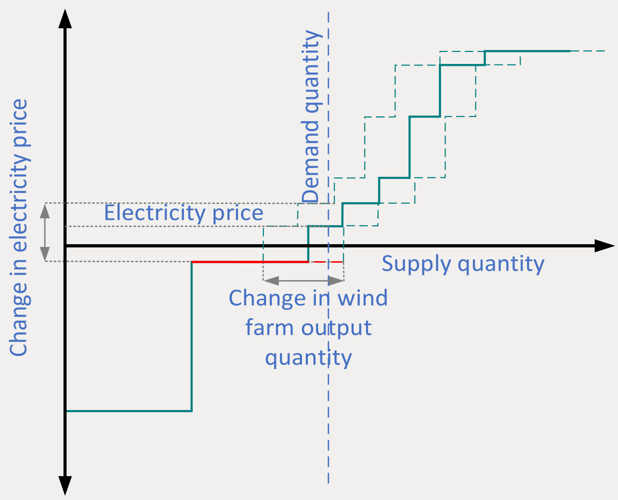
typically at negative $15/MWh. The relatively low balancing prices in 2019 were due to the lower average demand and the entry of Badgingarra wind farm.

Explanation: How supply and demand volatility affect price

Offers into the electricity market comprise a price quantity pair. The diagram shows a supply curve with quantity plotted on the horizontal axis and price on the vertical axis. The price for electricity will depend on where quantity of demand intersects the supply curve, indicated by the vertical line.



Intermittent generators such as wind and utility-scale solar farms have a variable quantity depending on weather conditions. Variable generator output, shown by the red step in the figure above, will alter the shape of the offer curve. For a given demand quantity, if the wind farm increases output it will shift the curve to the right making electricity cheaper. If it reduces output, the curve will shift to the left making electricity more expensive.



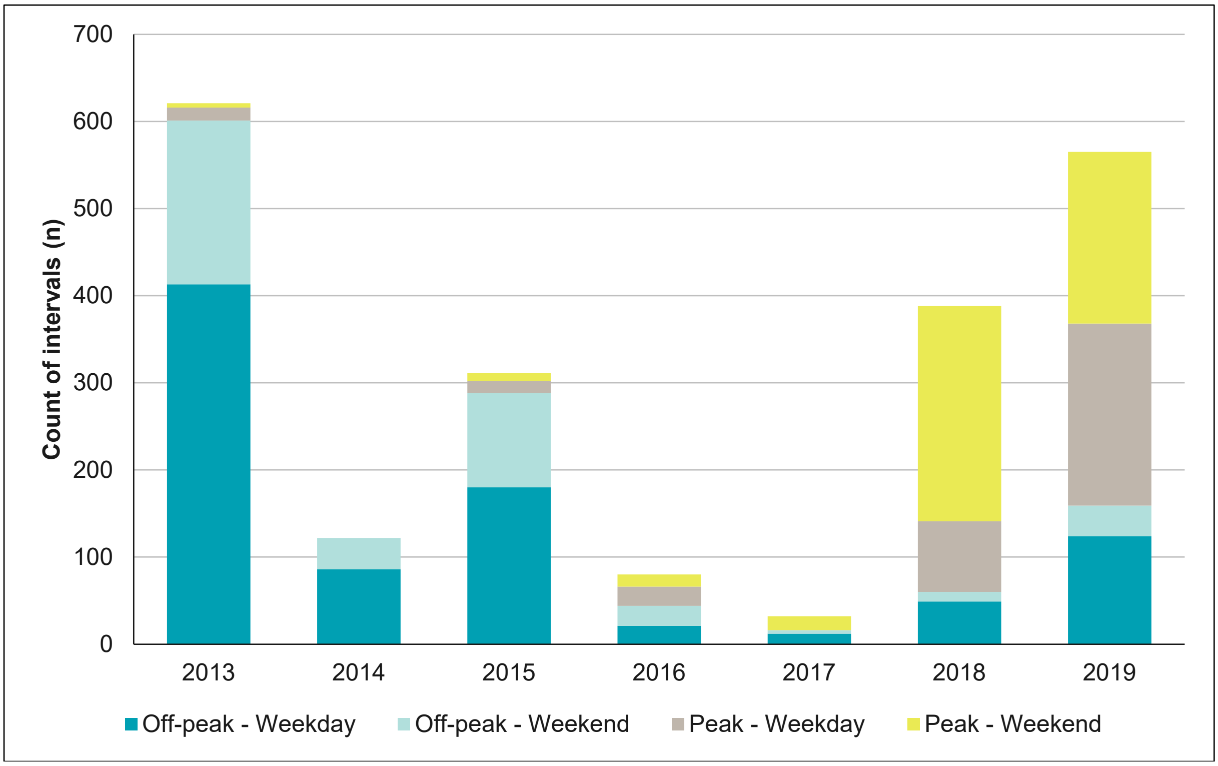
Rooftop PV output has a similar effect, but on the quantity of demand to be met through the WEM. Lower solar output shifts the demand quantity intersection point to the right making electricity more expensive, and to the left for higher solar output making it cheaper.

Incidence of negative pricing in the market

Negative prices occur when generators' cost of supply falls below zero, mainly when their cycling costs are substantial. For example, renewable generators receive revenue from the sale of renewable energy certificates to produce electricity. They are often willing to offer their energy for sale at negative prices to benefit from acquiring renewable energy certificates and selling the certificates to retailers. Coal generators can also incur substantial shut down and restart costs. These generators will bid some of their output quantities below zero if it is less expensive than turning off the generator. In this way the supply cost can fall below zero; this is a normal feature of electricity markets.

The frequency of intervals with negative prices increased in 2019. There were 565 trading intervals in 2019 where the market cleared at negative prices, up nearly half compared to the count of negative intervals in 2018.

Figure 25: Incidence of negative balancing market prices



Source: ERA analysis of AEMO data.

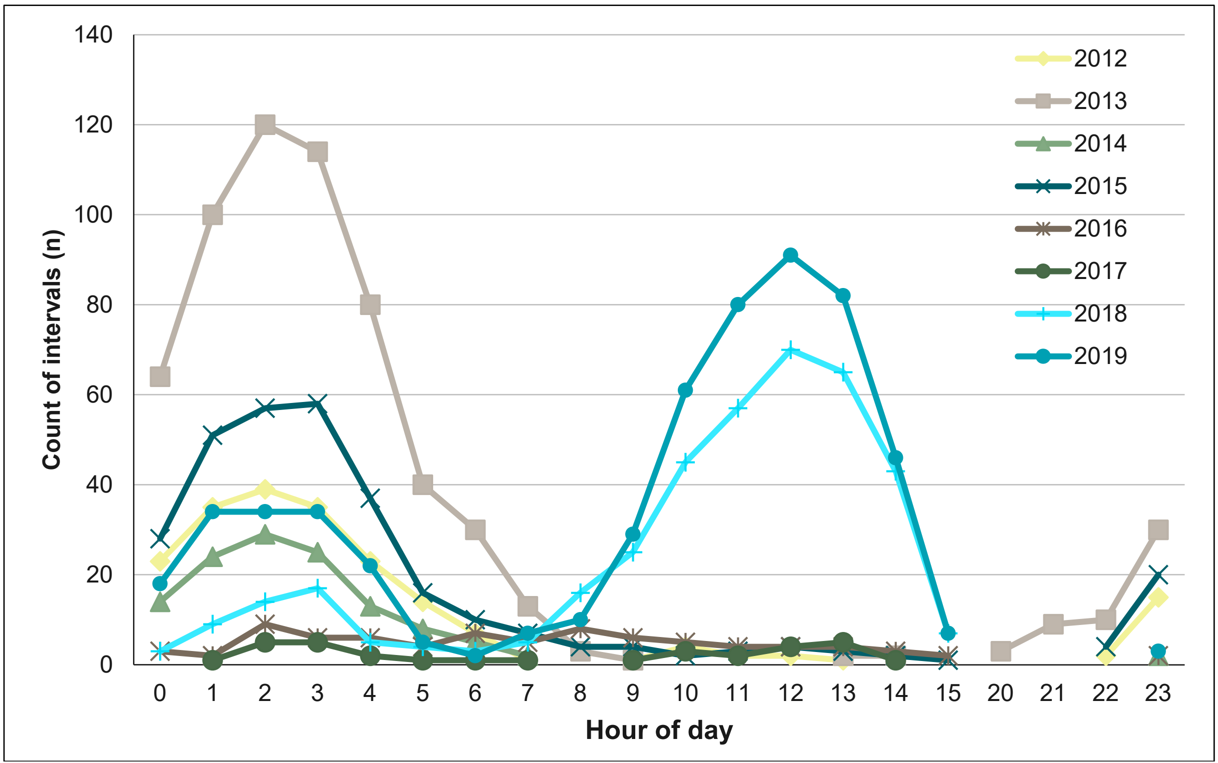
The distribution of negatively priced intervals has changed. In 2019, there were 406 negative pricing intervals in peak periods, up from 328 in 2018.[155] The increased occurrence of negative prices in peak periods is linked to falling daytime minimum demand, driven by increased rooftop solar generation and generally mild temperature conditions. Daytime negative prices mostly occurred when solar output is reducing overall demand, resulting in the balancing price reaching the negative range of the offer curves (see the explanation box above).

The number of negatively priced intervals during off-peak periods also increased in both 2018 and 2019 following a period of progressively fewer negatively priced intervals since 2013. Negatively priced intervals fell when there were generator retirements (such as Kwinana

155 Peak periods are defined as 8:00am to 10:00pm and off-peak periods as 10:00pm to 08:00am in the Wholesale Electricity Market Rules (WA), 21 July 2020, Chapter 11, Glossary, (online).

Power Station and the South West Cogeneration Joint Venture). The increase since 2018 may be linked with low demand and with new wind capacity in 2019.

Figure 26: Incidence of negative balancing market prices by time of day



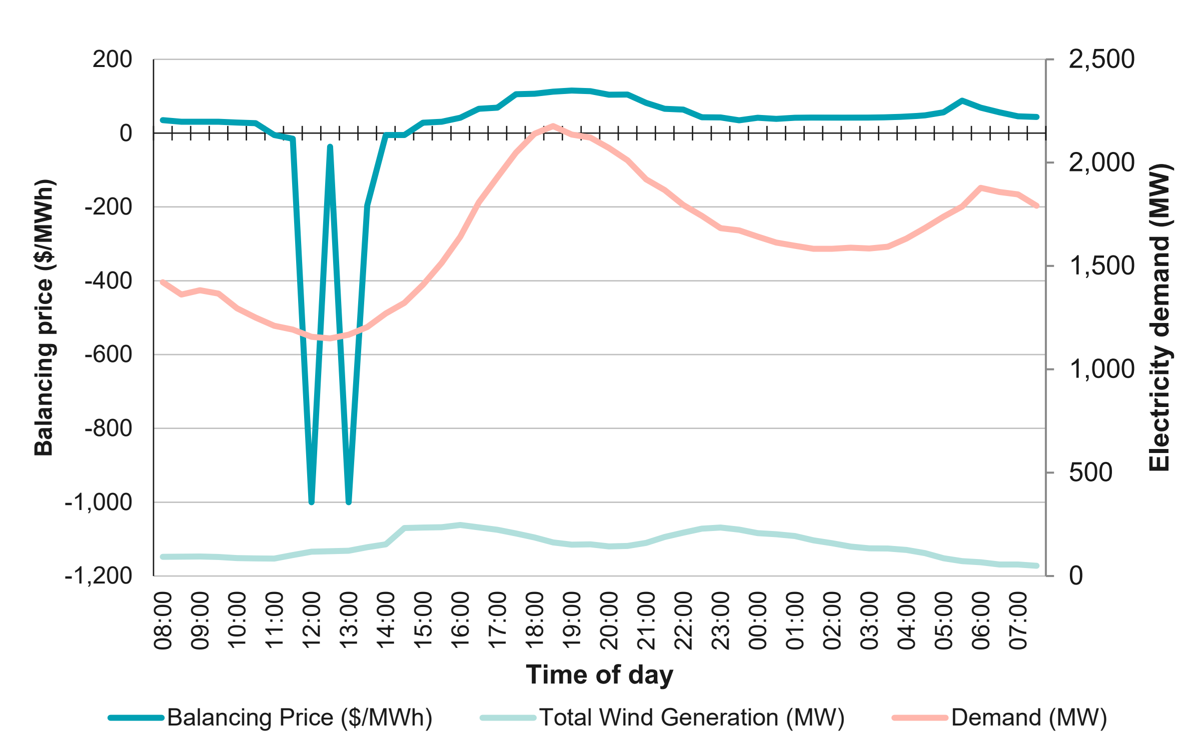
Source: ERA analysis of AEMO data.

Intervals where the market cleared at the floor price

During 2019, the balancing price reached the market floor price (the minimum STEM price) of negative $1,000/MWh for the first time since the market commencement. This occurred in three half hour trading intervals across Saturday 12 October and Sunday 13 October.[156]

[156] The three half hour intervals were: 1:00pm on 12 October and at 12:00pm and 1:00pm on 13 October.

Figure 27: Intervals where the market cleared at the Minimum STEM Price on 13 October 2019



Source: ERA analysis of AEMO data.

Over the preceding 24-month period, there were 70 occasions when demand fell to low levels, between 1,200 and 1,300 MW, but the balancing market price did not fall to -$1,000 MWh. There were three contributing factors to the minimum price events in October 2019:

- market bidding gate closure arrangements
- arrangements for bidding into the load following ancillary service (LFAS) market
- generators' decision to offer at the price floor.

These are discussed separately below.

Effect of market bidding gate closure arrangements

At present, the WEM rules require Synergy to bid electricity into the balancing market up to 10 hours ahead of the actual trading intervals and independent power producers must bid two hours ahead. AEMO provides generators with forecasts of wind generation, demand and supply quantities and the balancing merit order for future trading intervals to help them form their bids. This market information can change materially between when generators make their bids and the actual trading interval. On the three trading intervals where prices reached negative $1,000 per MWh, the forecast balancing price for the interval did not show a fall to negative $1,000 per MWh.

Effect of bidding arrangements into the load following market

Currently, under the WEM rules, participation in the LFAS market is compulsory for Synergy. The LFAS market closes before the balancing market to determine which generators are cleared to provide quantities of LFAS. The WEM rules require those generators cleared to provide LFAS to offer the LFAS quantity and their minimum generation quantity into the balancing market at the price floor, negative $1000 per MWh, to ensure the plant is dispatched to provide LFAS.

The current WEM requirement for LFAS is 85 MW (42.5 MWh) for each 30-minute interval. Synergy is typically the default provider. However, on the three trading intervals where the balancing price reached negative $1,000 per MWh, four large generators participated in the LFAS market and were cleared to provide 85 MW of LFAS. These four generators then bid their minimum generation quantities, 435 MW in total, into the balancing market at the floor price of negative $1,000 per MWh to ensure they were dispatched to provide 85 MW of LFAS. This created an excess supply of 350 MW of energy offered at negative $1,000 per MWh that could have been otherwise offered at its true cost of supply. The biggest contributor to this excess supply was NewGen Kwinana, which was cleared to provide 30 MW of LFAS, but offered 208 MW in the market to account for its minimum generation of 178 MW.

Effect of generators' decisions to bid at the price floor

It is common for a generator to bid in the minimum quantity of stable generation to run a facility, termed "mingen", at very low price. Aside from generators providing certain ancillary services, other generators will bid at negative prices to avoid being dispatched below their minimum stable generation limit. While the Market Rules prohibit bidding above short run marginal cost when it relates to market power, no such constraint exists for bidding below this, even as low as the floor.

Following the minimum pricing event

There are some actions under way to better assist generators when bidding into the market.

Requiring generators to make their bids well in advance of the trading interval means that market conditions and forecasts information can change considerably during this time. This is being addressed through:

- A current rule change, proposed by Perth Energy, and under consideration by the Rule Change Panel. The rule change proposes shortening gate closure to 30 minutes. This means generators will be able to change their price-quantity bids up to half an hour before the trading interval and so can base their bids on more up to date information.[157]
- The Energy Transformation Strategy plan to reduce gate closure to 15 minutes initially and then progress to real-time bidding, with no advance gate closure.[158]

Following the negative $1,000 per MWh pricing incidents in October 2019, Synergy proposed a rule change to amend the floor price. Any change to raise the floor price, to make it less negative, would limit the exposure of generators to losses from being required to offer ancillary services at the floor price. The ERA's response to the draft rule change report states, "the ERA does not consider that amending the minimum STEM price is the most appropriate means of addressing the risk that Synergy faces bidding at the price floor. Further, raising the minimum STEM price may have unintended and adverse consequences for the market."[159]

[157] Rule Change Panel, 2019, RC_2017_02 Implementation of 30-minute gate closure (online).

[158] Energy Transformation Taskforce, 2019, *Foundation Market Parameters*, pp. 15-16. (online).

[159] ERA, 2020, *Submission to RC_2019_05 Amending the Minimum STEM price definition and determination*, (online).

The Rule Change Panel is currently considering submissions received in preparing its final decision on the rule change proposal.

Pricing outcomes in the short-term energy market (STEM)

The STEM is a day-ahead forward market. AEMO calculates half-hourly clearing prices and quantities for the next day. The clearing price is determined by the amount of energy generators offer to produce, the forecast amount of energy needed by market customers, and the scheduled transactions between generators and market customers.[160] Market participants can procure energy in the STEM to manage their exposure to the risk of variable prices in the balancing market.

The day-ahead STEM also allows generators to coordinate their generation with fuel markets and reduce their fuel costs. For example, day-ahead markets assist gas-fired generators in procuring and transporting their gas supplies. This provides a 'convenience yield' to gas generators, which reduces offered supply prices to the STEM market. The next section provides a brief analysis of the pricing outcomes in the STEM compared to those in the balancing market.

To date, the volume of energy traded in the STEM has been substantially smaller than that in the balancing market. In 2019, the volume of energy traded in the STEM was approximately 4.2 per cent of electricity consumption in the system. Many market participants manage their exposure to the risk of variable balancing prices through bilateral contracts.

Figure 28 and 29 show the weekly summary data for the STEM in peak and off-peak intervals.

From 2013 to 2019, annual average STEM prices decreased on average by 3.2 per cent per year, driven primarily by decreases in peak period clearing prices.[161] There has been a downward trend in the monthly maximum clearing prices since June 2017. The STEM has also frequently cleared at negative prices during peak periods since September 2018. The occurrence of negative prices during peak periods can be explained by the uptake of the renewable energy technologies and behind-the-meter rooftop solar panels.

The price trends in the STEM reflect those in the balancing market. This is because the day-ahead STEM prices represent the best estimate of balancing market prices one day in advance. Therefore, STEM prices are closely linked with the clearing prices in the balancing market. Improvements in demand and generation forecasts can contribute to a greater level of convergence between STEM and balancing prices.[162] However, with the uptake of renewable energy technologies, including the behind-the-meter solar panels, these forecasts may become more challenging. The output of renewable energy generators is weather driven and hence highly variable. The forecast of the output of these generators one day in advance carries uncertainty.

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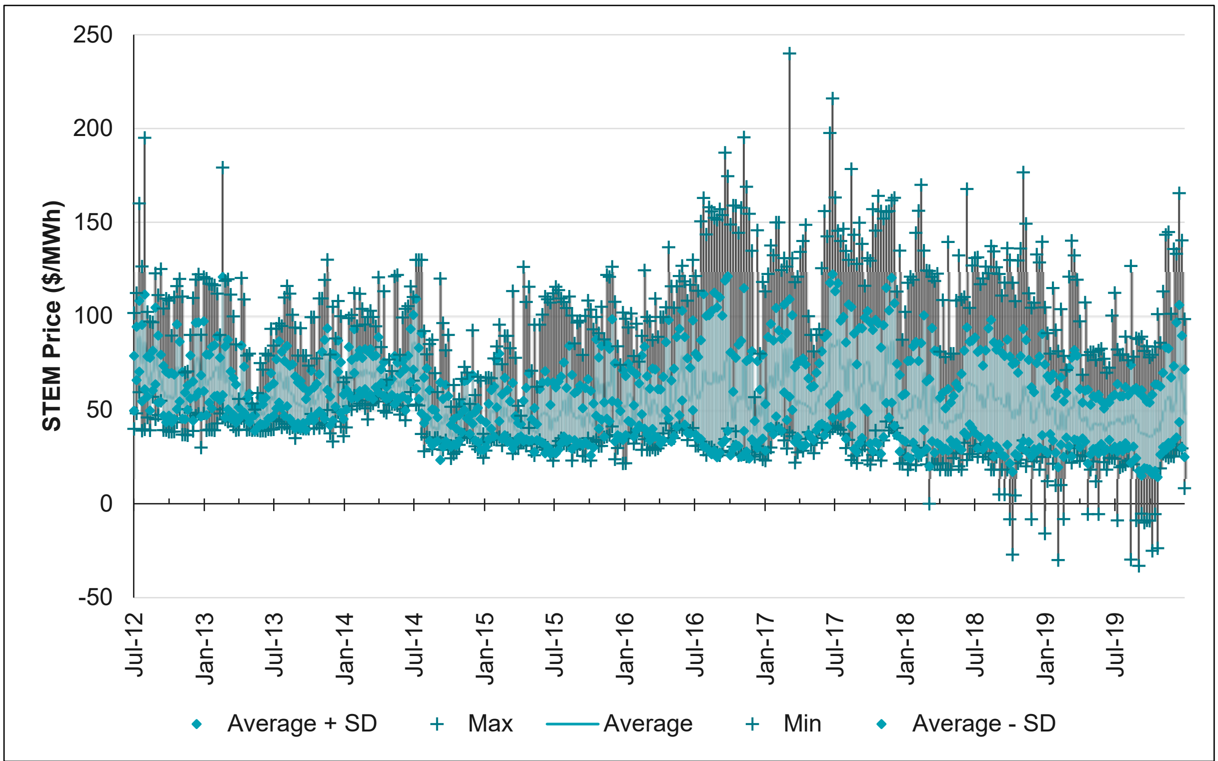
160 AEMO runs an auction for each trading interval of the next trading day, determining a STEM clearing price and clearing quantities. AEMO calculates the bids and offers for the STEM auction net of bilateral (and scheduled) transactions between buyers and sellers to the auction.

161 Estimated as compound annual growth rate.

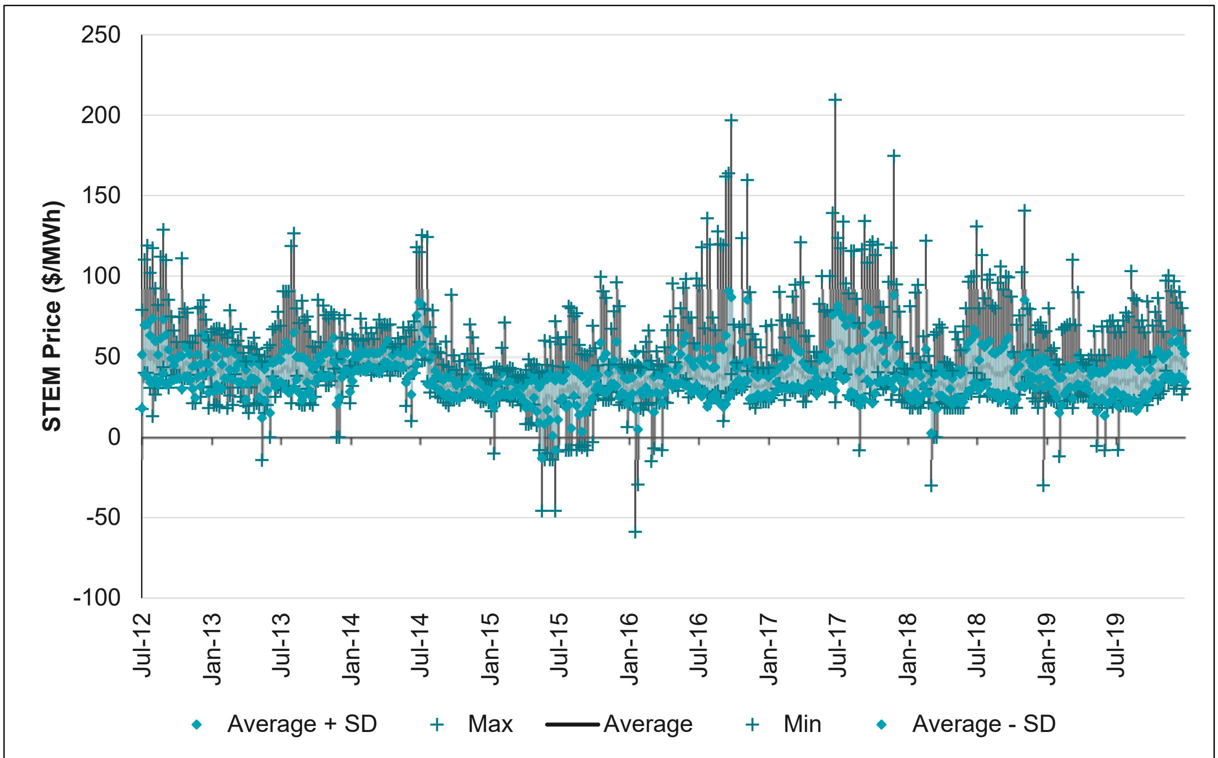
162 Increase in trading activity in the STEM market can also drive a larger level of convergence between STEM and balancing market clearing prices.

Figure 28: STEM weekly summary data, peak intervals



Source: ERA analysis of AEMO data.

Figure 29: STEM weekly summary data, off-peak intervals



Source: ERA analysis of AEMO data.

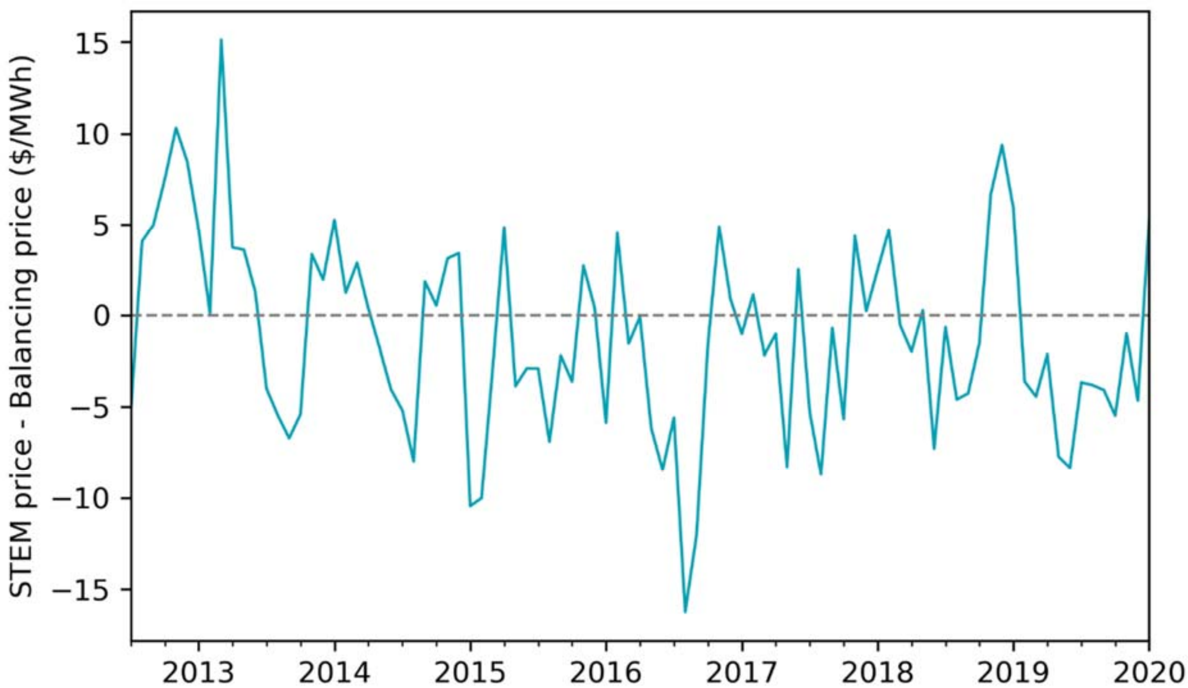
A comparison of STEM and balancing market clearing prices

Figure 30 depicts the average monthly clearing price difference between the STEM and balancing market. The monthly average difference between the clearing prices could reach up to $15/MWh. The STEM clearing price on average has been lower than the balancing price (by approximately $1.20), which could be due to a bias in forecasting supply and demand in the system.

The lower STEM price than the balancing price may also result from the existence of a 'convenience yield'.[163] The seller of energy in the STEM market may realise additional benefits (or avoid some costs) when entering into a day-ahead forward contract in the STEM market for instance, one day ahead a generator may purchase fuel at a lower cost. This convenience yield effect was also noted by the COAG Energy Council in its assessment of day-ahead markets.

The Council considered that a day-ahead electricity market allows "a gas generator to lock in a revenue stream for the sale of electricity and fund the procurement of fuel to meet its scheduled generation". The Council noted that the day-ahead market enabled gas generators to make nominations for gas supply, transportation and storage prior to commencement of the gas trading day which supported efficient operation of gas production, pipeline and storage infrastructure.[164]

Figure 30: Difference in monthly average STEM and balancing market clearing price



Source: ERA analysis of AEMO data.

163 For a discussion of convenience yields in electricity markets refer to Pozzi, (2007), The relationship between spot and forward prices in electricity markets, (online).

164 COAG Energy Council, 2020, Energy Security Board, System services and ahead markets, pp. 23–24, (online).

Pricing in the ancillary services markets

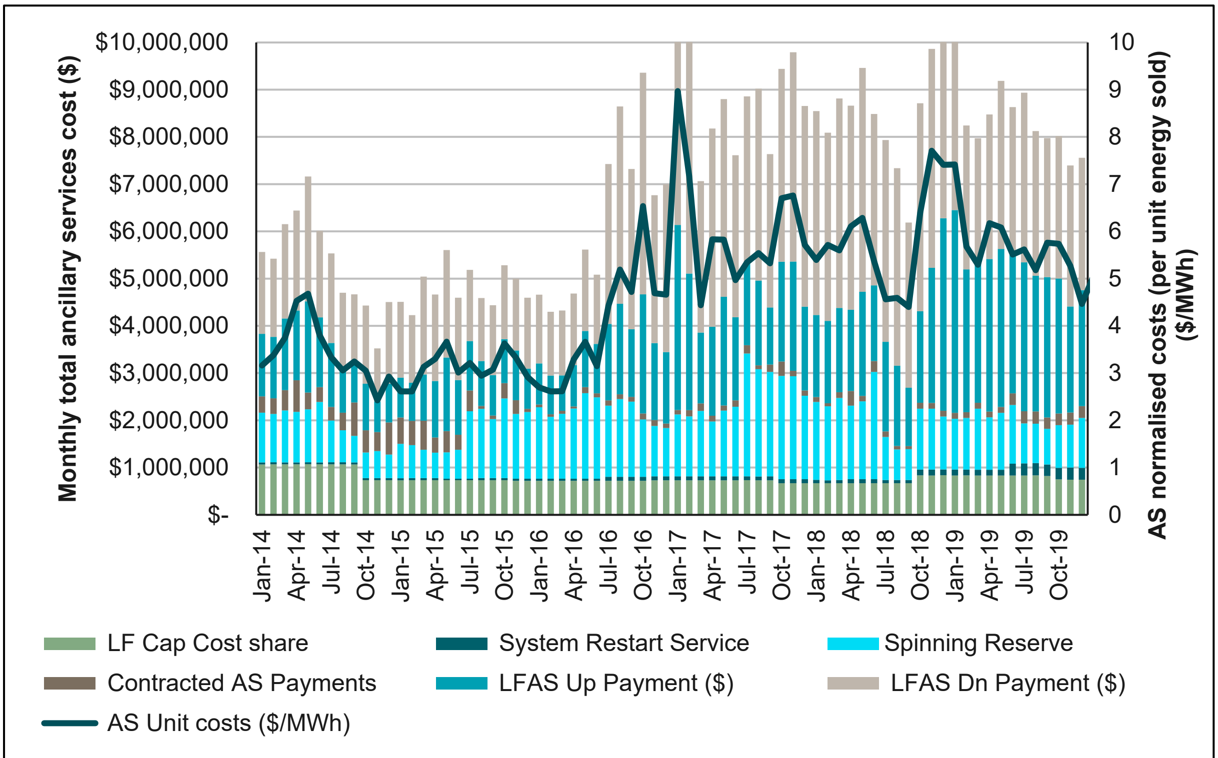
AEMO uses ancillary services to manage the supply and demand of electricity in real time, particularly when there are unplanned generator or network outages or unexpected deviations in energy demand. There are different categories of ancillary services in the WEM: spinning reserve, load rejection reserve, load following, dispatch support and system restart services. Except for the load following ancillary services (LFAS) which is provided through a market mechanism, all other ancillary services in the WEM are provided through administrative payment mechanisms.

From 2012 to 2019, the cost of ancillary services in the WEM increased by 11.6 per cent to around $100 million per year.

The ERA has calculated normalised annual ancillary service costs, that is, ancillary service costs per unit of energy delivered in the system. Ancillary services are offered as a direct contracted cost for a service (system restart service), a total cost (load rejection reserve) and on a capacity basis (load following service). Normalising the costs, by dividing the total ancillary service costs by the energy generated, allows the relative proportion of ancillary service costs to energy costs to be tracked over time.

The normalised cost of ancillary services in 2019 was $5.70/MWh, a decrease of 1.9 per cent from $5.80/MWh in 2018. However, if compared to 2015, the normalised cost of ancillary services in 2019 was 75 per cent higher. In 2019, ancillary service costs accounted for 10 per cent of normalised delivered energy cost in the system.

Figure 31: Ancillary service costs by service



Source: ERA analysis of AEMO data.

Note: LF Cap Cost share indicates the capacity cost of providing the LFAS capacity as calculated according to clause 9.9.2(p) of the WEM rules. Contracted ancillary service payments include load rejection service, dispatch support services and third-party spinning reserve.

Figure shows the breakdown of ancillary services costs by service. As discussed in the ERA's WEM report for 2017/18, most of the ancillary services cost increases were due to the LFAS market. Since the LFAS market began in 2014, prices for this service have increased substantially and reflect increases in balancing market prices, which underpin LFAS prices as explained in section 2.5. The step-change in LFAS costs noted in the 2016/17 WEM report has persisted through the 2018/19 financial year.[165]

Increased competition in the LFAS market could reduce the cost of LFAS. As also discussed in this report last year, competition in the LFAS market has been limited.

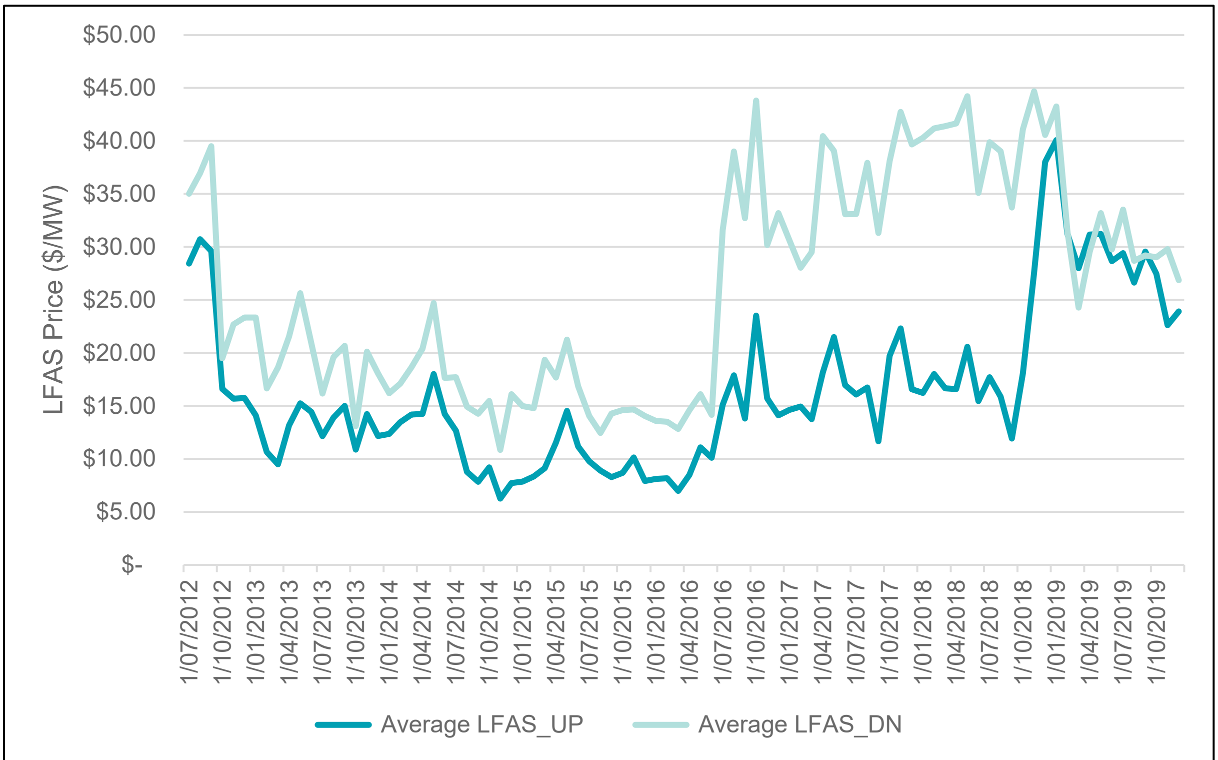
Payments for spinning reserve, which are calculated through an administered mechanism, have decreased from the 2017 peak, following AEMO's adoption of recommendations from the ERA on the calculation method.

Load following ancillary service

LFAS is the largest element of the market's ancillary services costs. LFAS is provided when participating generators' output is changed in real time to balance supply and demand and ensure frequency variations remain within prescribed limits to protect power system security. These markets are called downwards LFAS and upwards LFAS.

The overall cost of LFAS has barely moved in 2019 compared to 2018. All LFAS prices converged on a single price at the beginning of calendar year 2019 (Figure). Since then, price decreases in downwards LFAS have offset increases in upwards LFAS prices.

Figure 32: Monthly average LFAS prices



Source: ERA analysis of AEMO data.

165 ERA, 2018, *2016–17 Wholesale Electricity Market Report to the Minister for Energy, Appendices*, p. 10, (online).

While the LFAS requirement is ultimately driven by electricity demand and supply variability, LFAS quantities remained unchanged between 2013 and late 2019. In August 2019, AEMO amended the flat 72 MW LFAS requirement (upwards and downwards) to better meet requirements at different times of day. The requirement was increased to 85 MW from 5:30am to 7:30pm and reduced to 50 MW at other times.[166] This was predominantly driven by larger quantities of intermittent generation capacity.[167] Intermittent generators' output can change with time of day, solar irradiance and cloud cover (for solar generation), and with location and weather patterns for wind generation.

Synergy is the default provider of LFAS in the WEM. As of 2019, there was sufficient capacity from independent power producers eligible to participate in the LFAS market that could meet the LFAS requirement. Table provides the list of current registered LFAS providers and their quantities, other than Synergy.

Table 2: List of independent power producers providing the load following ancillary service [redacted]

Participant	Facility	Max. certified LFAS upwards (MW)	Max. certified LFAS downwards (MW)	Status
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Source: ERA analysis of AEMO data.

An increase in the number of participants providing LFAS would normally increase competition and drive lower prices. However, not all eligible generators participate in the LFAS (upwards and downwards) markets. The quantity of service provided by participants other than Synergy, comprising [redacted] is often not enough to meet the demand for the services. Participation in the LFAS market is mandatory for Synergy only. Some generators may not normally be in merit when demand is low or may be dispatched into the balancing market instead. The design of the LFAS market allow a degree of strategic bidding that would allow prices to be elevated higher than might be the case if the full quantities were offered.

166 AEMO, 2019, *Ancillary Services Report for the WEM 2019*, p. 18, (online).

167 The exception is biomass. Biomass generation is generally not weather dependent (with the exception of anaerobic digesters where the reaction rates are sensitive to ambient temperatures. Landfill gas projects have large, in-situ digesters (landfill cells) in which ground temperature changes lag ambient air temperatures. They are non-scheduled as the gas cannot be readily stored or pressurised.

[redacted] has reduced Synergy's price setting role at the margins. Synergy is still cleared to provide LFAS, albeit in smaller quantities, and sets the price 97 per cent of the time.

As balancing prices underpin LFAS prices, inefficiencies in the balancing market mean that LFAS prices are higher than they should be.

Market conduct investigations

On 26 July 2017, the ERA notified the Electricity Generation and Retail Corporation, trading as Synergy, that it had commenced an investigation into price-quantity offers submitted by Synergy in the Balancing Market.

Market generators such as Synergy are required to make price-quantity offers into the balancing market to supply electricity for each 30-minute trading interval. These offers are known as balancing submissions. Synergy is the largest generator in the balancing market, operating a generation portfolio made up of 30 individual generators.

Pursuant to clause 2.16.9B(aA) of the Wholesale Electricity Market Rules, for the trading period since 31 March 2016, the ERA investigated whether:

- Synergy's price-quantity offers may have exceeded its reasonable expectation of the short run marginal cost of generating the electricity.
- the behaviour related to market power.

The ERA has completed its investigation into Synergy's pricing behaviour and has found Synergy to have offered prices in its balancing submissions that exceeded its reasonable expectation of the short run marginal cost of generating the relevant electricity, and that this behaviour was related to Synergy's market power. This is prohibited under clause 7A.2.17 of the Market Rules.

The matter is now before the Electricity Review Board for a determination of whether Synergy's pricing behaviour breached clause 7A.2.17 of the Market Rules. If the Electricity Review Board finds Synergy in breach of the Market Rules, it may make orders to enforce the Market Rules, including imposing financial penalties.

Effectiveness of ERA's compliance with the market rules measures

The ERA provides a report to the Minster for Energy annually on its own compliance with the market rules and market procedures.

To assess its compliance, the ERA engaged consultants to independently audit its compliance during 2017/18.

The auditor concluded that "with the exception of two non-compliances published on the ERA's website on 3 May 2019, the ERA has complied in all material respects with the Market Rules and Market Procedures"

The two exceptions cited by the auditor concerned:

- Non-compliance with clauses 1.7.3 and 7.12.2 in August 2017 and May 2018 when the ERA published reports from AEMO that contained dispatch information for two separate events.
- Non-compliance with Market Rule 10.2.2(c) when the ERA inadvertently sent an internal email to a third-party who was not authorised to receive the email. The third party was a supplier and not a market participant. The third-party swiftly deleted the email.

The ERA has implemented processes and strategies to mitigate the chance of future noncompliance with these clauses.

Effectiveness of the rule change process

This is covered in section 3.2 of the main report.

Effectiveness of AEMO in carrying out its functions

The ERA is responsible for monitoring and enforcing compliance with the market rules. The ERA also reports on the effectiveness of AEMO (including in its capacity as System Management) in carrying out its functions.

On 3 February 2020 the ERA provided its annual report to the Minster for Energy on AEMO's compliance with the market rules over the 2018/19 financial year.[168] The report included the audit reports of AMEO's compliance with the market rules as well as the results of eight investigations carried out on AEMO's compliance with the market rules and market procedures in this report.

The ERA found that, of the 35 compliance incidents, 16 were low-risk, 13 medium-risk and 6 were high-risk. The report noted that AEMO had a strong compliance culture where self-reporting of non-compliances was encouraged and that AEMO also practiced proactive compliance risk management.

The report identified two material matters, including payments for System Restart Services. There were some instances were AEMO did not recover payments for non-performance with overpayments of $20,4539 estimated since July 2016. Applicable overpayments were recovered through the settlement adjustment process where possible.

The second matter concerned the incorrect charging of market fees since 2006 due to calculations in the settlements software not complying with the method specified in the market rules. AEMO estimated that the maximum amount overcharged to an individual participant was $242,000 and the maximum amount undercharged was $907,000. The error was addressed in October 2019.

During 2018/19 the ERA issued its first warning to AEMO under the market rules. The ERA investigated AEMO's self-reported non-compliant allocation of Certified Reserve Capacity that occurred in August 2016. AEMO allocated Certified Reserve Capacity to two participants without having the appropriate evidence to support the level of capacity requested. The ERA issued a warning as AEMO knowingly breached the market rules in circumstances that were avoidable.

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[168] ERA, 2019, *Report to the Minister for Energy on the Australian Energy Market Operator's Compliance 2017/18*, pp. 1-11. (online)

Bilateral trades

About 80 per cent of the total energy generated in the WEM is traded through bilateral contracts, while the remainder is traded through the balancing market and the STEM.[169]

Bilateral contracts are struck between generators and market customers (usually retailers). Such contracts provide generators and retailers with greater cash flow certainty and often enable the financing of generation projects. Although contracted generators and retailers are required to submit offers and bids into the STEM and balancing market, contracted quantities are settled outside of the market at their agreed contract price.

In most cases bilateral contracts do not affect how generators offer into the balancing market and the balancing market mostly achieves lowest-cost dispatch. However, generators and retailers manage the risk of their exposure to variation in the balancing market price through bilateral contracts. Uncontracted electricity must be sold to or purchased from the balancing market at the cleared market price.

The aim of the balancing market is to ensure generators are dispatched on the basis of lowest short-run cost.[170] There may be bilateral contract terms that would not lead to least cost dispatch. Bilateral contracts could include:

- A must-run clause in the contract, which forces the generator to run regardless of whether it is the lowest cost generator for given demand.
- A contract might circumvent short run marginal cost rule requirements, if it imposes costs on a generator that can't be legitimately included in a generators short run marginal cost or average variable cost.
- Some restriction or additional cost imposed by the contract that the generator includes as part of its short-run marginal cost, raising its SRMC above its real physical costs, or claiming that the contract prevents it from pricing at (or below) SRMC and so is not related to market power. This means that the generator is not dispatched as often as it could be based on its real operating costs, circumventing least-cost dispatch.
  - These could include either a direct penalty in the contract, an additional allowance for risk, or a directive to not produce (i.e. by pricing energy at the market cap).

Risk management

Retailers manage the risk of price variation through hedging arrangements. These can take the form of financial products as in the National Electricity Market, long-term offtake purchases or short-term supply arrangements. Hedging arrangements shield generators from low prices and limit retailers' exposure to high prices.

In the WEM, self-generation and bilateral supply contracts are the main risk management mechanisms. Market participants with more generation than they need to meet their customers' demand can on-sell this surplus to third parties. Regulations require Synergy to make standardised bilateral products available in the WEM via the standard product

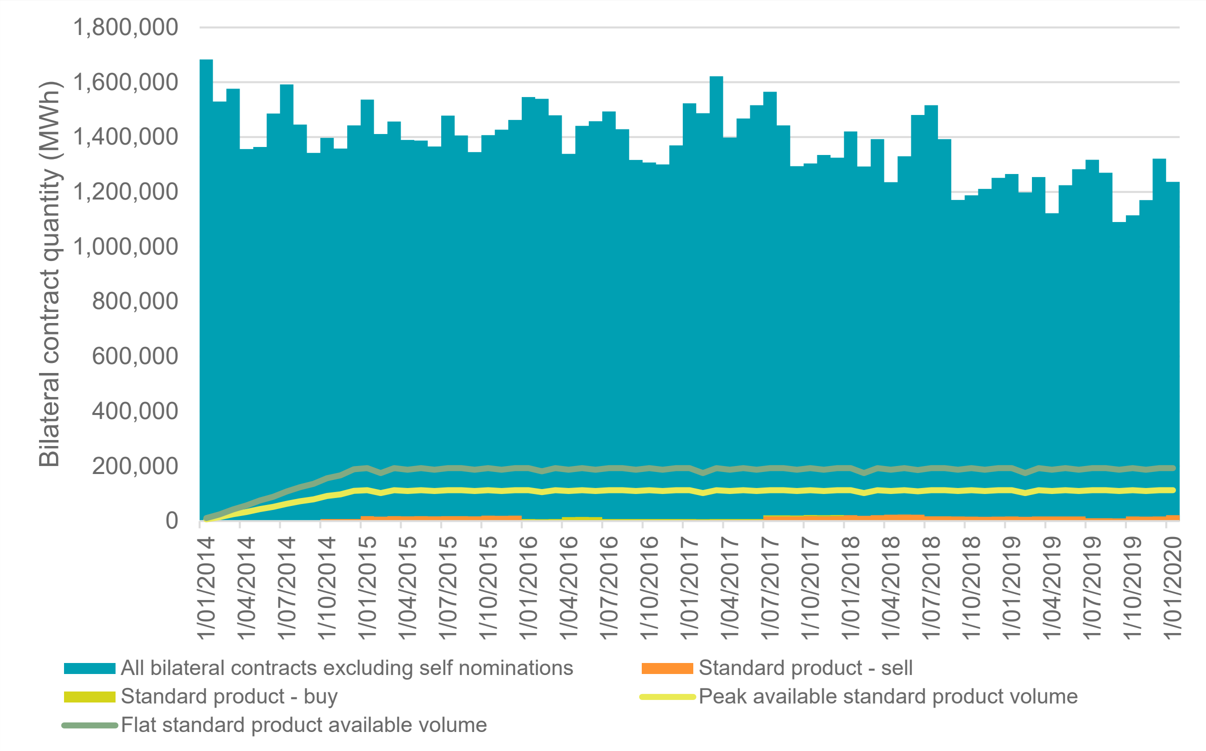
169 The Secretariat calculated market share (in percentage) of the amount of energy traded through different trading platforms of the WEM during financial years 2016/17, 2017/18 and 2018/19.

170 This also applies to the STEM and LFAS, but this paper will concentrate on the balancing market.

mechanism.[171] However, the suitability of this requirement as a hedging mechanism is limited and trades in such products have been thin and sporadic.[172]

Standard product traded volumes are relatively small in proportion to the total quantity of bilateral trades in the WEM and compared to the volumes available.

Figure 33: Standard product Vs all bilateral trades (excluding self-nominations)



Source: ERA analysis of AEMO and Synergy data.

The ERA regularly reviews the regulatory scheme that was set up to manage possible conflicts when retailer Synergy was merged with generator Verve Energy in 2014. In July 2019, the Minister for Energy endorsed some of the ERA's recommendations to improve the scheme.[173] For 2020, the buy-sell spread for Synergy's standard products was reduced from 20 per cent to 15 per cent.

A lower spread forces greater pricing discipline on Synergy, and this may result in standard products becoming more attractive as risk management instruments. After this one-year trial, the spread will revert to 20 per cent.

The directions report outlining the proposed changes also indicated that Synergy would be required to publish the transfer pricing mechanism and any subsequent amendments.[174] Other

171 Electricity Corporations (Electricity Generation and Retail Corporation) Regulations 2013 (WA), (online).

172 ERA, 2017, Report to the Minister on the effectiveness of the Electricity Generation and Retail Corporation Regulatory Scheme 2017, (online).

173 Two Ministerial Orders were gazetted on 23 July 2019 and require Synergy to publish updated foundation transfer pricing mechanism and to reduce the buy/sell standard product spread in 2020.

174 Public Utilities Office, 2018, Improving the effectiveness of the Electricity Generation and Retail Corporation Regulatory Scheme, (online).

reforms proposed by the ERA to improve the transparency of Synergy's financial reporting have not been adopted.[175]

[175] The Public Utilities Office's 2018 Electricity Generation and Retail Corporation (EGRC) Directions Report identified changes to the EGRC regulatory Scheme. This proposed to reduce the spread to 15 per cent for a twelve-month period and proposed amendments to publish the transfer pricing method but not the transfer price itself. It also did not implement recommended changes including:

- amending the credit requirements commensurate with the default exposure risk
- amending the force majeure clause to be more symmetrical
- extending the non-discrimination clause to foundation transfer pricing (this may not be current)
- Requiring Synergy to prepare detailed segmented financial reporting to distinguish between revenues, costs and profits for tis gas and electricity activities in each business unit instead recommending the ERA use its information gathering powers under the Economic Regulation Act.

Public Utilities Office, 2019, Electricity Generation and Retail Corporation Regulatory Scheme – Response to 2016 Report to the Minister for Energy on the effectiveness of the Scheme, Department of Treasury, online

Outages

Table 3 shows summary outage data for forced and planned outages for the last four calendar years. Muja G6 had the most substantial combined outage (planned and forced) in 2019 with the equivalent of an average 72 MW being unavailable for the year (37 per cent) . This was followed by Newgen Kwinana with 51 MW unavailable and Muja G5 with 48 MW unavailable. Muja G6 and G5 had the highest combined equivalent unavailability factors of 37 and 25 per cent, respectively. Pinjar GT9 and TESLA Picton had substantial unavailability factors of 18 per cent.

Table 3: Annual equivalent unavailability factors for planned and forced outages by facility

PARTICIPANT	FACILITY NAME	INSTALLED CAPACITY (MW)	FORCED OUTAGES (%)				PLANNED OUTAGES (%)				EQUIVALENT UNAVAILABILITY FACTOR (%)				AVERAGE UNAVAILABLE CAPACITY (MW)			
			2016	2017	2018	2019	2016	2017	2018	2019	2016	2017	2018	2019	2016	2017	2018	2019
ALCOA	ALCOA_WGP	26	5%	1%	13%	13%	1%	9%	0%	1%	6%	10%	14%	14%	1.5	2.7	3.6	3.7
ALINTA	ALINTA_PNJ_U1	143	0%	0%	0%	0%	6%	13%	2%	3%	7%	13%	2%	3%	9.3	18.7	3.0	4.7
	ALINTA_PNJ_U2	143	0%	1%	2%	1%	3%	5%	1%	11%	3%	6%	3%	12%	4.2	7.9	3.9	16.8
	ALINTA_WGP_GT	195.152	1%	0%	0%	0%	5%	2%	3%	1%	6%	3%	3%	2%	11.9	5.2	5.5	3.6
	ALINTA_WGP_U2	196.848	0%	0%	0%	0%	5%	3%	3%	16%	5%	3%	3%	16%	9.9	6.0	6.8	31.2
	ALINTA_WWF	89.1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.1	0.0	-	-
	BADGINGARRA_WF1	130	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-	-	-	-
Blairfox	BLAIRFOX_KARAKIN_WF1	5	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.0	-	-	-
	BLAIRFOX_WESTHILLS_WF3	5	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-	-	0.0	-
COLLGAR	INVESTEC_COLLGAR_WF1	206	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-	-	-	-
CTE	BIOGAS01	2	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-	-	-	-
Denmark Community Windfarm	DCWL_DENMARK_WF1	1.44	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.0	-	-	-
EDWFMAN	EDWFMAN_WF1	80	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.0	-	-	-
GLDFLDPW	PRK_AG	68	2%	0%	1%	1%	0%	1%	1%	1%	3%	1%	2%	3%	2.2	0.9	1.3	1.8
MBARKER	SKYFRM_MTBARKER_WF1	2.43	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.0	-	-	-
MERREDIN	NAMKKN_MERR_SG1	92.6	1%	0%	1%	0%	6%	1%	4%	1%	7%	1%	5%	2%	6.5	1.3	4.7	1.9
MUMBIDA	MWF_MUMBIDA_WF1	55	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.1	-	-	-
NGENEERP	NEWGEN_NEERABUP_GT1	342	0%	0%	0%	0%	3%	1%	0%	2%	3%	1%	0%	2%	9.6	4.9	0.6	5.8
NSFPTNRS	NORTHAM_SF_PV1	7.753	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-	-	-	-
SRV GRSF Pty Ltd	GREENOUGH_RIVER_PV1	10	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.0	-	-	-
STHRNCRS	STHRNCRS_EG	23	0%	0%	0%	4%	0%	0%	0%	3%	0%	0%	1%	7%	-	-	0.2	1.5
Summit Southern Cross Power	BW2_BLUEWATERS_G1	217	0%	51%	1%	0%	11%	0%	11%	1%	12%	51%	12%	1%	25.4	111.7	25.8	2.8
	BW1_BLUEWATERS_G2	217	1%	0%	0%	0%	16%	11%	13%	8%	18%	11%	13%	8%	38.1	24.7	29.0	18.1
	NEWGEN_KWINANA_CCG1	335	1%	0%	0%	0%	8%	4%	7%	15%	9%	5%	7%	15%	30.0	15.2	24.6	51.6

PARTICIPANT	FACILITY NAME	INSTALLED CAPACITY (MW)	FORCED OUTAGES (%)				PLANNED OUTAGES (%)				EQUIVALENT UNAVAILABILITY FACTOR (%)				AVERAGE UNAVAILABLE CAPACITY (MW)			
			2016	2017	2018	2019	2016	2017	2018	2019	2016	2017	2018	2019	2016	2017	2018	2019
Synergy	ALBANY_WF1	21.6	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.0	-	-	-
	COCKBURN_CCG1	249.7	0%	1%	8%	5%	16%	37%	0%	2%	16%	38%	8%	8%	40.4	94.0	19.3	19.8
	COLLIE_G1	318.3	1%	2%	1%	2%	11%	8%	4%	10%	12%	10%	5%	12%	38.7	31.5	14.8	37.7
	GRASMERE_WF1	13.8	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0.0	-	-	-
	KEMERTON_GT11	154.7	0%	0%	1%	0%	13%	3%	1%	0%	13%	3%	2%	0%	19.9	4.1	2.4	0.5
	KEMERTON_GT12	154.7	0%	0%	0%	0%	16%	2%	1%	0%	16%	2%	1%	0%	25.3	2.5	1.2	0.2
	KWINANA_GT2	103.2	2%	2%	2%	1%	11%	14%	9%	9%	13%	18%	11%	10%	13.8	18.5	11.0	10.4
	KWINANA_GT3	103.2	3%	5%	2%	1%	21%	11%	9%	10%	23%	18%	11%	11%	24.2	18.4	11.3	11.3
Synergy	MUJA_G5	195.8	1%	2%	3%	7%	10%	27%	6%	16%	12%	29%	9%	25%	23.4	57.6	17.7	48.1
	MUJA_G6	193.6	2%	2%	1%	9%	3%	13%	14%	28%	6%	15%	15%	37%	11.2	29.2	29.8	72.0
	MUJA_G7	212.6	0%	0%	8%	1%	17%	7%	19%	4%	17%	7%	26%	5%	36.6	14.0	56.3	9.7
	MUJA_G8	212.6	0%	0%	15%	4%	16%	9%	18%	5%	16%	9%	33%	8%	34.2	19.2	71.2	17.9
	MUNGARRA_GT1	39.5	0%	0%	0%	0%	3%	0%	0%	0%	3%	0%	0%	0%	1.2	0.2	0.1	-
	MUNGARRA_GT3	38	0%	0%	0%	0%	5%	3%	0%	0%	6%	3%	0%	0%	2.1	1.0	0.1	-
	PINJAR_GT1	38.5	0%	0%	0%	0%	0%	11%	10%	4%	0%	11%	10%	4%	0.1	4.1	3.9	1.7
	PINJAR_GT10	118.2	1%	1%	2%	3%	4%	25%	6%	1%	6%	26%	8%	4%	6.6	31.1	9.2	5.3
	PINJAR_GT11	130	1%	1%	1%	2%	3%	15%	7%	5%	5%	16%	8%	8%	6.0	20.2	10.4	9.8
	PINJAR_GT2	38.5	0%	0%	0%	0%	0%	3%	1%	10%	0%	3%	1%	10%	0.2	1.2	0.4	4.0
	PINJAR_GT3	39.3	0%	1%	1%	0%	3%	0%	18%	0%	3%	1%	19%	0%	1.3	0.4	7.5	0.2
	PINJAR_GT4	39.3	0%	0%	0%	0%	3%	0%	7%	0%	3%	0%	7%	1%	1.3	0.2	2.8	0.2
	PINJAR_GT5	39.3	0%	0%	0%	1%	9%	0%	3%	0%	9%	0%	4%	2%	3.4	0.1	1.4	0.7
	PINJAR_GT7	39.3	0%	0%	1%	0%	4%	0%	8%	0%	4%	0%	8%	0%	1.5	0.1	3.2	0.0
	PINJAR_GT9	118.2	3%	1%	2%	1%	34%	2%	7%	17%	37%	4%	9%	18%	43.4	4.2	10.8	21.4
	PPP_KCP_EG1	85.7	0%	0%	0%	0%	3%	3%	2%	6%	3%	3%	2%	6%	2.8	2.6	1.5	5.1
	WEST_KALGOORLIE_GT2	41.2	0%	1%	1%	0%	0%	2%	0%	0%	3%	3%	1%	0%	1.1	1.3	0.4	-
	WEST_KALGOORLIE_GT3	23.3	3%	0%	0%	0%	1%	3%	0%	0%	5%	3%	0%	0%	1.2	0.7	-	-
	KALBARRI_WF1	1.6	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-	-	-	-
TIWEST	TIWEST_COG1	42.1	1%	2%	1%	0%	9%	2%	1%	1%	10%	4%	2%	1%	4.3	1.7	0.9	0.6
TSLA_GER	TESLA_GERALDTON_G1	9.9	0%	0%	0%	0%	2%	0%	3%	2%	4%	1%	5%	3%	0.4	0.1	0.5	0.3
TSLA_KEM	TESLA_KEMERTON_G1	9.9	0%	0%	0%	0%	1%	0%	1%	1%	2%	0%	1%	1%	0.2	0.0	0.1	0.1
TSLA_MGT	TESLA_PICTON_G1	9.9	0%	0%	0%	0%	0%	1%	1%	16%	2%	1%	39%	18%	0.2	0.1	3.9	1.8
TSLA_NOR	TESLA_NORTHAM_G1	9.9	0%	0%	0%	1%	2%	1%	1%	1%	2%	2%	2%	4%	0.2	0.2	0.2	0.4
WA Biomass	BRIDGETOWN_BIOMASS_PLANT	40	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-	-	-	-
WENERGY	PERTHENERGY_KWINANA_GT1	116	1%	3%	4%	4%	13%	7%	2%	5%	15%	10%	7%	9%	17.1	11.6	8.3	10.7
WGRES	HENDERSON_RENEWABLE_IG1	3	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	-	-	-	-

Appendix 2 Stakeholder feedback

Table 4: Submission in response to *2018/19 Effectiveness of the Wholesale Electricity Market Issues paper*[176]

Submission	Comments	Addressed in the report
Dr. Abdullahi, AMSAS Consulting	This submission provided recommendations for the current reform program and suggestions on how to expand on the program. • The private sector, especially closed cycle gas turbines, can improve reliability and increase price competition. • The Government should exercise care when privatising the electricity network. • The Government should not rely on renewable generation for all power needs, especially industrial base load. Molten salt energy storage should be considered as a favoured firming technology for concentrating solar power generation but would need financial support to become established.	The report does not comment on how these recommendations could be incorporated into the reform process.
AEMO	AEMO supported a discussion of the implications of increasing power system variability and outlined AEMO's challenges in manually managing the WEM prior to the new market design to be implemented in 2022. It supported harnessing the capabilities of all available technologies to manage system variability but acknowledged the limitations of the current framework to support the financial viability of batteries. Demand response could participate in the market either by applying for capacity credits and being dispatched by AEMO or by reducing demand to reduce the Individual Reserve Capacity Requirement. Current circumstances skew demand response engagement toward limiting IRCR liabilities rather than reducing load to support system	The risks to future stability from variability is discussed in section 2.1.1.2. Further analysis on variability is contained in Appendix 1. The current discrimination in the WEM against batteries is discussed in section 2.3. IRCR is outlined in section 2.4. AEMO's comments on IRCR are referred to in Appendix 2.

176 Submissions available at ERA, 'Annual Wholesale Electricity Market Effectiveness Reports', (online) [accessed 15 July 2020].

Submission	Comments	Addressed in the report
	security. AEMO confirmed that self-curtailment to reduce IRCR is not transparent at the time and is difficult to forecast. There was limited co-ordination of planning and investment processes for network and the WEM, and that it was difficult to determine whether market and network costs are being minimised under current arrangements. The Whole of System Plan would provide the coordinating link between the market and network investment, and that AEMO will be well-suited to lead the development of future Plans. The Rule Change Panel should continue to support the role of ongoing market evolution. However, AEMO did not support any changes to the rule change process in terms of obligation or timing impositions on AEMO until after reform when business as usual returns.	The Whole of System Plan is discussed in section 3.1.2. The role of the Rule Change Panel is discussed in section 3.2.2.
Alinta Energy	Western Power's planned outage processes have resulted in substantial constraints on Badgingarra wind farm's output and reduced the quantity of low-cost generation coming into the market. Although the existing Market Rule (3.18.5C) requires cooperation of the network operator and market participants when planning their outages in some circumstances, Alinta recommended: • Greater co-ordination of network outages with market participants. • Consideration of a mechanism to ensure network planning outage decisions seek to minimise costs for the whole market: the network owner, the wholesale market and customers generally.	Section 2.2.1 refers to constraints on wind farm output. Coordination on planning outages is discussed at section 3.1.1.
Kleenheat	The current market structure did not allow the market to fully meet its objectives for promoting economic efficiency, minimising the long-term cost of electricity for consumers and managing electricity use. The example provided in support included:	The objectives of economic efficiency, minimising the long-term cost of electricity for consumers and managing electricity use are discussed in sections 2.1.3, 2.4 and 2.5.

Submission	Comments	Addressed in the report
	• The lack of liquidity and terms of Synergy's Standard Products makes it challenging for stand-alone retailers to compete effectively with vertically integrated generator/retailers. • The hedging product terms were not aligned with retail contract terms (typically fixed price contracts for 2-3 years). • Synergy's 20 per cent Standard Product spread set the benchmark for the rest of the industry.	
	Portfolio bidding by Synergy is not transparent and it is not clear that it places pricing discipline on Synergy. In evidence, Kleenheat stated it is difficult to contract for wholesale electricity supply on a competitive basis. Kleenheat supported a more liquid forward contract market and suggested this could be achieved through a mandatory auction process for a quantity of electricity from Synergy. However, in the absence of this other options included: • Reducing the bid/ask on Standard Products in improve liquidity and strengthen price discipline. • Introducing longer term Standard Products to align with retail contracts. • Improving transparency or assurance on the regulatory compliance of the transfer pricing arrangements within Synergy.	The ERA has investigated Synergy's bidding behaviour and found that Synergy was bidding into the electricity market at prices higher than the cost of generating the electricity. The matter is currently before the Electricity Review Board.
	Electricity markets need to coordinate the production, transfer and end use of electricity to minimise long-term costs to consumers. At present in the WEM, the relationship between the network and market optimises one or the other but not necessarily both. Kleenheat provided recommendations to address this, which included: • An independent body (the submission mentions the ERA) conduct cost-benefit analysis of Government incentives and incentive plans.	The Whole of System Plan is discussed in section 3.1.2.

Submission	Comments	Addressed in the report
	• Aligning planning timelines for access arrangements, ancillary service requirements and the Electricity Statement of Opportunity. • Improving the transparency of [government] initiatives, funds, accesses and subsidy mechanisms. • Simplifying committees and decision-making forums. Post reform, Kleenheat recommended that affordable electricity should be a main focus and that the ERA would be an appropriate entity to ensure this was delivered. There should be greater representation from retailers on the MAC and rule change proposals should be supported by independent cost-benefit analysis.	The ERA will continue periodic reviews of the effectiveness of the market against the WEM objectives. The role of the Rule Change Panel and the WEM decision-making process is discussed in section 3.2.
Perth Energy	Perth Energy supported an industry-wide assessment of network development. Market concentration was the single largest problem for the market, and it supported structural separation of Synergy to encourage competition and reduce market concentration. Perth Energy recommended bringing the National Electricity Market Dispatch Engine (NEMDE) into the WEM as soon as practicable. There was a need to improve the visibility of distributed energy resources (DER) because: • This would enable the Australian Energy Market Operator to better predict energy and ancillary service needs in the WEM. • The current lack of visibility hindered market participants’ ability to supply ancillary services.	Security constrained economic dispatch will be introduced through the reform process. The timing and implementation of a new dispatch engine will be determined by the Energy Transformation Taskforce. The visibility of DER resources is addressed by the DER Roadmap. The price signals and tariff reform for small consumers is mentioned in section 2.4.

Submission	Comments	Addressed in the report
	The lack of price signals to consumers would increase costs to some classes of consumers.	
[redacted]	[redacted]	[redacted]

Submission	Comments	Addressed in the report
	[redacted] [redacted] [redacted] [redacted] [redacted]	[redacted] [redacted] [redacted] [redacted]
Western Power	Western Power considered its existing approach is effective at coordinating outages. It was supportive of a planning process that would consider the effect of outages on market participants and the	Coordination on planning outages is discussed at section 3.1.1

Submission	Comments	Addressed in the report
	WEM. However, it suggested that any improvements to planning around least cost should be AEMO's responsibility. There is ambiguity in responsibility between network and market operators for transmission network voltage control and suggests the Energy Transformation Implementation Unit consider providing clarity through its system security and reliability workstream. Reactive power support could be offered by market participants as an essential system service (ancillary service) to manage voltage. Western Power agreed it has made decisions without visibility of market cost consequences and considered visibility of these consequences would assist future network investment decisions.	The need for clarity between responsibilities through the reform process is discussed in section 3.2

Appendix 3 List of tables and figures

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