CHAPTER 3

Energy and demand projections

3 Energy and demand projections

Key highlights

- This chapter describes the historical energy and demand, and provides forecast regional data disaggregated by zone.
- Queensland set a new record maximum transmission delivered demand of 9,031MW on 8 March 2022. This maximum demand occurred at 7.00pm and was 62MW higher than the previous maximum delivered demand set in 2019.
- Queensland set a new record minimum transmission delivered demand of 2,597MW on 25 September 2022. This minimum demand occurred at 11.00am and was 409MW lower than the previous record minimum set in September 2020.
- Native plus rooftop photovoltaic (PV) energy increased by approximately 1.6% between 2020/21 and 2021/22.
- Powerlink has adopted the Australian Energy Market Operator's (AEMO) 2022 Electricity Statement of Opportunity (ESOO) forecasts in its planning analysis for the 2022 Transmission Annual Planning Report (TAPR). Powerlink is focused on working with AEMO to understand the potential impacts of emerging technologies (e.g. electric vehicles and electrification of broader industry processes) and new industries so transmission network services are developed in ways that are valued by customers.
- Powerlink has not taken account of the Queensland Government's recently announced Queensland Energy and Jobs Plan (QEJP) in the preparation of these forecasts. This will be captured in future TAPRs, including the impacts of higher renewable energy targets released in this plan[1].
- Based on AEMO's Step Change scenario forecast, Queensland's delivered maximum demand is expected to have mild growth with an average annual increase of 2.0% per annum over the next 10 years.
- The uptake of rooftop PV and distribution connected solar systems is further reducing delivered demand during the day to the point where this is now lower than night time light load conditions. The rate at which minimum demand declines over the coming years will be closely related to the rate at which rooftop PV systems are installed. Falling minimum demand will result in a variety of impacts on the power system, some of which may necessitate investment on the transmission system.
- Queensland's transmission delivered energy is expected to increase over the next 10 years predominantly due to the electrification of load within a number of Queensland industries. Based on AEMO's Step Change scenario, transmission delivered energy consumption is expected to increase at an average rate of 0.6% per annum over the next 10 years.

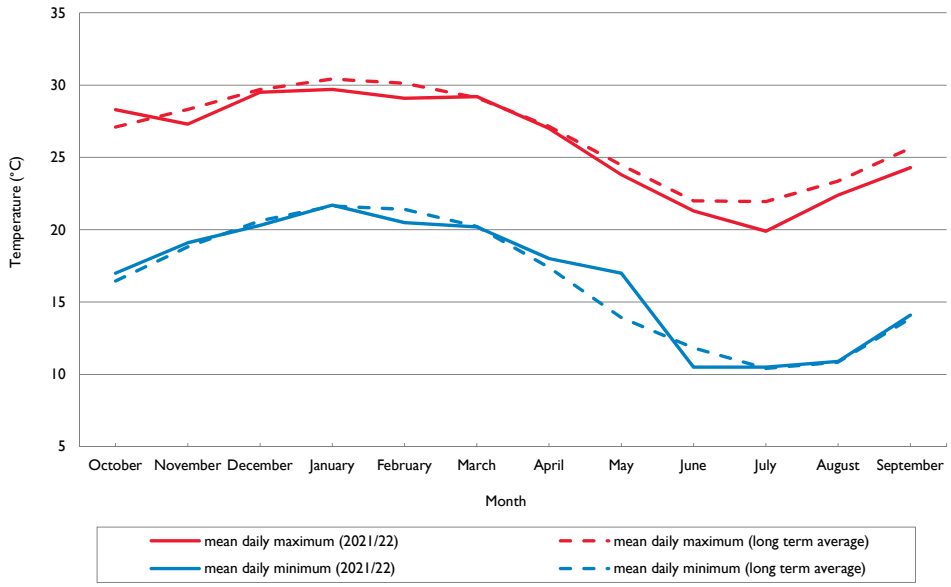
3.1 Overview

The 2021/22 summer Queensland maximum transmission delivered demand occurred at 7.00pm on 8 March 2022, when 9,031MW was delivered from the transmission grid (refer to Figure 3.4 for load measurement definitions). Operational 'as generated' peak was recorded at this same time, reaching 10,058MW. Peak native demand was recorded one hour prior at 6pm, reaching 9,326MW. After weather correction, the 2021/22 summer maximum transmission delivered demand was 8,876MW, 4.9% higher than that forecast in the 2021 ESOO Steady Progress scenario.

Figure 3.1 shows observed mean temperatures for Brisbane during 2021/22 compared with long-term averages. The comparison reveals a slightly cooler summer than average in south east Queensland, whilst daily maximum temperatures in March were slightly higher than the long-term average.

[1] Previous 50% Renewable Energy Target (QRET) by 2030 achieved two years earlier, 60% by 2030, 70% by 2032, followed by greater than 80% by 2035.

Figure 3.1 Brisbane temperature ranges over 2021/22 (1)



Note:

(1) Long-term average based on years 2000 to 2021/22.

The 2022 Queensland minimum delivered demand occurred at 11.00am on 25 September 2022, when only 2,597MW was delivered from the transmission grid (refer to Figure 3.4 for load measurement definitions). Operational 'as generated' minimum demand was recorded on 11 September 2022 at 1.00pm and set a new record for Queensland of 3,469MW, passing the previous minimum record of 3,784MW set in October 2021. At the time of minimum delivered demand directly connected loads made up about 66% of the transmission delivered demand with Distribution Network Service Provider (DNSP) customers making up the remainder. Mild weather conditions, during a weekend (Sunday) in combination with strong contribution from rooftop PV were contributors to this minimum demand.

Powerlink has worked with AEMO to derive transmission delivered equivalent demand and energy forecasts based on the forecast operational sent out quantities defined in AEMO's 2022 ESOO. Further information on the development of AEMO's 2022 ESOO is available on AEMO's website[2].

The AEMO 2022 ESOO forecasts provide the top-down, whole of state maximum demand forecast for the Queensland region. These are reconciled with bottom-up forecasts from DNSPs and directly connected customers to create the granular models needed to inform zonal or more localised issues.

The Queensland Government's 50% renewable energy target by 2030 (QRET) has driven renewable capacity in the form of solar PV and wind farms to connect to the Queensland transmission and distribution networks (refer to Table 8.1 and Table 8.2). Additional uncommitted distribution connected solar and wind farm capacity has been included into the 10-year outlook period from 2026 to model the Queensland Government's target. Powerlink has not taken account of the Queensland Government's recently announced Queensland Energy and Jobs Plan (QEJP) in the preparation of these forecasts. This will be captured in future TAPRs, including the impacts of higher renewable energy targets released in this plan.

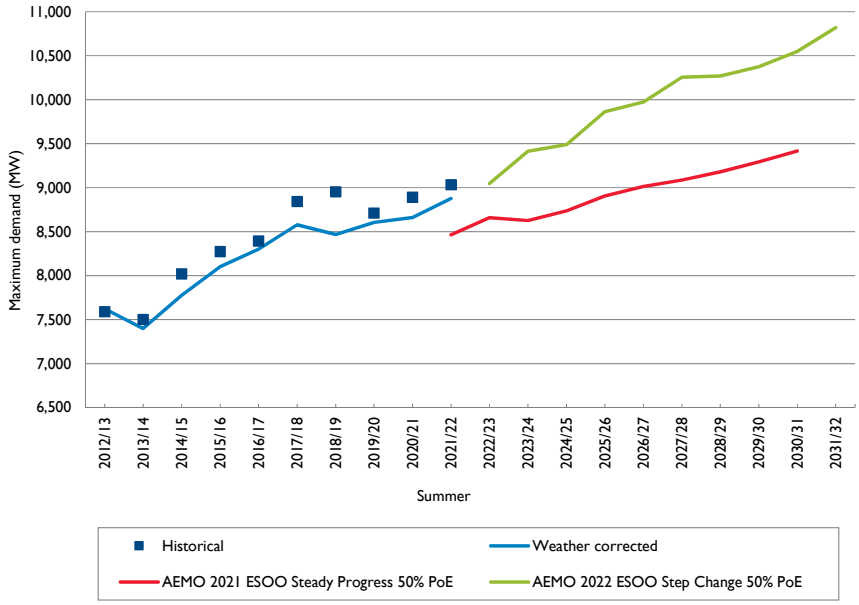
2 AEMO, Forecasting Approach - Electricity Demand Forecasting Methodology, September 2021.

3 Energy and demand projections

At the end of June 2022, Queensland reached 4,808MW of installed rooftop PV capacity[3]. Growth in rooftop PV capacity has decreased from around 65MW per month in 2020/21 to 56MW per month in 2021/22. An impact of rooftop PV, has been to time shift both the state's minimum and maximum demands. The minimum demand now occurs during the day rather than night time. The maximum demand now occurs between 6:00pm and 7:00pm. As a result of significant capacity increases in rooftop PV and small-scale Photovoltaic non-scheduled generation (PVNSG), maximum demand is unlikely to occur in the day time, it is now expected to occur in the early evening.

Figure 3.2 shows a comparison of AEMO's 2021 ESOO delivered summer maximum demand forecast based on the Steady Progress scenario with AEMO's 2022 ESOO based on the Step Change scenario, both with 50% Probability of Exceedance (PoE).

Figure 3.2 Comparison of AEMO's 2021 ESOO Steady Progress scenario delivered demand forecast with the 2022 ESOO Step Change scenario (1) (2)



Notes:

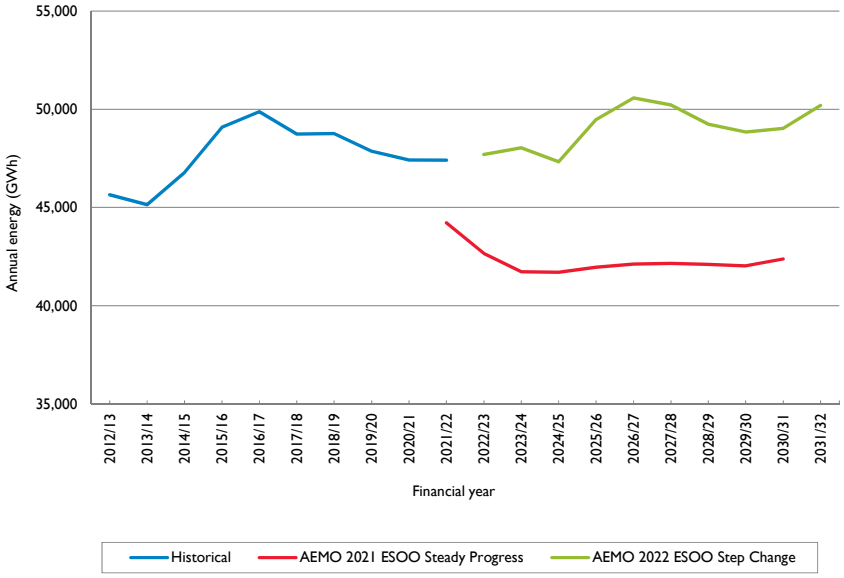
(1) AEMO's 2022 ESOO forecast has been converted from 'operational sent-out' to 'transmission delivered' for the purposes of comparison. Refer to Figure 3.4 for further details.

(2) AEMO's 2022 ESOO forecast has been adjusted for future uncommitted distribution connected renewables by Powerlink to incorporate the Queensland Government's target of 50% renewable energy by 2030.

Figure 3.3 shows a comparison of AEMO's 2021 ESOO delivered energy forecast based on the Steady Progress scenario with AEMO's 2022 ESOO Step Change scenario. Section 3.4 discusses updates included in AEMO's 2022 ESOO forecasts. The uplift in delivered energy in AEMO's 2022 Step Change scenario is from a combination of increasing consumption in both Energy Queensland's distribution network and Powerlink's directly connected customers. The increase in energy consumption is mainly due to industries beginning to electrify their operations to meet their emission reduction targets. Last years' forecast showed a flat forecast for Powerlink's direct connect customers and a declining forecast for Energy Queensland's consumption.

[3] Clean Energy Regulator, Postcode data for small-scale installations – all data, data as at 31/08/2022, September 2022. Whilst RET legislation allows a 12 month creation period for registered persons to create their certificates, updates for the first nine months of this window are generally not material.

Figure 3.3 Comparison of AEMO's 2021 ESOO Steady Progress scenario delivered energy forecast with the 2022 ESOO Step Change scenario (1)



Note:

(1) AEMO's 2022 ESOO forecast has been converted from 'operational sent-out' to 'transmission delivered' for the purposes of comparison. Refer to Figure 3.4 for further details.

3.2 Future forecasting challenges

Decentralisation, driven by future developments in battery storage technology coupled with rooftop PV and EVs, could see significant changes to future electricity usage patterns. This could reduce the need to develop transmission services to cover short duration peaks.

However, presently only approximately 20% of final energy consumption in Queensland is from electricity and this electrical energy is predominantly supplied from the interconnected power system. Therefore, the electrification of load historically supplied by the combustion of fossil fuels to various sectors of the economy such as transport, agriculture, mining and manufacturing may require a significant investment in the transmission and distribution networks. The drivers for the electrification of these sectors largely relate to the need to reduce carbon emissions for a variety of reasons (environmental factors, community and corporate expectations or the international treatment of exports with implicit emissions).

The growth in grid-supplied electricity through electrification will, to some extent, be offset by reductions in grid-supplied energy due to decentralisation. However, the geospatial distribution of these two effects are not expected to be uniform. There may be areas where net demand for grid-supplied electricity is likely to significantly increase, and other areas where it may decrease.

Powerlink is committed to understanding the future impacts of emerging technologies and electrification and to work with our customers and AEMO so that these are accounted for geospatially within future forecasts. This will allow transmission network services to be developed in ways that are valued by customers.

3 Energy and demand projections

3.3 Customer consultation

In accordance with the National Electricity Rules (NER), Powerlink has obtained summer and winter maximum demand forecasts over a 10-year outlook period from Queensland's DNSPs, Energex and Ergon Energy (part of the Energy Queensland group). These connection supply point forecasts are presented in Appendix A. Also in accordance with the NER, Powerlink has obtained summer and winter maximum demand forecasts from other customers that connect directly to the Powerlink transmission network.

Powerlink, Energex and Ergon Energy jointly conduct the Queensland Household Energy Survey (QHES) to improve understanding of consumer behaviours and intentions. This survey provides comprehensive insights on consumer intentions on electricity usage.

Powerlink is proactively engaging with customers to understand their decarbonisation plans. To enable efficient planning of the network, early customer consultation is required to allow transmission network services to be developed in ways that are valued by customers.

Transmission customer forecasts

New large loads

No new large loads have connected or have committed to connect in the outlook period[4].

Possible new large loads

There are several proposals under development for large mining, metal processing, other industrial loads and the electrification of existing loads. These proposed new large loads total approximately 4,820MW. The likely distribution of these loads are defined in Table 3.1. The majority of these proposed loads have not been included in AEMO's 2022 ESOO Step Change scenario forecast. However, AEMO's Step Change scenario forecast did allow for approximately 500MW of new electrification load in the Gladstone zone (refer to sections 6.10.2 and 9.2.3). The proposed load in the Gladstone zone in Table 3.1 is inclusive of this 500MW.

Table 3.1 Possible large loads excluded from the Slow Change, Step Change and Hydrogen Export scenario forecasts

Zone	Description	Possible load
Northern	Electrification of existing mining load New industrial and mining loads	Up to 1,010MW
Central	Hydrogen facility Electrification of existing industrial load New manufacturing loads	Up to 2,360MW
South Queensland	Hydrogen facility Data centre	Up to 1,450MW

3.4 Demand forecast outlook

The following sections outline the Queensland forecasts for energy, summer maximum demand, winter maximum demand and annual minimum demand. Annual maximum demands continue to be expected in the summer period. Annual minimum demands have generally occurred in winter and more recently in the shoulder periods.

[4] As of 30 June 2022. Fitzroy Mine in the Northern Bowen Basin has not been included in the forecast prepared for the 2022 TAPR.

The annual minimum demand has moved from overnight to the day time since 2018 (this is described in Section 2.5.2). The forecast for minimum delivered demand is now closely correlated to rooftop PV installations and embedded variable renewable energy (VRE) generators. Forecasts in this chapter are provided without predicting market outcomes, directions or constraints which may be imposed to ensure system security but impact on the output of these embedded VRE generators.

The 2022 TAPR reports on the Slow Change, Step Change and Hydrogen Export scenario forecasts provided by AEMO and aligned to their 2022 ESOO. Demand forecasts are also prepared to account for seasonal variation. These seasonal variations are referred to as 10% PoE, 50% PoE and 90% PoE forecasts. They represent conditions that would expect to be exceeded once in 10 years, five times in 10 years and nine times in 10 years respectively.

The forecast average annual growth rates for the Queensland region over the next 10 years under Slow Change, Step Change and Hydrogen Export scenarios are shown in Table 3.2. These growth rates refer to transmission delivered quantities as described in Section 3.4.1. For summer and winter maximum demand, growth rates are based on 50% PoE corrected values for 2021/22 and 2021 respectively.

Table 3.2 Average annual growth rate over next 10 years

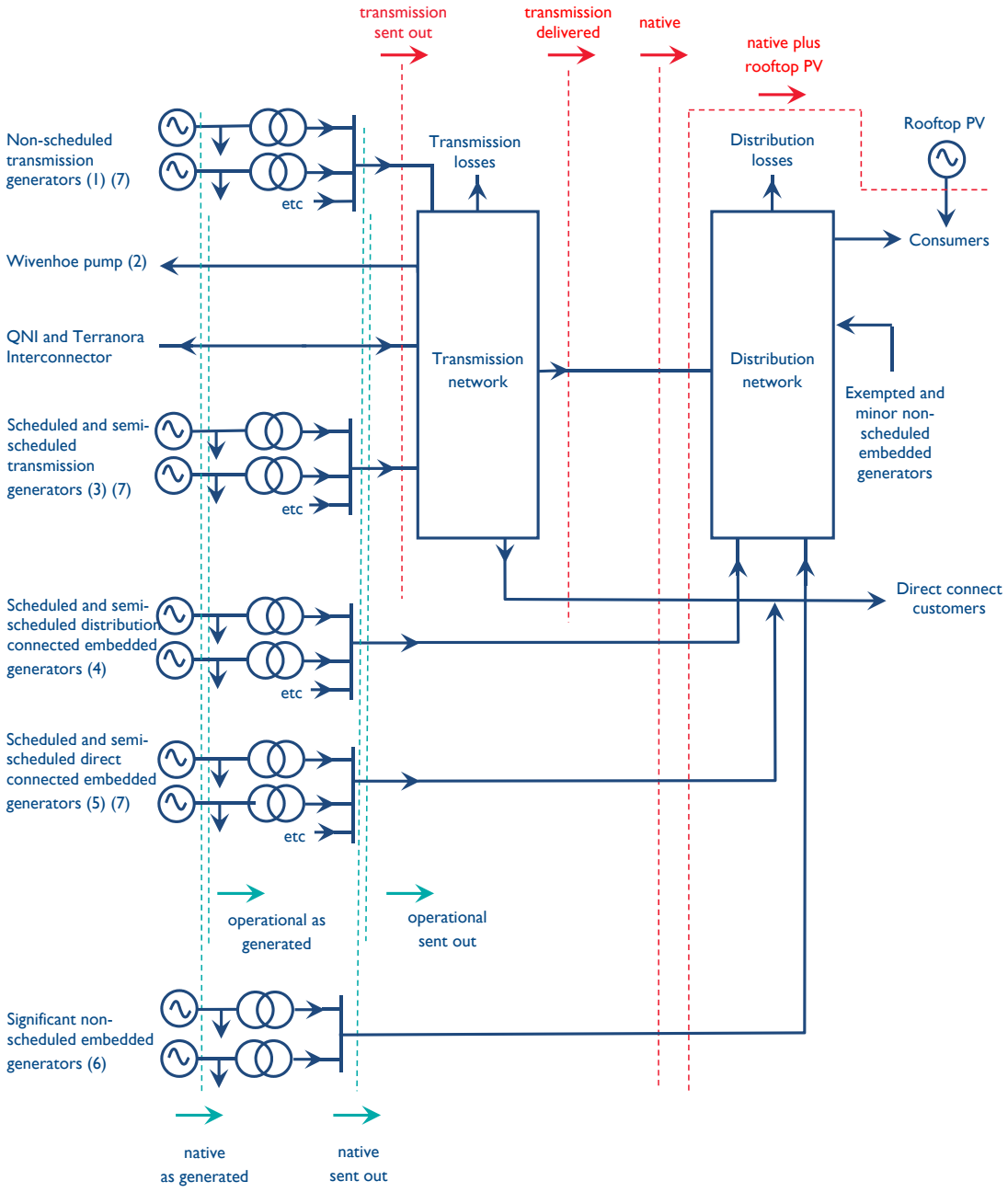
	AEMO future scenario outlooks		
	Slow Change	Step Change	Hydrogen Export
Delivered energy	-3.2%	0.6%	3.1%
Delivered summer maximum demand (50% PoE)	-0.6%	2.0%	2.9%
Delivered winter maximum demand (50% PoE)	-0.2%	2.6%	3.7%

3.4.1 Demand and energy terminology

The reported demand and energy on the network depends on where it is being measured. Individual stakeholders have reasons to measure demand and energy at different points. Figure 3.4 shows the common ways demand and energy measurements are defined, with this terminology used consistently throughout the TAPR.

3 Energy and demand projections

Figure 3.4 Load measurement definitions



Notes:

(1) Includes Invicta and Koombooloomba.

(2) Depends on Wivenhoe generation.

(3) Includes Yarwun which is non-scheduled.

(4) For a full list of scheduled and semi-scheduled distribution connected generators refer to Table 8.2.

(5) Sun Metals Solar Farm and Condamine.

(6) Lakeland Solar and Storage, Hughenden Solar Farm, Pioneer Mill, Moranbah North, Racecourse Mill, Barcaldine Solar Farm, Longreach Solar Farm, German Creek, Oaky Creek, Baking Board Solar Farm, Sunshine Coast Solar Farm and Rocky Point.

(7) For a full list of transmission network connected generators and scheduled and semi-scheduled direct connected embedded generators refer to Table 8.1.

3.4.2 Energy forecast

Historical Queensland energy measurements are presented in Table 3.3. They are recorded at various levels in the network as defined in Figure 3.4.

Transmission losses are the difference between transmission sent out and transmission delivered energy. Scheduled Power Station (PS) auxiliaries are the difference between operational 'as generated' and operational sent out energy.

Table 3.3 Historical energy (GWh)

Financial Year	Operational as generated	Operational sent out	Native as generated	Native sent out	Transmission sent out	Transmission delivered	Native	Native plus rooftop PV
2012/13	50,711	47,368	52,045	48,702	47,259	45,651	47,090	47,090
2013/14	49,686	46,575	51,029	47,918	46,560	45,145	46,503	46,503
2014/15	51,855	48,402	53,349	50,047	48,332	46,780	48,495	49,952
2015/16	54,238	50,599	55,752	52,223	50,573	49,094	50,744	52,509
2016/17	55,101	51,323	56,674	53,017	51,262	49,880	51,635	53,506
2017/18	54,538	50,198	56,139	51,918	50,172	48,739	50,925	53,406
2018/19	54,861	50,473	56,381	52,118	50,163	48,764	51,240	54,529
2019/20	54,179	50,039	55,776	51,740	49,248	47,860	50,804	54,449
2020/21	53,415	49,727	54,710	51,140	48,608	47,421	50,107	55,232
2021/22	53,737	49,940	54,744	51,052	48,625	47,405	50,081	56,159

The transmission delivered energy forecasts are presented in Table 3.4.

Table 3.4 Forecast annual transmission delivered energy (GWh)

Financial Year	Slow Change	Step Change	Hydrogen Export
2022/23	44,692	47,707	48,619
2023/24	42,887	48,037	48,538
2024/25	42,135	47,328	46,494
2025/26	41,628	49,473	46,379
2026/27	41,340	50,578	50,537
2027/28	41,108	50,221	52,008
2028/29	41,107	49,245	52,981
2029/30	33,885 (1)	48,840	56,539
2030/31	34,193	49,033	56,787
2031/32	34,283	50,201	64,401

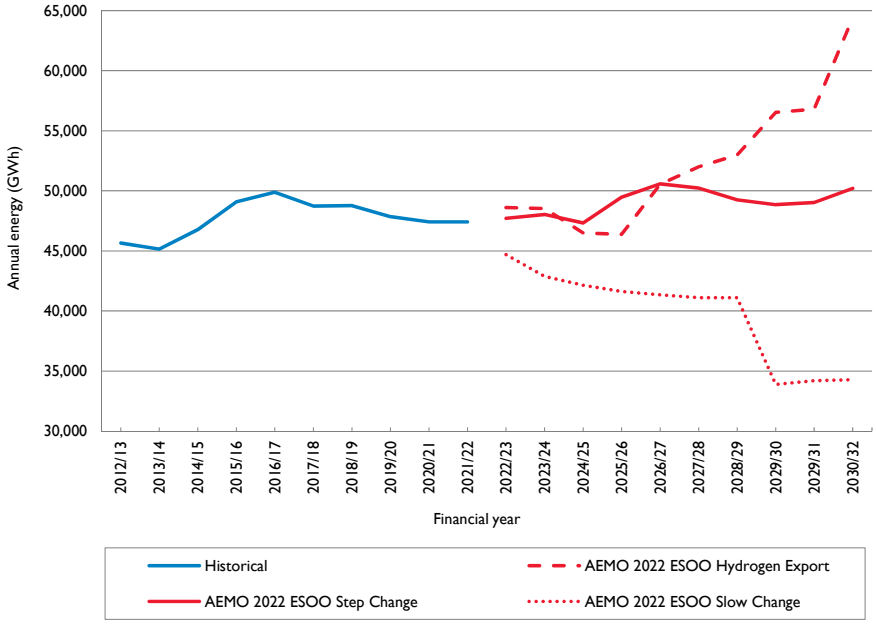
Note:

(1) AEMO assumes the shutdown of a large industrial load in the Slow Change scenario in summer 2029/30.

3 Energy and demand projections

The historical annual transmission delivered energy from Table 3.3 and the forecast transmission delivered energy for the Slow Change, Step Change and Hydrogen Export scenarios from Table 3.4 are shown in Figure 3.5.

Figure 3.5 Historical and forecast transmission delivered energy



The native energy forecasts are presented in Table 3.5.

Table 3.5 Forecast annual native energy (GWh)

Financial Year	Slow Change	Step Change	Hydrogen Export
2022/23	47,992	51,006	51,918
2023/24	46,949	52,099	52,599
2024/25	46,886	53,061	53,170
2025/26	46,408	55,417	54,688
2026/27	46,268	56,821	59,851
2027/28	46,176	56,917	62,345
2028/29	46,314	56,690	63,920
2029/30	39,244 (1)	56,839	68,847
2030/31	39,274	57,683	70,880
2031/32	39,521	59,113	79,826

Note:

(1) AEMO assumes the shutdown of a large industrial load in the Slow Change scenario in summer 2029/30.

3.4.3 Summer maximum demand forecast

Historical Queensland summer maximum demand measurements at time of transmission delivered peak are presented in Table 3.6.

Table 3.6 Historical summer maximum demand at time of transmission delivered peak (MW)

Summer	Operational as generated	Operational sent out	Native as generated	Native sent out	Transmission sent out	Transmission delivered	Transmission delivered corrected to 50% PoE	Native	Native plus solar PV
2012/13	8,278	8,208	8,448	8,427	8,113	7,597	7,638	7,911	7,911
2013/14	8,445	7,892	8,587	8,045	7,810	7,559	7,436	7,794	8,086
2014/15	8,809	8,360	9,024	8,623	8,276	7,983	7,737	8,330	8,524
2015/16	9,154	8,620	9,332	8,850	8,532	8,222	8,050	8,541	9,021
2016/17	9,412	8,856	9,572	9,078	8,694	8,347	8,257	8,731	8,817
2017/18	9,798	9,211	10,015	9,489	9,080	8,789	8,515	9,198	9,602
2018/19	10,010	9,433	10,173	9,666	9,248	8,969	8,488	9,387	9,523
2019/20	9,836	9,283	10,052	9,544	9,056	8,766	8,662	9,255	9,453
2020/21	9,473	8,954	9,627	9,161	8,711	8,479	8,660	8,929	9,256
2021/22	10,058	9,503	10,126	9,624	9,332	9,031	8,876	9,323	9,323

The summer transmission delivered maximum demand forecasts are presented in Table 3.7.

Table 3.7 Forecast summer transmission delivered maximum demand (MW) (1)

Summer	Slow Change			Step Change			Hydrogen Export		
	90% PoE	50% PoE	10% PoE	90% PoE	50% PoE	10% PoE	90% PoE	50% PoE	10% PoE
2022/23	8,372	8,699	9,105	8,710	9,047	9,466	8,820	9,163	9,590
2023/24	8,449	8,797	9,186	9,050	9,415	9,821	9,040	9,414	9,831
2024/25	8,401	8,711	9,106	9,164	9,488	9,901	9,211	9,543	9,969
2025/26	8,459	8,785	9,217	9,526	9,864	10,307	9,308	9,657	10,119
2026/27	8,511	8,808	9,231	9,669	9,972	10,400	10,046	10,352	10,800
2027/28	8,515	8,850	9,229	9,923	10,256	10,642	10,180	10,521	10,934
2028/29	8,684	9,006	9,425	9,961	10,269	10,695	10,367	10,683	11,135
2029/30 (2)	7,911	8,211	8,619	10,102	10,375	10,774	10,619	10,897	11,321
2030/31	7,944	8,253	8,655	10,281	10,549	10,953	10,893	11,175	11,630
2031/32	8,084	8,388	8,788	10,561	10,819	11,211	11,599	11,868	12,315

Notes:

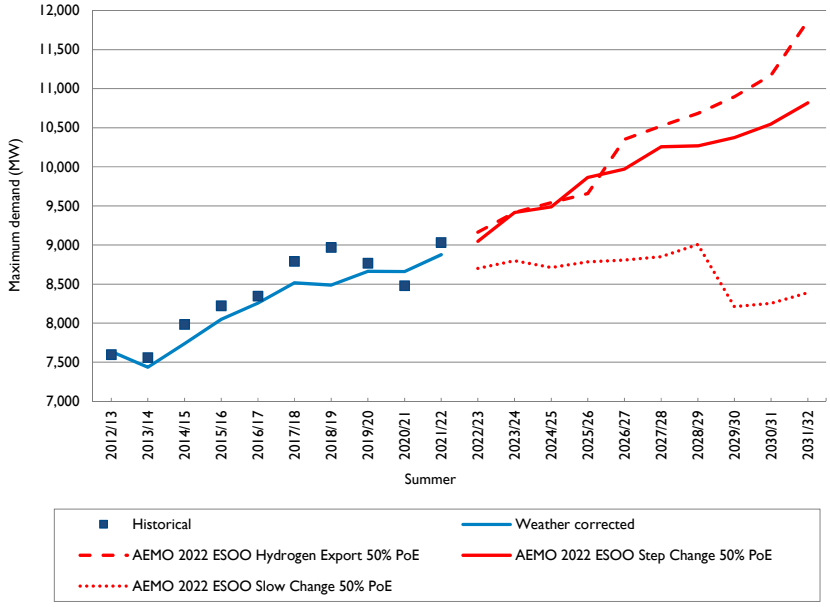
(1) Forecasts are provided without predicting market outcomes, directions or constraints which may be imposed to ensure system security but will impact the output of embedded VRE generators and, as a consequence, transmission delivered demand.

(2) Shutdown of a large industrial load is assumed in the Slow Change scenario in summer 2029/30.

3 Energy and demand projections

The summer historical transmission delivered maximum demands from Table 3.6 and the forecast 50% PoE summer transmission delivered maximum demands for the Slow Change, Step Change, and Hydrogen Export scenarios from Table 3.7 are shown in Figure 3.6.

Figure 3.6 Historical and forecast transmission delivered summer maximum demand



Historical Queensland summer maximum demand measurements at time of native peak are presented in Table 3.8.

Table 3.8 Historical summer maximum demand at time of native peak (MW)

Summer	Operational as generated	Operational sent out	Native as generated	Native sent out	Transmission sent out	Transmission delivered	Native	Native plus solar PV	Native corrected to 50% PoE
2012/13	8,479	8,008	8,691	8,245	7,920	7,588	7,913	7,913	7,952
2013/14	8,374	7,947	8,531	8,114	7,780	7,498	7,831	7,831	7,731
2014/15	8,831	8,398	9,000	8,589	8,311	8,019	8,326	8,512	8,084
2015/16	9,154	8,668	9,272	8,848	8,580	8,271	8,539	8,783	8,369
2016/17	9,412	8,886	9,584	9,062	8,698	8,392	8,756	8,899	8,666
2017/18	9,796	9,262	10,010	9,480	9,133	8,842	9,189	9,594	8,924
2018/19	10,044	9,450	10,216	9,626	9,240	8,951	9,415	9,685	8,930
2019/20	9,853	9,294	10,074	9,515	9,011	8,710	9,268	9,652	9,163
2020/21	9,473	8,954	9,627	9,161	8,711	8,479	8,929	9,254	9,110
2021/22	10,013	9,475	10,089	9,615	9,196	8,907	9,326	9,468	9,295

The summer native maximum demand forecasts are presented in Table 3.9.

Table 3.9 Forecast summer native maximum demand (MW)

Summer	Slow Change			Step Change			Hydrogen Export		
	90% PoE	50% PoE	10% PoE	90% PoE	50% PoE	10% PoE	90% PoE	50% PoE	10% PoE
2022/23	8,784	9,109	9,518	9,122	9,457	9,878	9,232	9,573	10,002
2023/24	8,764	9,110	9,501	9,368	9,731	10,139	9,454	9,826	10,245
2024/25	8,824	9,132	9,529	9,582	9,903	10,319	9,655	9,985	10,413
2025/26	8,832	9,155	9,590	9,954	10,289	10,735	9,927	10,274	10,739
2026/27	8,885	9,179	9,604	10,230	10,530	10,960	10,576	10,879	11,330
2027/28	8,957	9,291	9,672	10,347	10,678	11,066	10,731	11,069	11,485
2028/29	9,021	9,341	9,763	10,426	10,731	11,159	10,926	11,240	11,694
2029/30 (1)	8,259	8,557	8,967	10,579	10,850	11,251	11,207	11,482	11,908
2030/31	8,325	8,632	9,036	10,791	11,058	11,464	11,522	11,802	12,258
2031/32	8,432	8,734	9,136	11,068	11,323	11,717	12,273	12,540	12,989

Note:

(1) Shutdown of a large industrial load is assumed in the Slow Change scenario in summer 2029/30.

3.4.4 Winter maximum demand forecast

Historical Queensland winter maximum demand measurements at time of transmission delivered peak are presented in Table 3.10. As winter demand normally peaks after sunset, solar PV has no impact on winter maximum demand.

Table 3.10 Historical winter maximum demand at time of transmission delivered peak (MW)

Winter	Operational as generated	Operational sent out	Native as generated	Native sent out	Transmission sent out	Transmission delivered	Transmission delivered corrected to 50% PoE	Native	Native plus rooftop PV
2013	7,131	6,761	7,273	6,921	6,780	6,551	6,753	6,693	6,693
2014	7,288	6,895	7,448	7,091	6,853	6,642	6,761	6,879	6,879
2015	7,816	7,334	8,027	7,624	7,299	7,090	6,976	7,415	7,415
2016	8,017	7,469	8,176	7,678	7,398	7,176	7,198	7,456	7,456
2017	7,595	7,063	7,756	7,282	7,067	6,870	7,138	7,085	7,085
2018	8,172	7,623	8,295	7,803	7,554	7,331	7,654	7,580	7,580
2019	7,898	7,446	8,096	7,735	7,486	7,296	7,289	7,544	7,544
2020	8,143	7,671	8,320	7,941	7,673	7,483	7,276	7,751	7,751
2021	8,143	7,677	8,279	7,901	7,659	7,472	7,376	7,714	7,725
2022	8,162	8,216	8,238	8,347	8,141	7,921	(1)	8,127	8,127

Note:

(1) The winter 2022 weather corrected demand was not available at time of publication.

3 Energy and demand projections

The winter transmission delivered maximum demand forecasts are presented in Table 3.11.

Table 3.11 Forecast winter transmission delivered maximum demand (MW) (1)

Winter	Slow Change			Step Change			Hydrogen Export		
	90% PoE	50% PoE	10% PoE	90% PoE	50% PoE	10% PoE	90% PoE	50% PoE	10% PoE
2023	7,363	7,607	7,914	7,642	7,885	8,209	7,691	7,932	8,253
2024	7,351	7,596	7,908	7,811	8,056	8,379	7,781	8,028	8,353
2025	7,404	7,642	7,953	8,002	8,240	8,576	7,897	8,137	8,466
2026	7,432	7,671	7,979	8,381	8,623	8,942	8,296	8,539	8,854
2027	7,498	7,736	8,045	8,632	8,868	9,184	9,071	9,306	9,619
2028	7,559	7,801	8,118	8,707	8,936	9,255	8,958	9,184	9,503
2029	7,438	7,714	8,076	8,781	9,007	9,324	9,875	10,098	10,419
2030 (2)	6,869	7,116	7,433	8,875	9,108	9,418	11,219	11,451	11,766
2031	6,944	7,182	7,508	9,083	9,309	9,620	10,460	10,688	10,999
2032	7,007	7,250	7,563	9,321	9,543	9,854	10,386	10,615	10,925

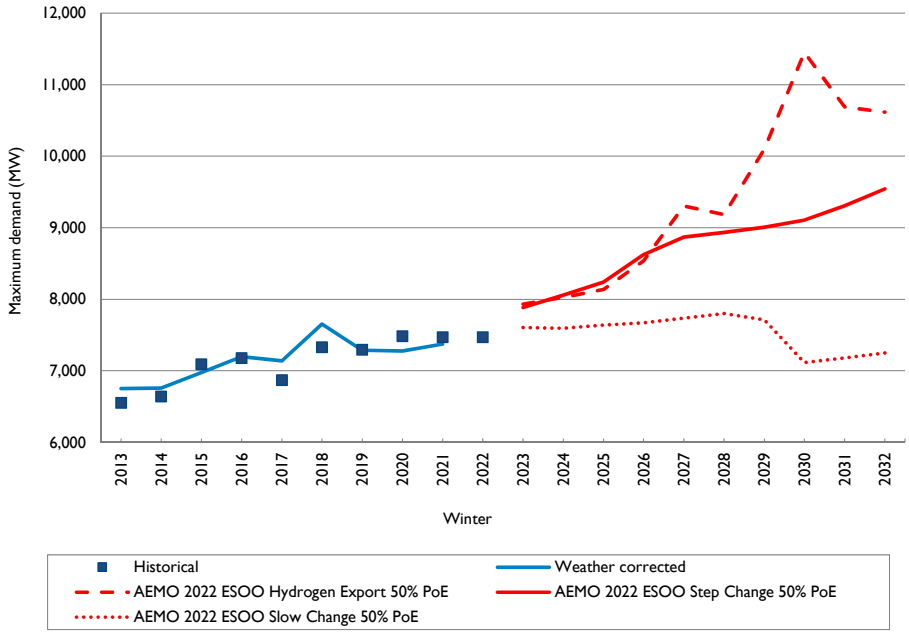
Notes:

(1) Forecasts are provided without predicting market outcomes, directions or constraints which may be imposed to ensure system security but will impact the output of embedded VRE generators and, as a consequence, transmission delivered demand.

(2) Shutdown of a large industrial load is assumed in the Slow Change scenario in summer 2029/30.

The winter historical transmission delivered maximum demands from Table 3.10 and the forecast 50% PoE summer transmission delivered maximum demands for the Slow Change, Step Change, and Hydrogen Export scenarios from Table 3.11 are shown in Figure 3.7.

Figure 3.7 Historical and forecast winter transmission delivered maximum demand



Historical Queensland winter maximum demand measurements at time of native peak are presented in Table 3.12. As winter demand normally peaks after sunset, solar PV has no impact on winter maximum demand.

Table 3.12 Historical winter maximum demand at time of native peak (MW)

Winter	Operational as generated	Operational sent out	Native as generated	Native sent out	Transmission sent out	Transmission delivered	Native	Native plus rooftop PV	Native corrected to 50 % PoE
2013	7,173	6,753	7,345	6,947	6,699	6,521	6,769	6,769	6,983
2014	7,307	6,895	7,470	7,077	6,854	6,647	6,881	6,881	6,999
2015	7,822	7,369	8,027	7,620	7,334	7,126	7,411	7,412	7,301
2016	8,017	7,513	8,188	7,686	7,439	7,207	7,454	7,454	7,479
2017	7,723	7,221	7,874	7,374	7,111	6,894	7,157	7,157	7,433
2018	8,172	7,623	8,295	7,750	7,554	7,383	7,633	7,633	7,904
2019	8,073	7,559	8,286	7,778	7,416	7,208	7,624	7,624	7,617
2020	8,143	7,671	8,320	7,885	7,673	7,441	7,708	7,708	7,544
2021	8,162	7,699	8,324	7,948	7,663	7,468	7,754	7,754	7,830
2022	8,625	8,216	8,701	8,347	8,141	7,921	8,127	8,127	(1)

Note:

(1) The winter 2022 weather corrected demand was not available at time of publication.

The winter native maximum demand forecasts are presented in Table 3.13.

Table 3.13 Forecast winter native maximum demand (MW)

Winter	Slow Change			Step Change			Hydrogen Export		
	90% PoE	50% PoE	10% PoE	90% PoE	50% PoE	10% PoE	90% PoE	50% PoE	10% PoE
2023	7,645	7,897	8,196	7,925	8,176	8,491	7,973	8,223	8,535
2024	7,640	7,893	8,198	8,148	8,402	8,717	8,162	8,418	8,735
2025	7,694	7,941	8,244	8,353	8,599	8,927	8,361	8,610	8,930
2026	7,732	7,980	8,279	8,751	9,002	9,312	8,799	9,050	9,357
2027	7,801	8,046	8,347	9,028	9,272	9,580	9,607	9,850	10,155
2028	7,865	8,115	8,424	9,150	9,388	9,699	9,503	9,737	10,048
2029	7,758	8,043	8,397	9,241	9,477	9,785	10,468	10,701	11,013
2030 (1)	7,184	7,440	7,749	9,376	9,618	9,920	11,873	12,114	12,419
2031	7,260	7,506	7,823	9,600	9,835	10,137	11,183	11,420	11,723
2032	7,323	7,574	7,878	9,864	10,094	10,397	11,177	11,414	11,716

Note:

(1) Shutdown of a large industrial load is assumed in the Slow Change scenario in summer 2029/30.

3.4.5 Annual minimum demand forecast

Historical Queensland annual minimum demand measurements at time of transmission delivered minimum are presented in Table 3.14.

Table 3.14 Historical annual minimum demand (MW)

Summer	Operational as generated	Operational sent out	Native as generated	Native sent out	Transmission sent out	Transmission delivered	Native	Native plus rooftop PV
2013	4,176	3,838	4,305	3,978	3,849	3,702	3,831	3,831
2014	4,073	3,780	4,274	4,027	3,768	3,664	3,923	3,923
2015	4,281	3,946	4,476	4,178	3,983	3,884	4,079	4,079
2016	4,944	4,470	5,101	4,686	4,471	4,336	4,552	4,552
2017	4,791	4,313	4,942	4,526	4,318	4,181	4,389	4,389
2018	4,647	4,165	4,868	4,501	4,143	4,008	4,366	5,572
2019	4,211	3,712	4,441	4,112	3,528	3,370	3,953	5,323
2020	3,897	3,493	4,094	3,767	3,097	3,006	3,675	5,882
2021	3,869	3,480	3,958	3,701	3,043	3,014	3,671	6,804
2022 (1)	3,504	3,065	3,617	3,283	2,707	2,597	3,173	6,457

Note:

(1) 2022 minimum based on preliminary data up to 3 October 2022.

Annual transmission delivered minimum demand forecasts are presented in Table 3.15.

Table 3.15 Forecast annual transmission delivered minimum demand (MW) (1)

Annual	Slow Change			Step Change			Hydrogen Export		
	90% PoE	50% PoE	10% PoE	90% PoE	50% PoE	10% PoE	90% PoE	50% PoE	10% PoE
2022/23	1,854	1,994	2,143	2,167	2,308	2,475	2,125	2,267	2,437
2023/24	1,350	1,497	1,646	1,854	2,026	2,220	1,597	1,772	1,973
2024/25	1,170	1,308	1,460	1,594	1,772	1,987	1,087	1,271	1,496
2025/26	901	1,049	1,203	1,500	1,658	1,823	695	893	1,145
2026/27	640	784	957	1,253	1,413	1,600	925	1,272	1,650
2027/28	425	568	744	929	1,079	1,263	731	946	1,206
2028/29	-188	2	234	470	648	838	342	684	1,090
2029/30 (2)	-641	-494	-323	146	376	656	668	917	1,217
2030/31	-759	-606	-431	-325	-124	81	118	339	554
2031/32	-874	-728	-536	-435	-231	-17	1,050	1,275	1,501

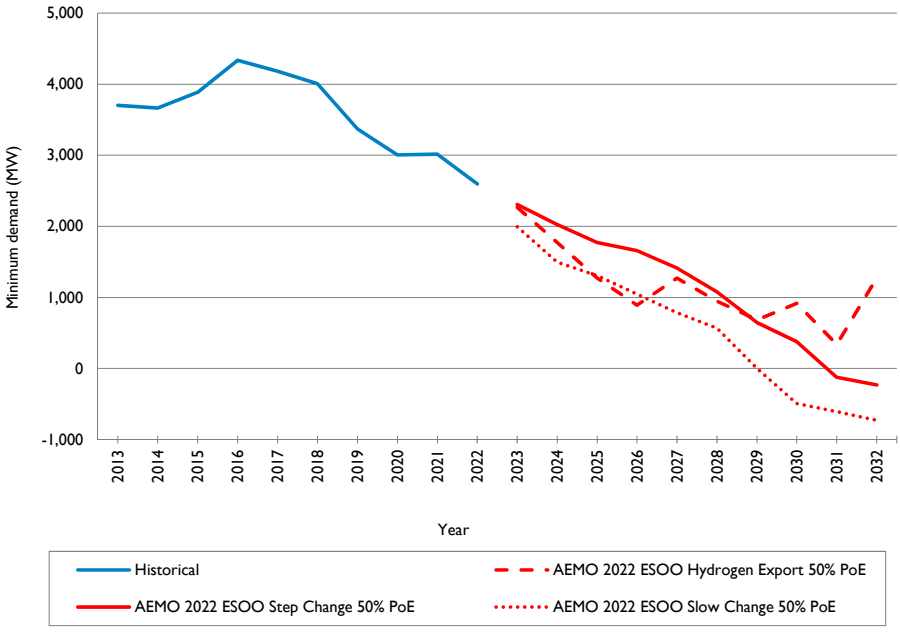
Notes:

(1) Forecasts are provided without predicting market outcomes, directions or constraints which may be imposed to ensure system security but will impact the output of embedded VRE generators and, as a consequence, transmission delivered demand.

(2) Shutdown of a large industrial load is assumed in the Slow Change scenario in summer 2029/30.

The annual historical transmission delivered minimum demands from Table 3.14 and the forecast 50% PoE annual transmission delivered minimum demands for the Slow Change, Step Change, and Hydrogen Export scenarios from Table 3.15 are shown in Figure 3.8.

Figure 3.8 Historical and forecast transmission delivered annual minimum demand



3 Energy and demand projections

Annual native minimum demand forecasts are presented in Table 3.16.

Table 3.16 Forecast annual native minimum demand (MW) (1)

Annual	Slow Change (2)			Step Change			Hydrogen Export		
	90% PoE	50% PoE	10% PoE	90% PoE	50% PoE	10% PoE	90% PoE	50% PoE	10% PoE
2022/23	2,837	2,980	3,127	3,173	3,318	3,481	3,131	3,277	3,443
2023/24	2,456	2,604	2,751	3,007	3,183	3,374	2,866	3,044	3,242
2024/25	2,250	2,390	2,540	2,784	2,966	3,177	2,597	2,785	3,006
2025/26	2,026	2,176	2,329	2,756	2,950	3,186	2,505	2,707	2,955
2026/27	1,819	1,965	2,136	2,630	2,792	2,977	2,929	3,279	3,654
2027/28	1,621	1,766	1,940	2,352	2,503	2,685	2,964	3,126	3,315
2028/29	921	1,115	1,343	2,036	2,217	2,404	2,806	3,151	3,554
2029/30 (2)	552	701	871	1,761	1,950	2,147	3,500	3,707	3,912
2030/31	445	599	773	1,604	1,806	2,010	3,304	3,528	3,741
2031/32	375	524	714	1,474	1,680	1,892	4,397	4,625	4,848

Notes:

(1) Forecasts are provided without predicting market outcomes, directions or constraints which may be imposed to ensure system security but impact on the output of these embedded VRE generators.

(2) Shutdown of a large industrial load is assumed in the Slow Change scenario in summer 2029/30.

3.5 Zone forecasts

AEMO's 2022 ESOO provides forecasts for Queensland as a single region. Forecasts from DNSPs and directly connected customers at each transmission connection supply point have been used to apportion the demand and energy forecasts into the 11 zones referenced throughout this TAPR. The 11 geographical zones are defined in Table C.1 and illustrated in Figure C.1 in Appendix C. Each zone normally experiences its own maximum demand, which is usually greater than that shown in tables 3.20 to 3.23.

Table 3.17 shows the average ratios of zone maximum transmission delivered demand to zone transmission delivered demand at the time of Queensland region maximum delivered demand. These values can be used to multiply demands in tables 3.20 and 3.22 to estimate each zone's individual maximum transmission delivered demand, the time of which is not necessarily coincident with the time of Queensland region maximum transmission delivered demand. The ratios are based on historical trends.

Table 3.17 Average ratios of zone maximum delivered demand to zone delivered demand at time of Queensland region maximum delivered demand

Zone	Winter	Summer
Far North	1.09	1.17
Ross	1.29	1.46
North	1.16	1.12
Central West	1.10	1.20
Gladstone	1.02	1.03
Wide Bay	1.02	1.07
Surat	1.20	1.17
Bulli	1.04	1.07
South West	1.04	1.11
Moreton	1.01	1.02
Gold Coast	1.03	1.10

Tables 3.18 and 3.19 show the historical and forecast of transmission delivered energy and native energy for the Step Change scenario for each of the 11 zones in the Queensland region.

3 Energy and demand projections

Table 3.18 Annual transmission delivered energy by zone (GWh)

Financial Year	Far North	Ross	North	Central West	Gladstone	Wide Bay	Surat	Bulli	South West	Moreton	Gold Coast	Total
Actuals												
2012/13	1,722	2,693	2,732	3,414	10,507	1,267		103	1,746	18,232	3,235	45,651
2013/14	1,658	2,826	2,828	3,564	10,293	1,321	338	146	1,304	17,782	3,085	45,145
2014/15	1,697	2,977	2,884	3,414	10,660	1,266	821	647	1,224	18,049	3,141	46,780
2015/16	1,724	2,944	2,876	3,327	10,721	1,272	2,633	1,290	1,224	17,944	3,139	49,094
2016/17	1,704	2,682	2,661	3,098	10,196	1,305	4,154	1,524	1,308	18,103	3,145	49,880
2017/18	1,657	2,645	2,650	3,027	9,362	1,238	4,383	1,497	1,315	17,873	3,092	48,739
2018/19	1,648	2,338	2,621	2,996	9,349	1,198	4,805	1,519	1,376	17,849	3,065	48,764
2019/20	1,594	2,466	2,495	2,859	9,303	1,031	5,025	1,580	1,141	17,395	2,971	47,860
2020/21	1,519	2,569	2,413	2,813	9,383	970	5,241	1,491	993	16,807	3,222	47,421
2021/22	1,598	2,418	2,755	2,776	9,124	904	5,420	1,395	990	17,101	2,924	47,405
Forecasts												
2022/23	1,454	2,659	2,507	2,560	9,369	936	5,319	1,721	1,046	17,162	2,974	47,707
2023/24	1,494	2,655	2,592	2,661	9,395	647	5,017	1,727	1,047	17,713	3,089	48,037
2024/25	1,404	2,502	2,447	2,518	9,846	386	4,511	1,579	959	18,025	3,151	47,328
2025/26	1,475	2,600	2,567	2,777	9,900	455	4,413	1,540	1,050	19,298	3,398	49,473
2026/27	1,456	2,564	2,530	2,734	11,128	447	4,323	1,507	1,037	19,426	3,426	50,578
2027/28	1,396	2,461	2,390	2,607	11,639	407	4,186	1,458	979	19,294	3,404	50,221
2028/29	1,294	2,290	2,215	2,413	12,145	342	3,924	1,365	891	19,010	3,356	49,245
2029/30	1,206	2,145	2,059	2,248	13,001	280	3,749	1,303	809	18,731	3,309	48,840
2030/31	1,173	2,028	1,937	2,128	13,871	243	3,535	1,225	759	18,804	3,330	49,033
2031/32	1,207	2,060	1,994	2,175	13,891	267	3,473	1,200	794	19,641	3,499	50,201

Table 3.19 Annual native energy by zone (GWh)

Financial Year	Far North	Ross	North	Central West	Gladstone	Wide Bay	Surat	Bulli	South West	Moreton	Gold Coast	Total
Actuals												
2012/13	1,722	3,080	3,064	3,767	10,507	1,292		103	1,988	18,332	3,235	47,090
2013/14	1,658	3,067	3,154	3,944	10,293	1,339	402	146	1,536	17,879	3,085	46,503
2014/15	1,697	3,163	3,434	3,841	10,660	1,285	1,022	647	1,468	18,137	3,141	48,495
2015/16	1,724	3,141	3,444	3,767	10,721	1,293	2,739	1,290	1,475	18,011	3,139	50,744
2016/17	1,704	2,999	3,320	3,541	10,196	1,329	4,194	1,524	1,549	18,134	3,145	51,635
2017/18	1,667	2,935	3,296	3,493	9,362	1,259	4,853	1,497	1,527	17,944	3,092	50,925
2018/19	1,670	2,894	3,211	3,608	9,349	1,266	5,163	1,519	1,550	17,945	3,065	51,240
2019/20	1,614	2,899	3,159	3,656	9,303	1,282	5,395	1,580	1,479	17,466	2,971	50,804
2020/21	1,539	2,904	2,982	3,552	9,383	1,234	5,451	1,491	1,476	17,152	2,943	50,107
2021/22	1,618	2,900	3,212	3,515	9,124	1,164	5,626	1,395	1,454	17,149	2,924	50,081
Forecasts												
2022/23	1,486	3,303	3,065	3,342	9,369	1,240	5,595	1,721	1,682	17,229	2,974	51,006
2023/24	1,526	3,373	3,150	3,443	9,395	1,271	5,616	1,727	1,724	17,785	3,089	52,099
2024/25	1,540	3,408	3,192	3,485	9,846	1,278	5,606	1,724	1,735	18,096	3,151	53,061
2025/26	1,637	3,553	3,358	3,688	9,900	1,352	5,605	1,721	1,838	19,367	3,398	55,417
2026/27	1,643	3,561	3,364	3,688	11,128	1,353	5,606	1,722	1,835	19,495	3,426	56,821
2027/28	1,619	3,523	3,289	3,624	11,639	1,328	5,607	1,723	1,799	19,362	3,404	56,917
2028/29	1,577	3,461	3,223	3,536	12,145	1,282	5,575	1,715	1,741	19,079	3,356	56,690
2029/30	1,534	3,396	3,147	3,450	13,001	1,235	5,570	1,715	1,681	18,801	3,309	56,839
2030/31	1,525	3,379	3,124	3,426	13,871	1,216	5,565	1,714	1,658	18,875	3,330	57,683
2031/32	1,580	3,451	3,218	3,510	13,891	1,249	5,583	1,718	1,705	19,709	3,499	59,113

Tables 3.20 and 3.21 show the historical and forecast of transmission delivered summer maximum demand and native summer maximum demand for each of the 11 zones in the Queensland region. It is based on the Step Change scenario and average (50% PoE) summer weather.

3 Energy and demand projections

Table 3.20 State summer maximum transmission delivered demand by zone (MW)

Summer	Far North	Ross	North	Central West	Gladstone	Wide Bay	Surat	Bulli	South West	Moreton	Gold Coast	Total
Actuals												
2012/13	278	297	373	546	1,219	233	13	14	231	3,766	627	7,597
2013/14	296	401	427	504	1,152	248	13	17	267	3,597	637	7,559
2014/15	278	381	399	466	1,254	263	96	81	227	3,846	692	7,983
2015/16	308	392	411	443	1,189	214	265	155	231	3,953	661	8,222
2016/17	258	222	378	429	1,193	270	421	178	286	3,993	719	8,347
2017/18	304	376	413	463	1,102	278	504	183	301	4,147	718	8,789
2018/19	342	339	400	484	1,096	285	526	191	312	4,270	724	8,969
2019/20	286	325	391	368	1,080	263	610	191	267	4,276	709	8,766
2020/21	254	405	431	471	1,111	298	588	165	248	3,894	614	8,479
2021/22	363	441	473	518	1,103	269	594	174	253	4,146	697	9,031
Forecasts												
2022/23	345	353	520	435	1,162	210	599	188	204	4,313	718	9,047
2023/24	360	366	541	476	1,169	249	610	186	239	4,484	735	9,415
2024/25	352	365	548	473	1,218	244	614	184	233	4,521	736	9,488
2025/26	371	375	576	507	1,224	259	611	182	248	4,742	769	9,864
2026/27	374	370	579	502	1,359	235	597	182	225	4,778	771	9,972
2027/28	384	398	592	544	1,413	277	614	181	265	4,813	775	10,256
2028/29	383	393	588	549	1,468	276	615	181	265	4,782	769	10,269
2029/30	389	399	593	553	1,562	282	615	181	271	4,764	766	10,375
2030/31	399	408	600	560	1,657	290	616	181	279	4,790	769	10,549
2031/32	418	426	618	579	1,662	305	620	181	294	4,925	791	10,819

Table 3.21 State summer maximum native demand by zone (MW)

Summer	Far North	Ross	North	Central West	Gladstone	Wide Bay	Surat	Bulli	South West	Moreton	Gold Coast	Total
Actuals												
2012/13	277	417	422	568	1,213	241		14	328	3,799	634	7,913
2013/14	271	423	386	561	1,147	260	88	21	316	3,755	603	7,831
2014/15	278	399	479	548	1,254	263	189	81	254	3,889	692	8,326
2015/16	308	423	491	519	1,189	214	370	155	257	3,952	661	8,539
2016/17	269	364	512	559	1,088	276	498	175	329	3,974	712	8,756
2017/18	310	480	486	508	1,102	278	617	183	328	4,179	718	9,189
2018/19	338	456	432	562	1,104	293	630	191	340	4,338	731	9,415
2019/20	287	451	441	530	1,084	277	660	191	305	4,322	720	9,268
2020/21	256	508	483	596	1,111	314	681	165	307	3,894	614	8,929
2021/22	363	516	504	591	1,103	269	708	174	254	4,143	697	9,322
Forecasts												
2022/23	345	465	562	527	1,159	237	710	187	248	4,302	715	9,457
2023/24	359	469	582	553	1,166	248	706	185	258	4,472	733	9,731
2024/25	354	477	593	563	1,221	255	721	185	264	4,532	738	9,903
2025/26	374	488	622	597	1,229	270	719	183	278	4,757	772	10,289
2026/27	378	494	629	608	1,369	273	722	184	281	4,815	777	10,530
2027/28	386	507	639	627	1,423	279	718	183	287	4,848	781	10,678
2028/29	387	503	638	633	1,485	280	721	183	288	4,835	778	10,731
2029/30	394	509	643	638	1,582	285	722	183	293	4,825	776	10,850
2030/31	405	520	653	647	1,682	295	726	184	303	4,862	781	11,058
2031/32	424	538	671	665	1,686	310	728	184	318	4,996	803	11,323

Tables 3.22 and 3.23 show the historical and forecast of transmission delivered winter maximum demand and native winter maximum demand for each of the 11 zones in the Queensland region. It is based on the Step Change scenario and average (50% PoE) winter weather.

3 Energy and demand projections

Table 3.22 State winter maximum transmission delivered demand by zone (MW)

Winter	Far North	Ross	North	Central West	Gladstone	Wide Bay	Surat	Bulli	South West	Moreton	Gold Coast	Total
Actuals												
2013	209	300	344	433	1,195	192	75	21	262	2,964	556	6,551
2014	226	344	355	463	1,200	204	16	51	257	2,975	551	6,642
2015	192	289	332	429	1,249	203	137	137	258	3,267	597	7,090
2016	226	249	370	417	1,242	206	390	181	279	3,079	537	7,176
2017	241	368	366	377	1,074	216	513	187	248	2,797	483	6,870
2018	242	366	335	439	1,091	235	475	186	336	3,086	540	7,331
2019	234	284	362	419	1,037	239	615	195	293	3,078	540	7,296
2020	227	306	327	449	1,104	246	531	191	313	3,274	515	7,483
2021	204	296	334	383	1,075	250	592	179	339	3,275	545	7,472
2022	230	246	322	431	991	280	508	162	360	3,780	611	7,921
Forecasts												
2023	235	263	398	548	1,127	238	538	193	287	3,442	616	7,885
2024	240	269	405	565	1,128	246	537	191	293	3,552	630	8,056
2025	247	278	418	583	1,140	256	535	189	304	3,652	638	8,240
2026	254	289	437	618	1,185	269	544	187	319	3,852	669	8,623
2027	263	288	452	647	1,207	279	546	188	331	3,978	689	8,868
2028	258	282	443	643	1,328	273	539	185	325	3,975	685	8,936
2029	258	282	442	650	1,385	273	536	184	324	3,986	687	9,007
2030	259	282	441	648	1,448	274	538	185	326	4,015	692	9,108
2031	264	285	444	652	1,544	280	538	185	334	4,081	702	9,309
2032	271	291	448	657	1,646	289	541	185	344	4,156	715	9,543

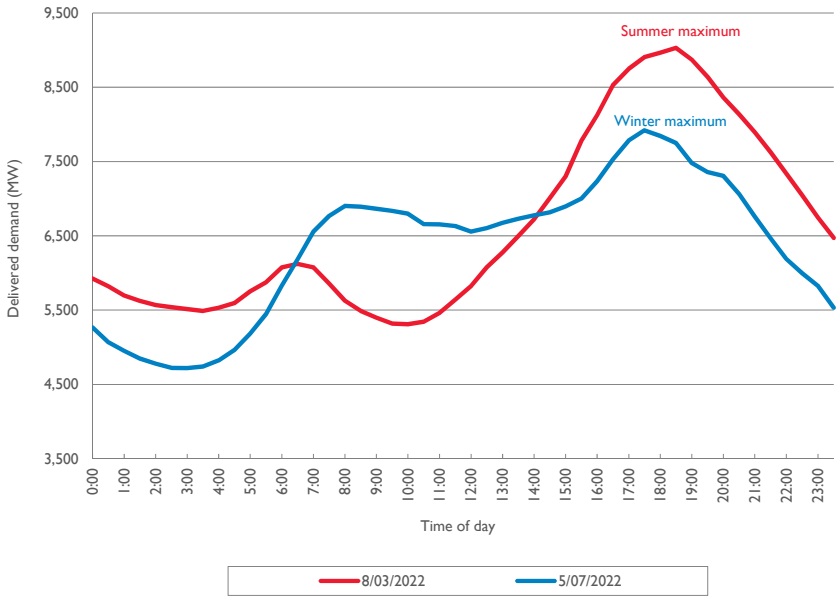
Table 3.23 State winter maximum native demand by zone (MW)

Winter	Far North	Ross	North	Central West	Gladstone	Wide Bay	Surat	Bulli	South West	Moreton	Gold Coast	Total
Actuals												
2013	195	291	374	499	1,200	195	89	17	290	3,040	579	6,769
2014	226	369	420	509	1,200	204	90	51	286	2,975	551	6,881
2015	192	334	404	518	1,249	203	208	137	288	3,281	597	7,411
2016	216	358	419	504	1,229	200	467	193	310	3,008	550	7,454
2017	218	367	416	415	1,070	220	554	182	276	2,913	526	7,157
2018	242	360	410	494	1,091	235	654	186	336	3,085	540	7,633
2019	230	307	408	483	1,066	241	628	207	346	3,176	532	7,624
2020	227	329	406	492	1,104	247	624	191	342	3,231	515	7,708
2021	206	255	366	459	1,079	232	691	181	357	3,373	559	7,758
2022	230	248	375	458	991	280	634	162	357	3,779	611	8,125
Forecasts												
2023	234	297	461	605	1,119	237	703	191	304	3,414	611	8,176
2024	240	304	471	626	1,127	246	706	191	313	3,548	630	8,402
2025	248	314	485	645	1,141	257	707	189	324	3,650	639	8,599
2026	255	326	504	681	1,188	270	716	187	340	3,864	671	9,002
2027	265	325	522	712	1,213	281	723	189	353	3,997	692	9,272
2028	261	321	515	712	1,342	277	717	187	348	4,016	692	9,388
2029	261	322	514	720	1,402	277	715	187	348	4,036	695	9,477
2030	263	324	516	721	1,471	279	721	188	351	4,081	703	9,618
2031	269	328	520	726	1,571	286	722	188	360	4,152	714	9,835
2032	277	335	525	733	1,678	295	726	189	371	4,235	728	10,094

3.6 Summer and winter maximum and annual minimum daily profiles

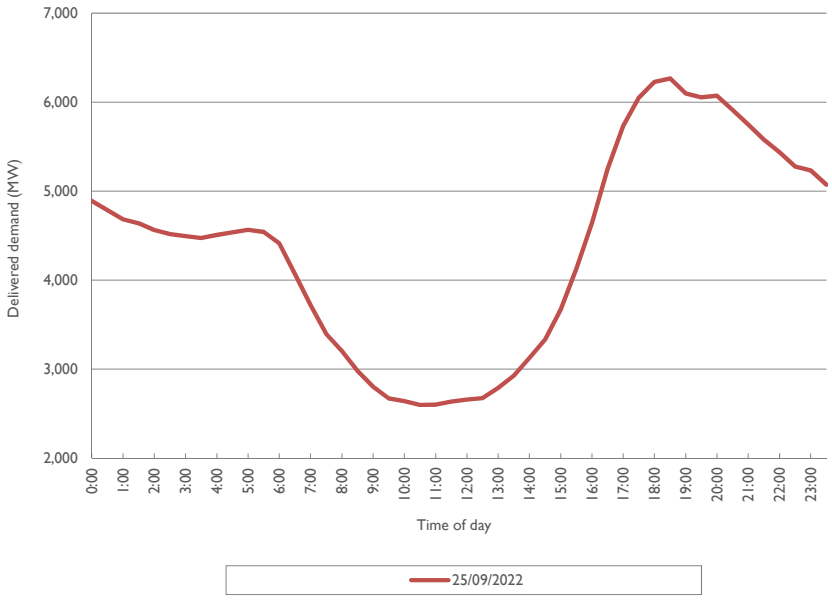
The daily load profiles (transmission delivered) for the Queensland region on the days of summer 2021/22 and winter 2022 maximum demands are shown in Figure 3.9.

Figure 3.9 Daily load profile of summer 2021/22 and winter 2022 maximum transmission delivered demand days



The 2022 annual minimum (transmission delivered) daily load profile for the Queensland region is shown in Figure 3.10.

Figure 3.10 Daily load profile of 2022 minimum transmission delivered day (1)



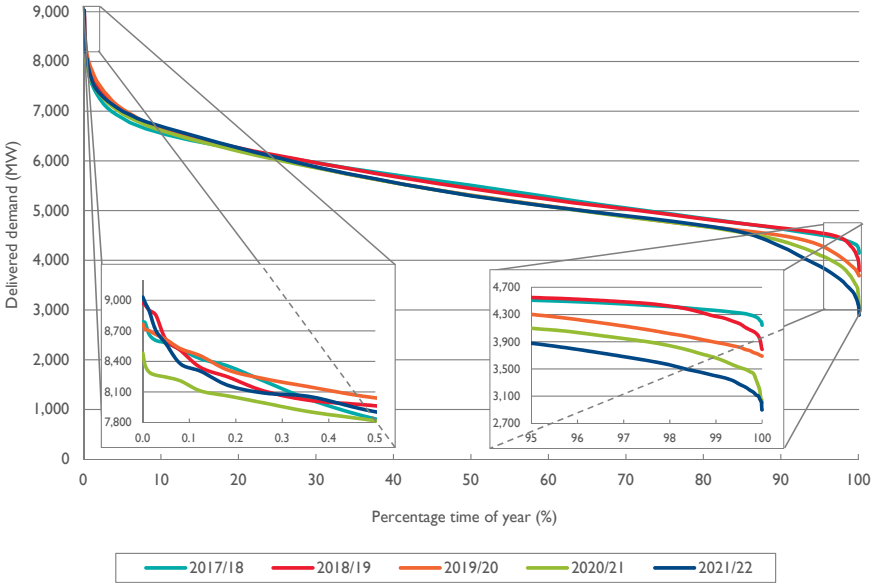
Note:

(1) Based on preliminary meter data up to 3 October 2022.

3.7 Annual load duration curves

The annual historical load duration curves for the Queensland region transmission delivered demand since 2017/18 is shown in Figure 3.11.

Figure 3.11 Historical transmission delivered load duration curves



3 Energy and demand projections