COMMERCIAL IN CONFIDENCE

FINAL REPORT

Water NSW's Broken Hill Pipeline

Bulk Water Transport Volume Demand and Energy Review

Prepared for
Independent Pricing and Regulatory Tribunal

3 June 2022

THE CENTRE FOR INTERNATIONAL ECONOMICS
www.TheCIE.com.au

The Centre for International Economics is a private economic research agency that provides professional, independent and timely analysis of international and domestic events and policies.

The CIE's professional staff arrange, undertake and publish commissioned economic research and analysis for industry, corporations, governments, international agencies and individuals.

CANBERRA
Centre for International Economics
Ground Floor, 11 Lancaster Place
Canberra Airport ACT 2609

Telephone +61 2 6245 7800
Facsimile +61 2 6245 7888
Email cie@TheCIE.com.au
Website www.TheCIE.com.au

SYDNEY
Centre for International Economics
Level 7, 8 Spring Street
Sydney NSW 2000

Telephone +61 2 9250 0800
Email ciesyd@TheCIE.com.au
Website www.TheCIE.com.au

Contents

BOXES, CHARTS AND TABLES

Executive summary

The Task

IPART has commenced its review of maximum prices to apply from 1 July 2022 for:

- Essential Water's water and wastewater services to its customers in Broken Hill and surrounding areas (Menindee, Sunset Strip and Silverton), and
- Water NSW's Broken Hill Pipeline (the Pipeline) bulk water transportation services covering Broken Hill and surrounding areas.

As part of the price reviews, IPART has engaged The Centre for International Economics (The CIE) to complete an independent evaluation of:

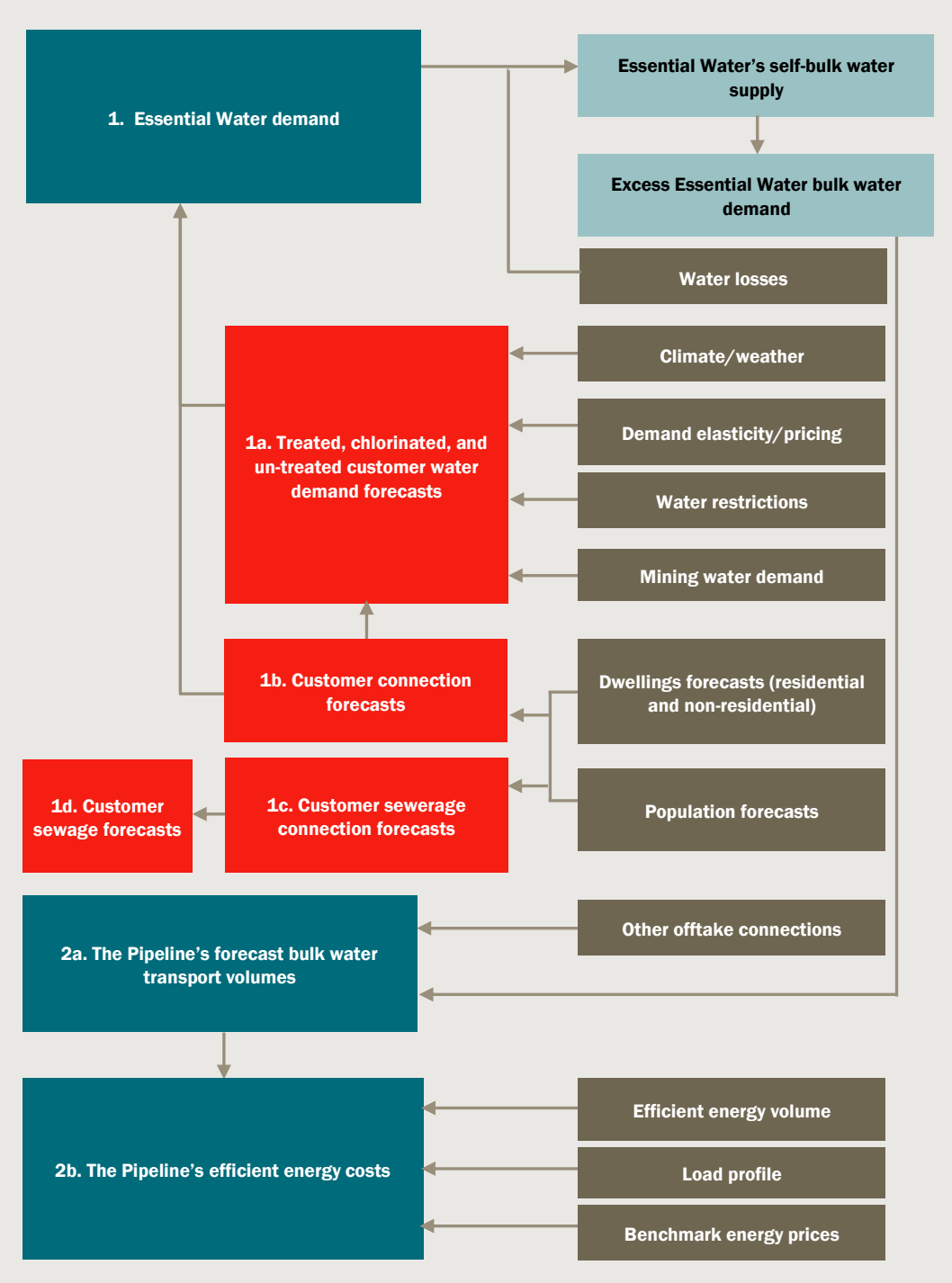
1 Essential Water's forecast customer demand, consisting of:
   a) customer number forecasts (table A.1 for potable water and table A.2 for sewerage), and
   b) water demand forecasts for treated water (table A.3), chlorinated water (table A.4), un-treated water sales (table A.5) and sewerage (table A.6), and
2 the Pipeline's:
   a) bulk water customer demand forecasts (table A.7), and
   b) proposed efficient energy costs (table A.8). [1]

This report covers task 2. Task 1 is covered in The CIE 2021, 'Essential Water's water and sewerage services in Broken Hill: Demand Review Final Report', December.

Each of these forecasts are underpinned by demographic and climatic inputs outlined in chart 1, which in turn have been assessed as part of the scope of works.

[1] Refer to Appendix A for Essential Water's customer and water demand, as well as and Water NSW's Broken Hill Pipeline forecast bulk water transport connections and volumes.

1 Overview of the scope of works



Data source: CIE.

Purpose of forecasting

Demand forecasts form a primary input into regulatory decisions. Demand forecasts:

- influence the notional revenue allowance through:
  - operating expenditure projections
  - capital expenditure projections and hence the regulatory asset base, which in turn impacts on depreciation and the return on capital, and
  - influence prices as prices are set so that demand multiplied by prices is equal to the notional revenue allowance.

Demand forecasts are also a primary input into decision-making by businesses. They can help to inform:

- pricing structures
- risks and risk management — if demand forecasts have a stochastic component rather than being a single forecast, and
- capital and operating expenditure planning decisions.

Pipeline bulk water transport service

Offtake connections

Table 2 presents Water NSW's proposed pipeline bulk water transport customer connection forecasts, and CIE's recommendation.

2 Forecast pipeline customer connections

	2022-23	2023-24	2024-25	2025-26	2026-27
	No.	No.	No.	No.	No.
Water NSW's proposal					
Essential Water	1	1	1	1	1
Other offtakes	5	5	5	5	5
Total	**6**	**6**	**6**	**6**	**6**
CIE's recommendation					
Essential Water	1	1	1	1	1
Other offtakes	5	5	5	5	5
Total	**6**	**6**	**6**	**6**	**6**

Source: Note: Water NSW currently has five offtakes (Kudgee Station, Netley Cattle Yards, Netley Station, Pinepoint / Sunnydale and Balaclava). Netley Cattle Yards and Netley Station are not taking any water and have not entered into a Water Agreement. All the other Offtakes are taking water. The Offtake Structure Pinepoint/Sunnydale is one structure but two customers who share the costs 50:50 for that offtake. Water NSW therefore refers to five offtakes with four offtake customers.

Source: Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', pp. 65-66, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF ;CIE.

We consider continuing the remaining offtake customer numbers based on existing agreements is reasonable, given that:

- forecast Essential Water bulk water transport volumes account for ~ 99.6 per cent of forecast Pipeline bulk water transport volumes (discussed above), and
- the remaining Pipeline transport connections collectively account for <1 per cent of total forecast Pipeline bulk water transport volumes (discussed below).

However, we understand Water NSW has not actively sought additional Pipeline bulk water transport connections, post the initial 2017 pipeline scoping study. We suggest Water NSW undertake active research to understand if additional pipeline bulk water transport connections would be sought.

Refer to chapter 1 for further discussion.

Pipeline bulk water transport volumes

Table 3 presents Water NSW's proposed pipeline bulk water transport volumes and CIE's recommendation.

3 Forecast pipeline bulk water transport volumes

	2022-23	2023-24	2024-25	2025-26	2026-27
	ML	ML	ML	ML	ML
Water NSW's proposal					
Essential Water [a]	5 574.7	5 553.1	5 531.5	5 509.9	5 488.1
Other offtakes	2.8	2.8	2.8	2.8	2.8
Evaporation losses	435.3	435.3	435.3	435.3	435.3
Total	**6 012.8**	**5 991.2**	**5 969.6**	**5 948.0**	**5 926.2**
CIE's recommendation					
Essential Water (CIE central case) [a]	5 792.4	5 769.4	5 746.4	5 723.3	5 700.3
Other offtakes	3.6	3.6	3.6	3.6	3.6
Evaporation losses	389.8	389.8	389.8	389.8	389.8
Total	**6 185.8**	**6 162.8**	**6 139.8**	**6 116.7**	**6 093.7**

[a] Excludes potential Cobalt Blue Mine.

Source: Water NSW 2021, 'Attachment 4 – WaterNSW (Pipeline) AIR/SIR 2021'; CIE.

Essential Water bulk water transport volumes

Essential Water's forecast bulk water volumes are discussed in The CIE 2021, 'Essential Water's water and sewerage services in Broken Hill: Demand Review Final Report', December. We consider it reasonable that Essential Water will source most of its bulk water from the River Murray and transport via the pipeline over the 2022 determination, given the:

- historical preference for Essential Water to source its bulk water needs from the Pipeline, after the Pipeline commenced operations in May 2019, and
- the improved bulk water quality supplied to Broken Hill since the Pipeline commenced operations, compared to Stephen's Creek Reservoir.[2]

Other offtake customer annual bulk water transport volumes

Water NSW forecast the annual bulk water transport volumes for other offtakes to remain steady at 2.81 ML, 23 per cent below 2020-21 actual sales of 3.64 ML.[3] Water NSW's forecast reduction in other offtake customer bulk water transport volumes appears to correlate with recent climate conditions, assuming increased rainfall carries over into the 2022 determination period. However, Water NSW has not substantiated the reduction in other customer forecast pipeline bulk water transport volumes for the 2022 determination period. We conclude the 2019-20 actual other offtake bulk water transport volume (the latest full year data currently available) of 3.64 ML per annum is used as the forecast for the 2022 determination period.

Evaporation losses

Water NSW's proposed evaporation losses of 435.4 ML per year is greater than the 2019-20 financial year reported actual annual evaporation of 389.8 ML (the latest full year actual data available).

We recommend at the next Pipeline review the actual annual reported evaporation volumes are assessed against that calculated using the Stephens Creek weather station average monthly evaporation data, to determine if it truly represents the Pipeline's forecast evaporation.

Energy review

Efficient energy volume

Table 4 presents Water NSW's proposed forecast pipeline variable and fixed energy parameters used to calculate benchmark energy costs, and CIE's recommendation.

---

2 Essential Water 2021, 'Essential Water Pricing Proposal: Submission', p. 66, June; Essential Water responses to information request, RFI 3, 1 October 2021 and 12 October 2021; Broken Hill City Council 2021, 'Broken Hill City Council's Submission to Essential Water's water and sewerage services in Broken Hill from 1 July 2022', p. 6, October, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Online-Submission-Broken-Hill-City-Council-D.-Turley-AM-22-Oct-2021-092624891.PDF

3 As stated in Water NSW 2021, 'Attachment 4 – WaterNSW (Pipeline) AIR/SIR 2021'

4 Forecast pipeline fixed and variable energy parameters

	Variable	Fixed
	MWh/ML	MWh/day
Water NSW's proposal	1.64	6.39
CIE's recommendation	1.64	6.39

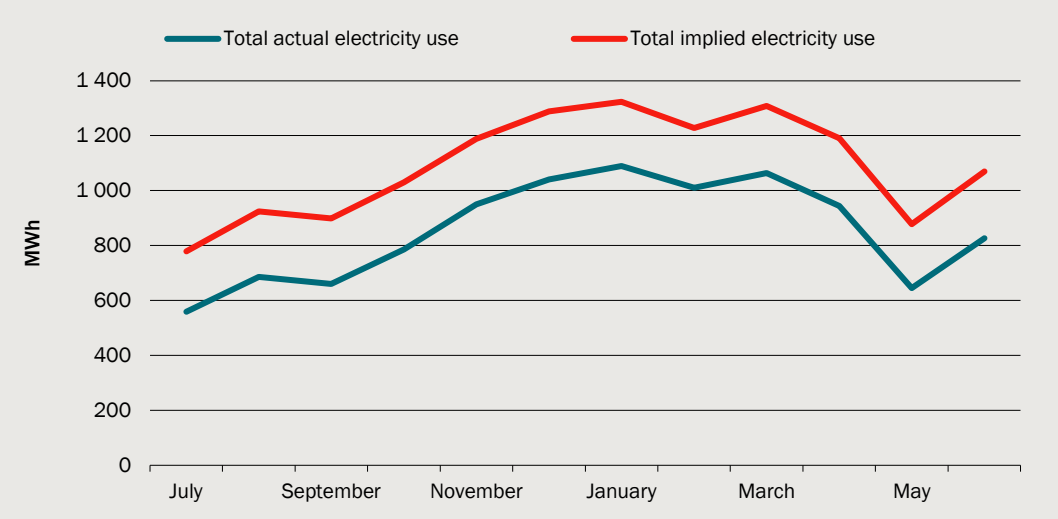
Notes: MWh/ML (Megawatt hours per megalitre); MWh/day (Megawatt hours per day).

Source: Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 37, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF; CIE.

Water NSW's assumed variable and fixed energy parameters are modelled outcomes, derived following an engineering assessment during the 2019 Pipeline price review.[4] These modelled energy parameters are the most detailed energy use estimates currently available for the Pipeline, as they consider the Pipeline's specific engineering inputs and configuration. However, future energy use forecasts can be improved via further assessment of the Pipeline's actual energy use over time.

For example, an evaluation of the Pipeline's actual monthly electricity use and water pumped, supplied by Water NSW, indicates the assumed energy parameters are greater than actually energy use (chart 5).

5 2019-20 actual monthly Pipeline electricity use compared to implied electricity use



Note: The implied fixed electricity use calculated assuming 6.39 MWh/day and the implied variable electricity use calculated assuming 1.64MWh/ML.

Data source: Water NSW 2021, 'Attachment 4 – WaterNSW (Pipeline) AIR/SIR 2021'; CIE.

4 Synergies Economic Consulting 2019, 'Expenditure review of WaterNSW's Wentworth to Broken Hill Pipeline: Final; Report', Table 30 Recommended efficient energy volume, p. 119, January; IPART 2019, 'Murray River to Broken Hill Pipeline WaterNSW: Final Report', p. 29, https://www.ipart.nsw.gov.au/sites/default/files/documents/final-report-murray-river-to-broken-hill-pipeline-waternsw-may-2019_0.pdf

A linear regression analysis[5] of 2019-20 energy use (table 6) indicates the assumed:

- 1.64 MWh/ML variable parameter is an upper bound value within the 95 per cent confidence interval that aligns closely with actual variable electricity consumption MWh/ML, with a possible lower bound estimate of 1.17 MWh/ML.
- 6.39 MWh/day fixed parameter:
  - is at the most upper limit of the estimated 95 per cent confidence interval, represented by the intercept in table 6, noting the parameter is not statistically significant at the 10 per cent level, and
  - the difference between the implied electricity use and actuals, as supplied by Water NSW, is largely corrected when an implied fixed energy parameter close to 0 is used.
    - This suggests the fixed energy parameter is likely to be greater than actual energy consumption, based on an assessment of the 2019-20 monthly electricity use data provided by Water NSW.

6 Regression analysis output for monthly electricity consumption and ML pumped

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-22.843	13.104	-1.743	0.112	-52.042	6.355
ML pumped	1.605	0.023	68.348	0.000	1.552	1.657

Notes: Adjusted R Square is 0.99765. Coefficients calculated using monthly electricity data.
Sources: Water NSW 2021, 'Attachment 4 – Water NSW (Pipeline) AIR/SIR 2021'; CIE.

Given the fixed and variable energy parameters have a significant flow on impact to the pumping profile, and ultimately the benchmark forecast electricity costs, we recommend:

- Water NSW provide substantiating evidence that the assumed 6.39 MWh/day reflects actual fixed energy use. This should include an engineering assessment of the fixed energy consumption at the three pumping stations, and bulk water storage, which in turn are influenced by a range of operational engineering considerations. For example:
  - planned maintenance and or planned/unplanned outages
  - operational factors such as flow rates, current BWS volumes, forecast and current power usage and periods, and
  - algal conditions in the River Murray and water quality conditions in the Bulk Water Storage, and
- the variable and fixed energy parameters are subject to an engineering assessment at the next Pipeline review that incorporates several years of actual electricity meter read data and adjusted if necessary.

5 $Monthly\ electricity\ consumption = \beta 0 + \beta 1\ ML\ pumped$

Pumping profile

Water NSW converted the annual water consumption forecasts into a half-hourly profile by scaling using the 2019-20 historical pumping profile. Water NSW argue this approach ensures the pumping profile incorporates the Pipeline's operational constraints.[6]

In addition to historical pumping profiles, we have also considered a simulated pumping profile. This takes a pumping model which was developed by IPART for the 2019 Murray River to Broken Hill Pipeline determination. The model assumes that pumping is smoothed over the year, with the model seeking to pump constantly over the year to meet expected annual demand (including losses), subject to constraints (the pipeline flow rate and minimum and maximum storage levels).

We consider using the IPART simulated pumping profile to be preferred to using actual data as:

- The pumping profile depends on the level of demand. As demand is expected to fall over the determination period, we would expect the pumping profile to change – using actual data does not allow the profile to change with demand.
- 2019-20 actual data may not reflect efficient pumping. Against the cost minimisation profile estimated from the IPART model, pumping during the year was not efficient.
- The simulated pumping profile accounts for losses, pipeline downtime, and Water NSW advice that the storage levels generally do not go below 60 per cent (they are maintained at between 60 per cent and 80 per cent capacity[7]).

Table 7 shows Water NSW's forecast pumping profile electricity demand and our recommendation.

7 Forecast pumping profile electricity demand

	2022-23	2023-24	2024-25	2025-26	2026-27
	MWh	MWh	MWh	MWh	MWh
Water NSW proposed					
Off-peak	8 737	8 710	8 684	8 657	8 630
Shoulder	3 239	3 230	3 222	3 213	3 204
Peak	218	218	218	218	218
Total [a]	**12 194**	**12 158**	**12 124**	**12 088**	**12 052**
	Share of total	Share of total	Share of total	Share of total	Share of total
Off-peak	73%	73%	73%	73%	73%
Shoulder	27%	27%	27%	27%	27%
Peak	2%	2%	2%	2%	2%

6 Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 37, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF

7 Water NSW response to IPART Stylised Pumping Profile.

	2022-23	2023-24	2024-25	2025-26	2026-27
	MWh	MWh	MWh	MWh	MWh
CIE recommendation					
Off-peak	9 871	9 893	9 857	9 848	9 842
Shoulder	2 225	2 167	2 169	2 141	2 112
Peak	386	371	375	367	365
Total [b]	**12 482**	**12 431**	**12 401**	**12 356**	**12 319**
	Share of total	Share of total	Share of total	Share of total	Share of total
Off-peak	79%	80%	79%	80%	80%
Shoulder	18%	17%	17%	17%	17%
Peak	3%	3%	3%	3%	3%

[a] *Assumes electricity volumes of 6.39 MWh/day and 1.64MWh/ML and Essential Water's forecast bulk water transport volumes of 5 575ML in 2022-23, 5 553 ML in 2023-24, 5 532 ML in 2024-25, 5 510 ML in 2025-26, and 5 488 ML in 2026-27; losses at the bulk supply facility of 435 ML per annum, and other offtake bulk water transport volumes of 3 ML per annum.*

[b] *Assumes electricity volumes of 6.39 MWh/day and 1.64MWh/ML and forecast CIE bulk water transport volumes of 5 792 ML in 2022-23, 5 769 ML in 2023-24, 5 746 ML in 2024-25, 5 723 ML in 2025-26, 5 700 ML in 2026 27 and losses at the bulk supply facility of 389.8 ML per annum, and other offtake bulk water transport volumes of 3 ML per annum.*

Sources: Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE - STC"; Water NSW 2021, Email 'Pumping Profile Update', 15 October 2021; CIE.

We recognise there may be some determinants of an efficient pumping profile which is not characterised in the IPART model, such as labour costs or operation risks. Also, daily data on actual storage levels was not available, which would help better understand how the Pipeline is currently operated. We recommend that the model is further refined in consultations with Water NSW at the next Pipeline review.

Electricity costs

Water NSW engaged Frontier Economics to provide forecast energy prices for the five-year determination period. A cost build-up approach was used, incorporating:[8]

- wholesale electricity costs for the assumed demand profile
- costs of complying with state and federal government policies
- costs associated with the New South Wales Energy Savings Scheme
- National Electricity Market fees, ancillary services charges and costs of meeting prudential requirements
- energy losses incurred during the transmission and distribution of electricity to customers
- network costs (including the Climate Change Fund Levy)
- retail margin, and
- retail operating cost.

8 Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 130, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF

To account for the potential changes, Water NSW propose a true-up mechanism where movements in the wholesale and network cost components of the benchmark electricity price are assessed at the end of the 2022 determination period.[9]

We consider Frontier Economics electricity forecast approach and Water NSW's proposed cost true up are reasonable as:

- all energy cost components likely to be included in the Pipeline's electricity bill have been incorporated
- the latest published data at the time of Water NSW's submission has been used, and will be used to estimate electricity costs in the true-up process, and
- both wholesale and network charges are largely exogenous.

However, in summary, we have made the following amendments to the forecast energy prices, with further details in tables 8 to 10:

- updated benchmark energy price components where new information has become available since Water NSW lodged its submission, and
- amended wholesale and network costs associated with the recommended bulk water transport volumes and pumping profile.

8 Summary of energy price amendments

	2022-23 forecast	2023-24 forecast	2024-25 forecast	2025-26 forecast	2026-27 forecast	Comment	Energy price impact[a]
	($/MWh, 2021-22)	($/MWh, 2021-22)	($/MWh, 2021-22)	($/MWh, 2021-22)	($/MWh, 2021-22)		
Wholesale energy purchase costs[b]							
Water NSW's submission	51.80	52.99	52.99	52.99	52.99	Impacted by: ▪ amended bulk water transport volumes and pumping profile	Decrease
CIE's recommendation[c]	51.17	52.33	52.33	52.33	52.33		
Network costs							
Water NSW's submission							
Network access charge	19.16	19.16	19.16	19.16	19.16		No change
Energy peak	37.26	37.26	37.26	37.26	37.26		
Energy shoulder	31.94	31.94	31.94	31.94	31.94		
Energy off-peak	26.42	26.42	26.42	26.42	26.42		

9 Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 130, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF

	2022-23 forecast	2023-24 forecast	2024-25 forecast	2025-26 forecast	2026-27 forecast	Comment	Energy price impact[a]
	($/MWh, 2021-22)	($/MWh, 2021-22)	($/MWh, 2021-22)	($/MWh, 2021-22)	($/MWh, 2021-22)		
Demand peak	9.10	9.10	9.10	9.10	9.10	▪ No change to the **unit prices** recommended. ▪ However, estimated **total network costs** impacted by the change to the pumping profile and bulk water transport volumes.	
Demand shoulder	8.23	8.23	8.23	8.23	8.23		
Demand off-peak	2.46	2.46	2.46	2.46	2.46		
CIE's recommendation							
Network access charge	19.16	19.16	19.16	19.16	19.16		
Energy peak	37.26	37.26	37.26	37.26	37.26		
Energy shoulder	31.94	31.94	31.94	31.94	31.94		
Energy off-peak	26.42	26.42	26.42	26.42	26.42		
Demand peak	9.10	9.10	9.10	9.10	9.10		
Demand shoulder	8.23	8.23	8.23	8.23	8.23		
Demand off-peak	2.46	2.46	2.46	2.46	2.46		
LRET							
Water NSW's submission	4.21	2.62	2.62	2.62	2.62	▪ Higher forward certificate prices. ▪ Slight decrease to the RRP	Increase
CIE's recommendation	6.74	5.86	5.86	5.86	5.86		
SRET							
Water NSW's submission	8.50	8.29	8.09	7.89	7.70	▪ Slight decrease to the STP	Decrease
CIE's recommendation	8.25	8.05	7.86	7.66	7.48		

	2022-23 forecast	2023-24 forecast	2024-25 forecast	2025-26 forecast	2026-27 forecast	Comment	Energy price impact[a]
	($/MWh, 2021-22)	($/MWh, 2021-22)	($/MWh, 2021-22)	($/MWh, 2021-22)	($/MWh, 2021-22)		
NSW ESS							
Water NSW's submission	4.29	4.29	4.29	4.29	4.29	▪ Decrease to the AEMC's forecast published in the 2021 Residential Electricity Price Trends.	Decrease
CIE's recommendation[d]	2.87	2.87	2.87	2.87	2.87		
Market fees							
Water NSW's submission[e]	0.65	0.65	0.65	0.65	0.65	▪ Decrease to AEMO's forecast fees.	Decrease
CIE's recommendation[e]	0.58	0.58	0.58	0.58	0.58		
Ancillary service fees							
Water NSW's submission[e]	0.366	0.366	0.366	0.366	0.366	▪ Applied a longer averaging period of 7 years, compared to 5 years ▪ Updated June 2021 inflation values	Decrease
CIE's recommendation[e]	0.362	0.362	0.362	0.362	0.362		

[a] Compared to Water NSW's submission.

[b] CIE's recommended total wholesale electricity costs also differ to Water NSW's proposal due to a lower combined distribution and transmission loss factor of 0.9568 per annum, compared to Water NSW's proposed 0.9689 per annum.

[c] Figures differ to Draft Report due to amendments to the recommended pumping profile, following new information provided by Water NSW. For example, accounting for pipeline downtime and Water NSW advice that the storage levels generally do not go below 60 per cent.

[d] Figures differ to the Draft Report due to updated AEMC's forecast published residential electricity price trends, released on 25 November 2021.

[e] Minor adjustments made to Draft Report figures following final review.

Notes: LRET is Large-scale Renewable Energy Target; SRET is Small-scale Renewable Energy Scheme; RRP is renewable power percentages; STP is Small-scale Renewable Energy Scheme; AEMC is the Australian Energy Market Commission; AEMO is the Australian Energy Market Operator; ESS is the NSW Energy Savings Scheme.

Source: Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE – STC; CIE.

9 Summary of energy price amendments (retail margin)

	2022-23 forecast	2023-24 forecast	2024-25 forecast	2025-26 forecast	2026-27 forecast	Comment	Energy price impact[a]
	Per cent of total costs	Per cent of total costs	Per cent of total costs	Per cent of total costs	Per cent of total costs		
Water NSW's submission	5.70	5.70	5.70	5.70	5.70	No change	No change
CIE's recommendation	5.70	5.70	5.70	5.70	5.70		

[a] Compared to Water NSW's submission.

Source: Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE – STC; CIE.

10 Summary of energy price amendments (retail operating costs)

	2022-23 forecast	2023-24 forecast	2024-25 forecast	2025-26 forecast	2026-27 forecast	Comment	Energy price impact[a]
	$2021-22	$2021-22	$2021-22	$2021-22	$2021-22		
Water NSW's submission	2 387	2 387	2 387	2 387	2 387	Updated inflation figures	Increase
CIE's recommendation [b]	2 418	2 418	2 418	2 418	2 418		

[a] Compared to Water NSW's submission.

[b] Figures differ to the Draft Report following new information provided by Water NSW.

Source: Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE – STC; CIE.

Table 11 shows Water NSW's submitted benchmark electricity costs and our recommendation.

11 Forecast benchmark electricity costs

	2022-23	2023-24	2024-25	2025-26	2026-27	Total
	$'000	$'000	$'000	$'000	$'000	$'000
Water NSW proposal[a]						
Wholesale	612	624	622	621	619	3 098
Renewable	203	181	178	175	172	908
Market fees and ancillary services	12	12	12	12	12	12
Network charges	644	643	641	639	637	3 204
Retail operating cost margin	91	91	90	90	90	452
Total electricity costs	**1 563**	**1 551**	**1 544**	**1 537**	**1 530**	**7 724**
CIE's recommendation [b]						
Wholesale	611	622	621	619	617	3 090

	2022-23	2023-24	2024-25	2025-26	2026-27	Total
	$'000	$'000	$'000	$'000	$'000	$'000
Renewable	213	200	197	194	191	995
Market fees and ancillary services	11	11	11	11	11	56
Network charges	616	612	611	608	606	3 053
Retail operating cost & margin	90	90	90	89	89	447
Total electricity costs	**1 542**	**1 536**	**1 529**	**1 521**	**1 513**	**7 640**

[a] Assumes electricity volumes of 6.39 MWh/day and 1.64MWh/ML and Essential Water's forecast bulk water transport volumes of 5 575ML in 2022-23, 5 553 ML in 2023-24, 5 532 ML in 2024-25, 5 510 ML in 2025-26, and 5 488 ML in 2026-27; losses at the bulk supply facility of 435 ML per annum, and other offtake bulk water transport volumes of 3 ML per annum.

[b] Assumes electricity volumes of 6.39 MWh/day and 1.64MWh/ML and forecast Essential Water bulk water transport volumes of 5 792 ML in 2022-23, 5 769 ML in 2023-24, 5 746 ML in 2024-25, 5 723 ML in 2025-26, and 5 700 ML in 2026-27; losses at the bulk supply facility of 389.8 ML per annum, and other offtake bulk water transport volumes of 3 ML per annum.

Source: Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 130, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF; CIE.

Note, the figures in table 11 assume the variable and fixed electricity loads of 6.39 MWh per day and 1.64 MWh per ML respectively. Therefore, updates to these figures will change the forecast electricity costs.

1 Water NSW Pipeline connections and bulk water transport volumes

Pipeline connections

Water NSW forecasts six Pipeline connections, Essential Water and five other offtakes, to remain constant from 2020-21 and over the next determination period (2022-23 to 2026-27) (table 1.1).

1.1 Water NSW Broken Hill Pipeline forecast customer and offtake numbers

	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27
Essential Water	1	1	1	1	1	1
Other offtakes	5	5	5	5	5	5
Total	**6**	**6**	**6**	**6**	**6**	**6**

Note: WaterNSW currently has five offtakes (Kudgee Station, Netley Cattle Yards, Netley Station, Pinepoint / Sunnydale and Balaclava). Netley Cattle Yards and Netley Station are not taking any water and have not entered into a Water Agreement. All the other Offtakes are taking water. The Offtake Structure Pinepoint/Sunnydale is one structure but two customers who share the costs 50:50 for that offtake. WaterNSW therefore refers to five offtakes with four offtake customers.

Source: Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', pp. 65-66, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF.

Offtakes are:

- Kudgee Station
- Netley Cattle Yards
- Netley Station
- Pinepoint / Sunnydale, and
- Balaclava.

Water NSW state,

> "the offtake forecast in our submission is based on actual usage and actual number of customers / offtake assets installed at the pipeline. Offtake customers have signed agreements to secure access to the pipeline. We have not received any requests to install additional offtakes at the pipeline."[10]

We understand:

- the current and forecast number of connections arose as part of the initial Pipeline scoping study undertaken by RMCG in 2017, who met with landholders at Coombah

10 Water NSW 2021, response to information request RFI 7, October 7, 2021

Station as part of their report into determining what additional customers, beyond Essential Water, were potentially available to connect to the Pipeline.[11]

- Water NSW do not have plans for additional offtake customers at the time of their pricing submission.[12]

We consider continuing the remaining offtake customer numbers based on existing agreements is reasonable, given that:

- forecast Essential Water bulk water transport volumes account for ~ 99.6 per cent of forecast Pipeline bulk water transport volumes (discussed above), and
- the remaining Pipeline transport connections collectively account for <1 per cent of total forecast Pipeline bulk water transport volumes (discussed below).

However, we understand Water NSW has not actively sought additional Pipeline bulk water transport connections, post the initial 2017 pipeline scoping study. We suggest Water NSW undertake active research to understand if additional pipeline bulk water transport connections would be sought.

Pipeline bulk water transport volumes

Water NSW forecast total bulk water pipeline transport volumes to decrease by 1.8 per cent over the determination period, comparing 2026-27 forecasts with 2021-22 (table 1.2). The decline in forecast pipeline bulk water transport volumes over the determination period is wholly attributed to Essential Water, with other offtake transport volumes and evaporation losses forecast to remain constant.

1.2 Water NSW projected annual consumption met by the Broken Hill Pipeline

Consumption Volumes	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2021-22 to 2026-27
	ML	ML	ML	ML	ML	ML	Per cent
Essential Water	5 596.3	5 574.7	5 553.1	5 531.5	5 509.9	5 488.1	-1.9
Other offtakes	2.8	2.8	2.8	2.8	2.8	2.8	0.0
Evaporation losses	435.3	435.3	435.3	435.3	435.3	435.3	0.0
Total	**6 034.4**	**6 012.8**	**5 991.2**	**5 969.6**	**5 948.0**	**5 926.2**	**-1.8**

Note: Totals may not sum due to rounding.

Source: Water NSW 2021, 'Attachment 4 – Water NSW (Pipeline) AIR/SIR 2021.

11 Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 68, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF.

12 Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 66, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF.

Essential Water

Essential Water's forecast bulk water volumes are discussed in, The CIE 2021, 'Essential Water's water and sewerage services in Broken Hill: Demand Review: Final Report', December. A relevant follow up issue, is where Essential Water will source that bulk water from? The potential options are Essential Water sources its bulk water:

- exclusively (100 per cent) from the River Murray and transported via the Pipeline to Broken Hill
- exclusively (100 per cent) from its own bulk water storages (Stephens Creek and Umberumberka Reservoirs), or
- from a combination of the River Murray via the Pipeline and its own storages.

For the 2019 determination, IPART applied a reduction in the amount of water Essential Water sourced from the River Murray and transport via the Pipeline, by the median value of available bulk water from Essential Water's own water sources (1 910 ML per annum).[13] Water NSW contend, in reality, bulk water transport volumes have been approximately 30 per cent above the 2019 determination allowances, with the discrepancy wholly attributed to the 1 910 ML per annum adjustment. [14]

Water NSW propose that no adjustments be made by IPART for Essential Water's metered bulk water transport volume forecasts, given Water NSW's assertion that:[15]

- very little (if any) water is currently sourced from Essential Water's own infrastructure (i.e. Stephens Creek Reservoir), and
- little (if any) is forecast to be sourced by Essential Water for the 2022 Determination period.

Essential Water confirmed they will source 100 per cent of their forecast bulk water demand from the River Murray and transported via the Pipeline for the 2022 determination, stating:[16]

- use of the River Murray and transported via the Pipeline is the default bulk water setting, unless there is a requirement for use of Stephens Creek as the emergency reservoir, with a significant capital investment required if Stephens Creek is to become a secondary water source for Broken Hill rather than an emergency supply.

---

13 Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 67, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF

14 Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 67, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF

15 Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 67, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF

16 Essential Water responses to information request, RFI 3, 1 October 2021 and 12 October 2021.

  - We understand Essential Water has requested $500 000 in operational expenditure funding to complete a business case, as part of the IWCM and Water Storages Strategy, to determine:
    - the long term functional requirements of Stephens Creek and Umberumberka Reservoirs (water supply and or alternative uses)
    - supply reliability, and
    - emergency/backup local storage requirements.
- Compared to sourcing bulk water from the River Murray and transporting via the Pipeline, Stephens Creek Reservoir's:
  - chemical dosage is higher due to the poorer water quality, and
  - water pumping electricity consumption is greater, noting a 500KW Solar Bank is located on the Broken Hill Bulk Supply Pump Station.
- Stephens Creek Reservoir is effectively dry 60 per cent of the time
- Essential Water is obligated to transport (and pay for) 8ML per day from the Pipeline, as per the Raw Water supply agreement (box 1.3).
  - However, we note, the Raw Water supply agreement conditions, including the minimum 8ML Essential Water daily transport volume requirement, can be renegotiated if circumstances require.
- Changing water sources creates additional tasks for the Water Treatment Operators, with additional testing and dosing process required to ensure the plant is reconfigured to treat the different water source.

1.3 Water NSW Pipeline and Essential Water Raw Water Supply Agreement

We understand Water NSW and Essential Water have entered into a Raw Water Supply Agreement specifying the following minimum and maximum bulk water supply from the River Murray and transported via the Pipeline to Essential Water:[17]

- **Minimum take** 8 ML in any 24 hour period
- **Peak Day Demand** 37.4 ML
- **Peak Week Demand** 226.4 ML
- **Peak Month Demand** 927.4 ML
- **Peak Annual Demand** 7 586.6 ML
- **Peak Season Demand** 3 708 ML
- **Maximum Demand**:
  - the Peak Day Demand in any 24 hour period
  - the Peak Week Demand in any 7 day period
  - the Peak Month Demand in any month
  - the Peak Season Demand between 1 December and
  - 31 March in any year, and

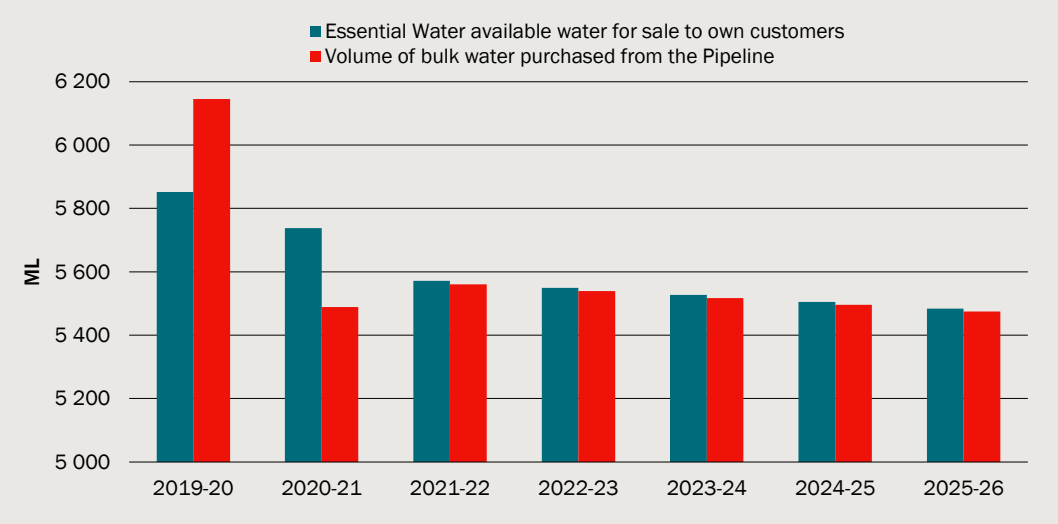
17 Water NSW 2018, 'Raw Water Supply Agreement Schedule 1 – Details', November.

– the Peak Annual Demand in any year.

The above supply agreement specifics are anticipated to be in force for a period of 100 years after the Operations Date.

Chart 1.4 shows Essential Water sourced over 96 per cent of its annual bulk water supply from the River Murray and transported via the Pipeline over the current determination period, 105 per cent in 2019-20[18] and 96 per cent in 2020-21, with 99.8 per cent forecast to be sourced from the Pipeline over the 2022 determination period.

1.4 Essential Water bulk water Pipeline source volumes



Note: Some purchased bulk water usage was used to replenish Stephens Creek reservoir in 2019-20

Data source: Essential Water AIR_SIR_FY21 actuals update_14Oct2021.

Further, stakeholders have noted an improvement to bulk water quality associated with changing the water source to the River Murray and transported via the Pipeline.[19]

We consider it reasonable that Essential Water will source most of its bulk water from the River Murray and transported via the Pipeline over the 2022 determination, given the:

- historical preference for Essential Water to source its bulk water needs from the River Murray and transport via the Pipeline, after it commenced operations in 2019-20, and
- the improved bulk water quality supplied to Broken Hill since the Pipeline commenced operations, compared to Stephen's Creek Reservoir.[20]

18 Some purchased bulk water usage was used to replenish Stephens Creek reservoir in this year.

19 Broken Hill City Council 2021, 'Broken Hill City Council's Submission to Essential Water's water and sewerage services in Broken Hill from 1 July 2022', p. 6, October, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Online-Submission-Broken-Hill-City-Council-D.-Turley-AM-22-Oct-2021-092624891.PDF

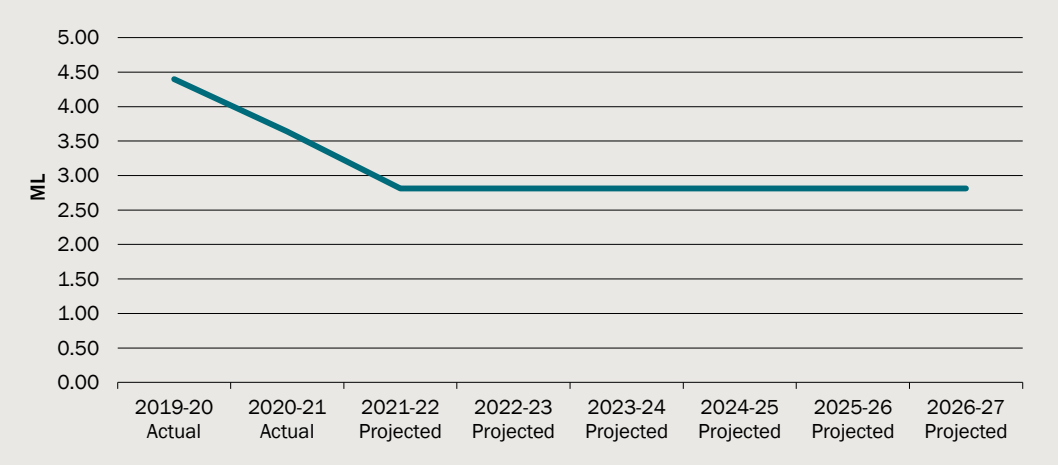
20 Essential Water 2021, 'Essential Water Pricing Proposal: Submission', p. 66, June; Essential Water responses to information request, RFI 3, 1 October 2021 and 12 October 2021; Broken

Other pipeline customer connections

Water NSW forecast non-Essential Water offtake customer annual bulk water transport volumes to remain steady at 2.81 ML, 23 per cent below 2020-21 actual bulk water transport volumes of 3.64 ML (chart 1.5).

Water NSW state Netley Cattle Yards and Netley Station are not taking any water and have not entered into a Water Agreement. All the other Offtakes are taking water.[21] No further details are provided for the reasons why outlook year forecasts are below actuals.

1.5 Water NSW actual and forecast offtake customer annual demand



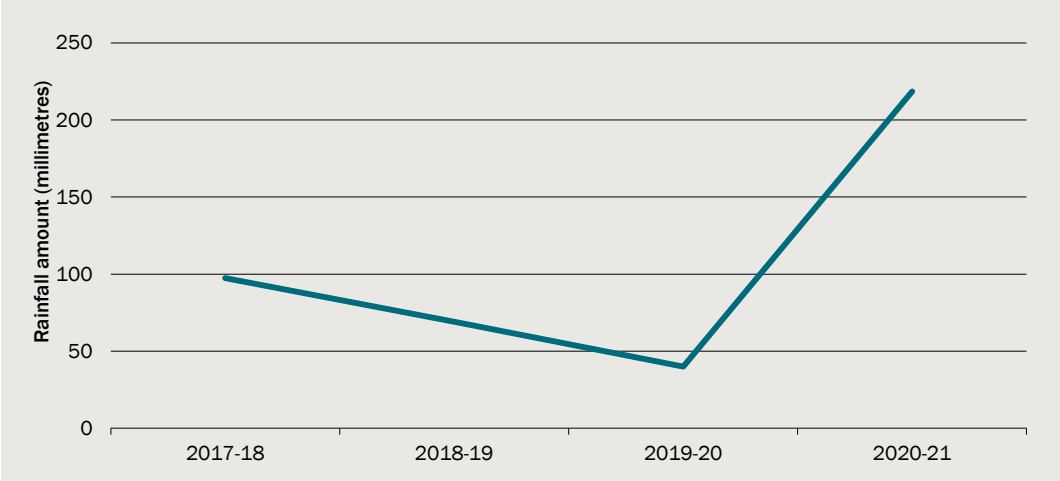
Data source: Water NSW 2021, 'Attachment 4 – WaterNSW (Pipeline) AIR/SIR 2021.

Historical rainfall data (chart 1.6) measured near the offtake customer locations, shows 2020-21 was a higher rainfall year, compared to 2019-20, indicating a negative correlation between offtake water demand and rainfall.

Hill City Council 2021, 'Broken Hill City Council's Submission to Essential Water's water and sewerage services in Broken Hill from 1 July 2022', p. 6, October, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Online-Submission-Broken-Hill-City-Council-D.-Turley-AM-22-Oct-2021-092624891.PDF

21 Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', pp. 65-66, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF

1.6 Historical rainfall at Water NSW Pipeline sites



Data source: Bureau of Meteorology 2021, 'Climate Data Online 'Daily rainfall, Broken Hill (Langwell)', weather station 47056, http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=136&p_display_type=dailyDataFile&p_startYear=&p_c=&p_stn_num=47056

Water NSW's forecast reduction in other offtake bulk water transport volumes appears to correlate with recent climate conditions, assuming increased rainfall carries over into the 2022 determination period. However, Water NSW has not substantiated the reduction in other customer forecast pipeline bulk water transport volumes for the 2022 determination period. We conclude the 2019-20 actual other offtake bulk water transport volume (the latest full year data currently available) of 3.64 ML per annum is used as the forecast for the 2022 determination period.

Evaporation losses

Water NSW forecast water losses to be constant at 435 ML per annum over the next regulatory period.[22] In response to an information request, Water NSW state:

> "The volume of water losses used was advised by the O&M contractor as the design evaporation rate, calculated using 1995 to 2018 BOM data and the Bulk Water Storage cell areas. This is the volume of evaporation expected when actual climate conditions are in line with historical averages."[23]

We understand the annual evaporation rate was calculated as:

- the Bureau of Meteorology monthly mean daily evaporation for Stephens Creek Reservoir weather station[24], multiplied by
- 167 494m^2, the total surface area of both bulk water storage cells (cell 1 is 72 756m^2, cell 2 is 94 738m^2), and
- summed across all months.

Water NSW's evaporation loss calculation is shown in table 1.7.

22 Water NSW 2021, 'Attachment 4 – Water NSW (Pipeline) AIR/SIR 2021'

23 Water NSW response to information request, RFI 6, 7 October 2021.

24 The closest data set available from the Bureau of Meteorology at the time of design.

1.7 Water NSW's evaporation loss calculation

	Days	Mean Daily Evaporation	kL[a]	ML/day	ML/month
		mm			
January	31	12.7	2,127	2.1	65.9
February	28	11.2	1,876	1.9	52.5
March	31	8.8	1,474	1.5	45.7
April	30	5.8	971	1.0	29.1
May	31	3.4	569	0.6	17.7
June	30	2.4	402	0.4	12.1
July	31	2.6	435	0.4	13.5
August	31	3.8	636	0.6	19.7
September	30	5.7	955	1.0	28.6
October	31	8	1,340	1.3	41.5
November	30	9.7	1,625	1.6	48.7
December	31	11.6	1,943	1.9	60.2
Annual		**7.1**[b]			**435.4**[c]

[a] Mean daily monthly evaporation multiplied by 167 494 and divided by 1 000. For example, January is 12.7 multiplied by 167 494/1000.

[b] Average of all months.

[c] Sum of all months

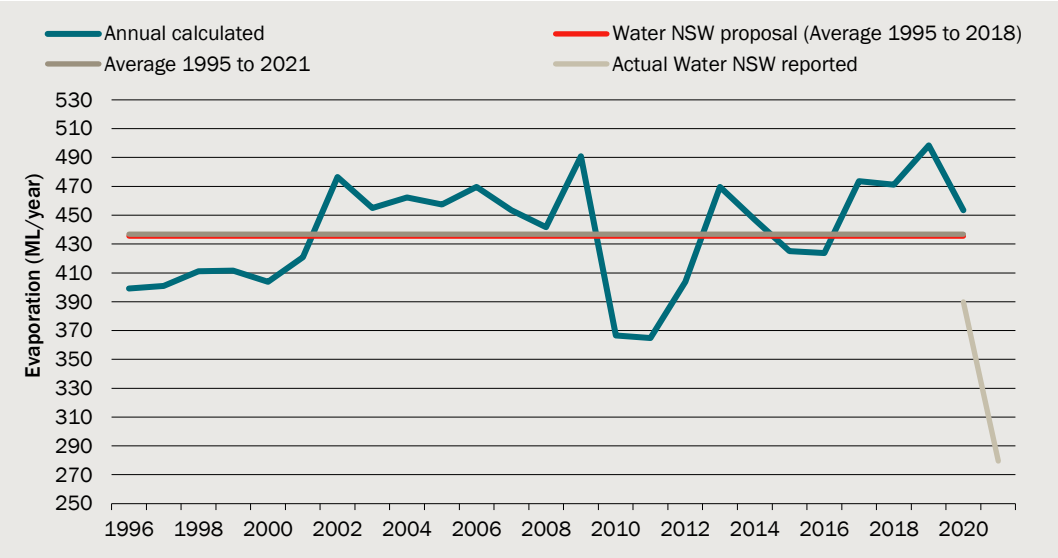
Note: Mean daily evaporation data for the period 1995 to 2018. Updating to include data for 1995 to 2021 increases estimated annual evaporation to 436.9 ML.

Source: Water NSW response to information request evaporation losses (RFI 6), 21 October 2021.

Chart 1.8 compares Water NSW's proposed annual evaporation to:

- the calculated evaporation for each year over the period 1996 to 2020, shown as the teal line (i.e., not an average), and
- actual Water NSW reported evaporation in their latest Annual Information Return (light grey line).

1.8 Water NSW's proposed evaporation losses compared to annual calculated evaporation and reported actuals



Note: Actual Water NSW reported are financial years. 2020-21 is year to date April.

Data source: Bureau of Meteorology 2021, 'Climate statistics for Australian locations, Monthly Climate Statistics for BROKEN HILL (STEPHENS CREEK RESERVOIR) [047031], http://www.bom.gov.au/jsp/ncc/cdio/cvg/av; CIE.

Water NSW's proposed Pipeline evaporation of 435.4 ML per year is greater than the 2019-20 financial year reported actual annual evaporation of 389.8 ML (the latest full year actual data available). Given the material difference between annual calculated and actual evaporation, we recommend Water NSW further substantiate the use of Stephens Creek Reservoir Weather Station evaporation data as the basis for the 2022 determination forecasts. For example, we understand Essential Water use SILO latitude and longitude data to estimate site specific annual evaporation for its bulk water assets.[25]

We conclude:

- the 2019-20 actual evaporation value of 389.8ML per annum is used as the forecast for the 2022 determination period, and
- at the next Pipeline review, the actual annual reported evaporation volumes are assessed against that calculated using the Stephens Creek weather station average monthly evaporation data, to determine if it truly represents the Pipeline's forecast evaporation.

25 Queensland Government 2021, 'SILO climate database - evaporation – synthetic', https://www.longpaddock.qld.gov.au/silo/

2 Energy review

Efficient energy volume

Water NSW assume a fixed energy use of 6.39MWh per day and a pumping efficiency (variable energy use) of 1.64MWh per ML pumped, quoted as being sourced from the 2019 Determination.[26] Water NSW contend:

- The fixed and variable energy Pipeline demand was derived from a bottom-up equipment load list provided by the Pipeline contract operator and maintenance provider, which was reviewed by Synergies in the 2018 Broken Hill Pipeline Price Review. Synergies recommended scope adjustments to the pipeline's fixed load on the opinion that some loads are likely to operate almost constantly (e.g. ventilation fans and air conditioning) whereas other loads are likely to operate intermittently (e.g. cranes and compressors).
- An analysis of alternative values and comparison to other relevant water utilities is of limited value as:
  - the matter was comprehensively reviewed in the last price review
  - the fixed loads are highly dependent on the equipment utilised on site, the unique operating environment of Broken Hill and the characteristics and design of the pipeline, and
  - pump stations, which was subject to a competitive tender process, deemed prudent and efficient by Synergies and IPART in 2018, and in which other proponents submitted proposals on the design, construction and operation of the pipeline, which was assessed holistically against the other submissions and tender criteria.

We understand:

- Synergies concluded the fixed and variable energy consumption parameters shown in table 2.1, which where accepted by IPART for the 2019 Final Determination, with the exception of a downward adjustment of 0.0934 to the variable energy pumping profile to remove the evaporative losses contingency, with evaporation losses instead included in the 2019 Determination water demand scenarios
- Table 2.1 values were derived following Synergies review of:
  - Trility calculator's summary outputs submitted by Water NSW, and
  - IPART's subsequent energy calculator methodology and assumptions.

---

26 Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 37, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF

2.1 Benchmark fixed and variable electricity parameters

	Variable	Fixed
	MWh/ML	MWh per day
Synergies 2019 review	1.73	6.39
IPART 2019 determination Final Decision	1.64	6.39
Water NSW 2022 determination proposal	1.64	6.39

Source: Synergies Economic Consulting 2019, 'Expenditure review of Water NSW's Wentworth to Broken Hill Pipeline: Final; Report', Table 30 Recommended efficient energy volume, p. 119, January; IPART 2019, 'Murray River to Broken Hill Pipeline Water NSW: Final Report', p. 29, https://www.ipart.nsw.gov.au/sites/default/files/documents/final-report-murray-river-to-broken-hill-pipeline-waternsw-may-2019_0.pdf

We acknowledge Water NSW's efficient energy parameter volumes were assessed by IPART and its engineering consultants as part of the 2019 Determination. However, we note Synergies conclusion that: [27]

> "… the energy demands estimated for the Pipeline are modelled outputs, and there is likely to be a large number of variables that are subject to some degree of uncertainty, whose true value/performance will not be known until the Pipeline has been in operation for a period of time."

We, therefore, consider it prudent to assess Water NSW's assumed forecast fixed and variable energy profiles against actual data. Comparing the Pipeline's actual monthly electricity and water pumped use to that implied by the assumed 6.39 MWh/day fixed and 1.64MWh/ML variable energy parameters indicates 2019-20 implied electricity use was 28 per cent above actual electricity use (table 2.2).

2.2 2019-20 actual monthly Pipeline electricity use compared to implied electricity use assuming 6.39 MWh/day fixed and 1.64MWh/ML variable energy parameters

Month	Total actual electricity use	Water pumped	Days in month	Implied fixed electricity use	Implied variable electricity use	Total implied electricity use	Difference implied vs. actual	Difference implied vs. actual
	MWh	ML		MWh	MWh	MWh	MWh	Per cent
July	558.9	354.0	31	198.1	580.6	778.7	219.8	39
August	685.7	443.0	31	198.1	726.5	924.6	239.0	35
September	660.5	431.0	30	191.7	706.8	898.5	238.0	36
October	785.3	507.0	31	198.1	831.5	1 029.6	244.3	31
November	949.7	608.0	30	191.7	997.1	1 188.8	239.1	25
December	1 040.7	665.0	31	198.1	1 090.6	1 288.7	248.0	24
January	1 089.4	686.0	31	198.1	1 125.0	1 323.1	233.7	21
February	1 010.8	636.0	28	178.9	1 043.0	1 222.0	211.2	21
March	1 064.0	677.0	31	198.1	1 110.3	1 308.4	244.3	23

27 Synergies Economic Consulting 2019, 'Expenditure review of Water NSW's Wentworth to Broken Hill Pipeline: Final; Report', Table 30 Recommended efficient energy volume, p. 116

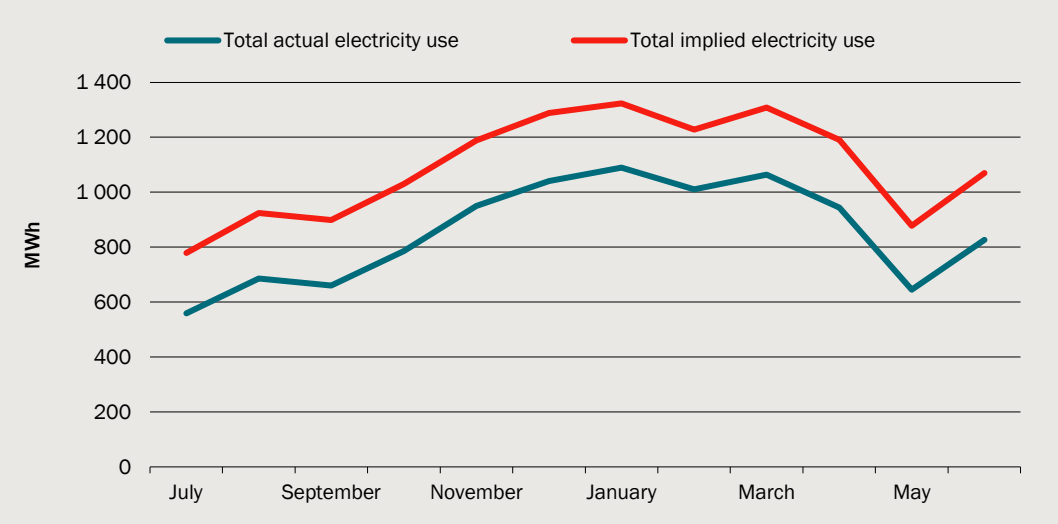
Month	Total actual electricity use	Water pumped	Days in month	Implied fixed electricity use	Implied variable electricity use	Total implied electricity use	Difference implied vs. actual	Difference implied vs. actual
	MWh	ML		MWh	MWh	MWh	MWh	Per cent
April	944.2	609.0	30	191.7	998.8	1 190.5	246.3	26
May	644.9	414.0	31	198.1	679.0	877.1	232.1	36
June	826.9	535.0	30	191.7	877.4	1 069.1	242.2	29
Total	**10 260.8**	**6 565.0**	**365**	**2 332.4**	**10 766.6**	**13 099.0**	**2 838.1**	**28**

Note: The implied fixed electricity use calculated assuming 6.39 MWh/day and the implied variable electricity use calculated assuming 1.64MWh/ML.

Source: Water NSW 2021, 'Attachment 4 – Water NSW (Pipeline) AIR/SIR 2021'; CIE.

Chart 2.3 graphically shows the monthly difference between actual and implied 2019-20 electricity use. Of interest, is the relatively constant difference across all months (distance between the red and teal lines).

2.3 2019-20 actual monthly Pipeline electricity use compared to implied electricity use

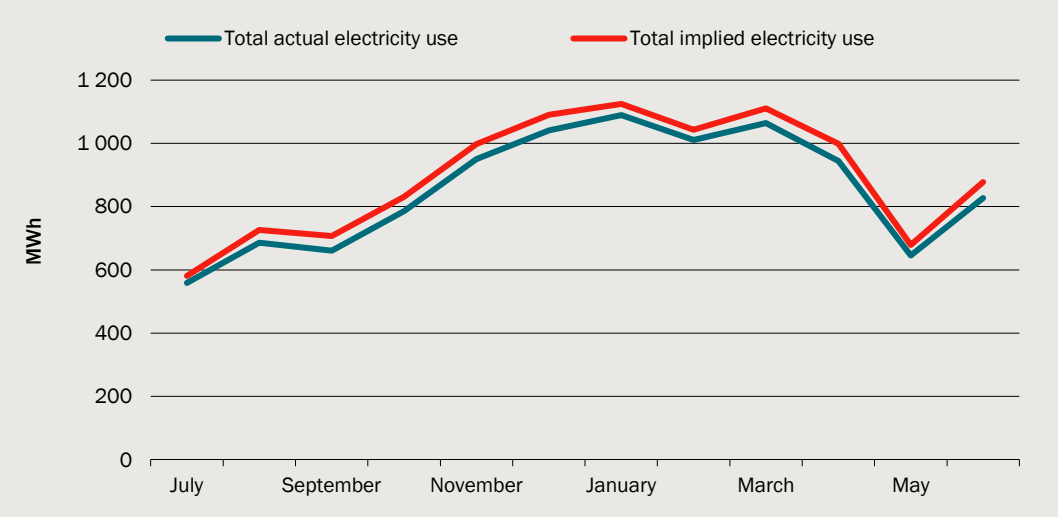


Note: The implied fixed electricity use calculated assuming 6.39 MWh/day and the implied variable electricity use calculated assuming 1.64MWh/ML.

Data source: Water NSW 2021, 'Attachment 4 – Water NSW (Pipeline) AIR/SIR 2021'; CIE.

Water NSW advise the electricity use data submitted in the Water NSW's Pipeline Annual Information Return cannot be broken down to fixed and variable energy use and total electricity use is therefore included only in the variable section. Of interest, when the implied fixed energy parameter is reduced to 0, the difference between the 2019-20 implied and actual electricity use reduces to 5 per cent, graphically shown in chart 2.4.

2.4 2019-20 actual monthly Pipeline electricity use compared to implied electricity use (no fixed energy use parameter)



Data source: Note: The implied fixed electricity use calculated assuming 0 MWh/day and the implied variable electricity use calculated assuming 1.64MWh/ML.

Data source: Water NSW 2021, 'Attachment 4 – Water NSW (Pipeline) AIR/SIR 2021'; CIE.

Comparing all available monthly water pumped and electricity use data (April 2019 to April 2021 inclusive) results in a similar outcome of estimated energy use being greater than actual energy use, by approximately 29 percent (table 2.5 and chart 2.6).

2.5 Actual monthly pipeline electricity use compared to implied electricity use assuming 6.39 MWh/day fixed and 1.64MWh/ML variable energy parameters (April 2019 to April 2021)

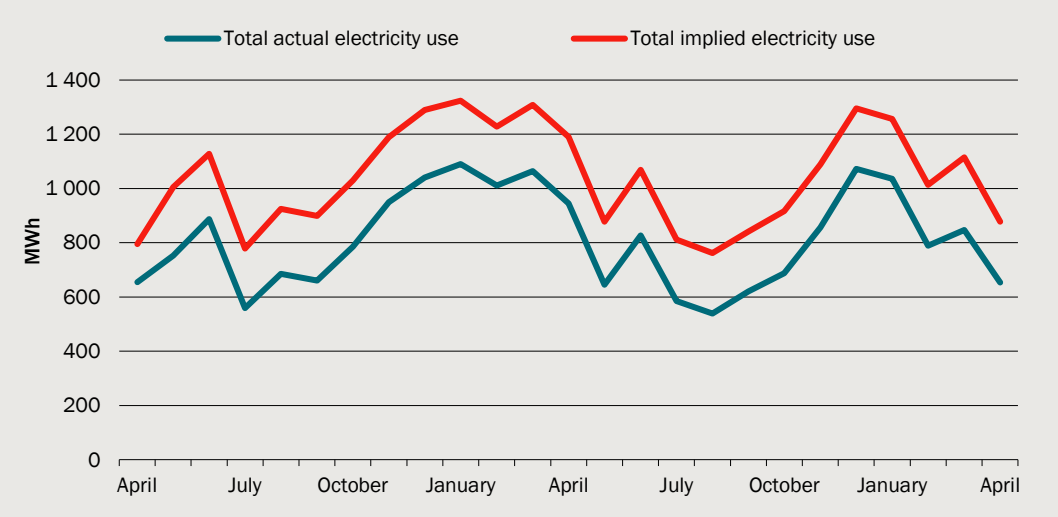
Month	Total actual electricity use	Water pumped	Days in month	Implied fixed electricity use	Implied variable electricity use	Total implied electricity use	Difference implied vs. actual	Difference implied vs. actual
	MWh	ML		MWh	MWh	MWh	MWh	Per cent
Total[a]	**20 236.8**	**12 895**	**761**	**4 862.8**	**21 147.8**	**26 010.6**	**5 773.8**	**29**

[a] *For the period April 2019 to April 2021 inclusive.*

Note: The implied fixed electricity use calculated assuming 6.39 MWh/day and the implied variable electricity use calculated assuming 1.64MWh/ML.

Source: Water NSW 2021, 'Attachment 4 – Water NSW (Pipeline) AIR/SIR 2021'; CIE.

2.6 Actual monthly Pipeline electricity use compared to implied electricity use (April 2019 to April 2021)

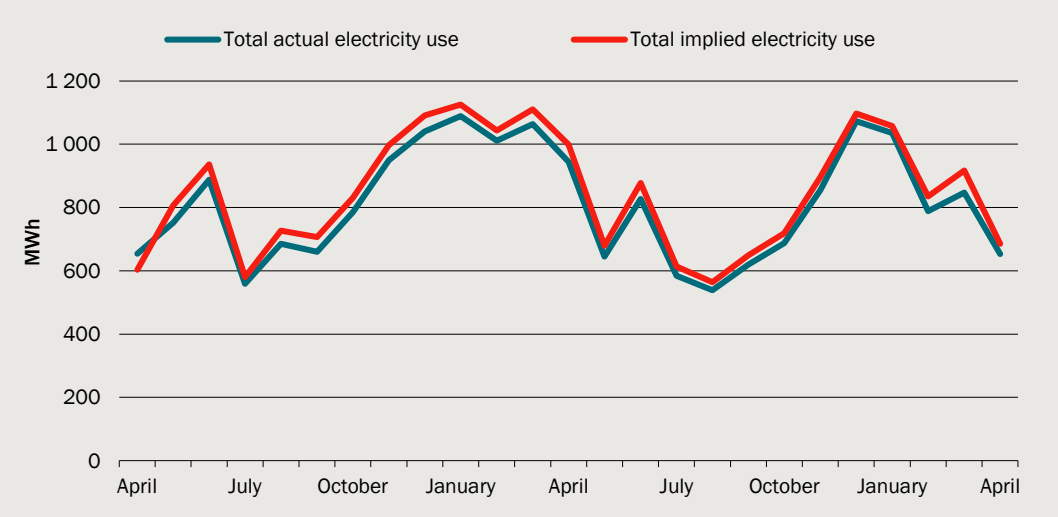


Note: The implied fixed electricity use calculated assuming 6.39 MWh/day and the implied variable electricity use calculated assuming 1.64MWh/ML.

Data source: Water NSW 2021, 'Attachment 4 – Water NSW (Pipeline) AIR/SIR 2021'; CIE.

Again, the difference between the implied and actual electricity use reduces to 5 per cent when the fixed energy parameter is reduced to 0, graphically shown in chart 2.7.

2.7 April 2019 to April 2021 actual monthly Pipeline electricity use compared to implied electricity use (no fixed energy use parameter)



Note: The implied fixed electricity use calculated assuming 6.39 MWh/day and the implied variable electricity use calculated assuming 1.64MWh/ML.

Data source: Water NSW 2021, 'Attachment 4 – Water NSW (Pipeline) AIR/SIR 2021'; CIE.

Variable energy parameter

A linear regression analysis of the form

$Monthly\ electricity\ consumption = \beta 0 + \beta 1\ ML\ pumped$ (table 2.8), indicates the assumed 1.64 MWh/ML variable parameter is within the 95 per cent confidence interval and aligns closely with actual variable electricity consumption MWh/ML (chart 2.9).

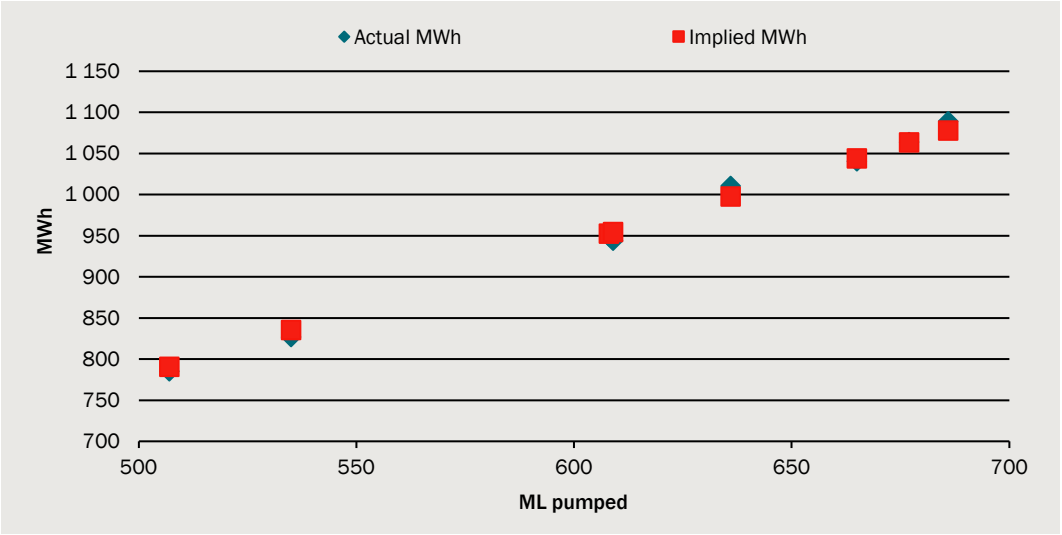
2.8 Regression analysis output for monthly electricity consumption and ML pumped

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-22.843	13.104	-1.743	0.112	-52.042	6.355
ML pumped	1.605	0.023	68.348	0.000	1.552	1.657

Notes: Adjusted R Square is 0.99765. Coefficients estimated using monthly electricity data.

Sources: Water NSW 2021, 'Attachment 4 – Water NSW (Pipeline) AIR/SIR 2021'; CIE.

2.9 2019-20 monthly electricity consumption MWh and ML pumped line fit plot



Data source: Water NSW 2021, 'Attachment 4 – Water NSW (Pipeline) AIR/SIR 2021'; CIE.

However, a follow up regression excluding the intercept term, $Monthly\ electricity\ consumption - 6.39 MWh\ per\ day = \beta 1 ML\ pumped$ indicates the variable electricity parameter is between 1.169 and 1.278 (table 2.10).

2.10 Regression analysis output for monthly electricity consumption and ML pumped — no intercept

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0	N/A	N/A	N/A	N/A	N/A
ML pumped	1.224	0.025	49.874	0.000	1.170	1.278

Notes: Adjusted R Square is 0.99765. Coefficients estimated using monthly electricity data.

Sources: Water NSW 2021, 'Attachment 4 – Water NSW (Pipeline) AIR/SIR 2021'; CIE.

Regression analysis using all available data (April 2019 to April 2021), produces a variable parameter range of:

- 1.489 to 1.641, with an intercept (table 2.11), and
- 1.173 to 1.245, without an intercept (table 2.12).

2.11 Regression analysis output for monthly electricity consumption and ML pumped

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	2.401	19.430	0.124	0.903	-37.792	42.594
ML pumped	1.565	0.037	42.484	0.000	1.489	1.641

Notes: For the period April 2019 to April 2021 inclusive. Adjusted R Square is 0.987. Coefficients estimated using monthly electricity data.

Sources: Water NSW 2021, 'Attachment 4 – Water NSW (Pipeline) AIR/SIR 2021'; CIE.

2.12 Regression analysis output for all available monthly electricity consumption and ML pumped – no intercept

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.000	#N/A	#N/A	#N/A	#N/A	#N/A
ML pumped	1.209	0.018	69.034	0.000	1.173	1.245

Notes: For the period April 2019 to April 2021 inclusive. Adjusted R Square is 0.953. Coefficients estimated using monthly electricity data.

Sources: Water NSW 2021, 'Attachment 4 – Water NSW (Pipeline) AIR/SIR 2021'; CIE.

We, therefore, consider the assumed 1.64 MWh/ML as an upper bound estimate, with a possible lower bound estimate of 1.17 MWh/ML, based on actual monthly electricity use.

Fixed energy parameter

The assumed 6.39MWh/day fixed energy parameter used by IPART to set prices in 2019 is at the most upper limit of the estimated 95% confidence interval represented by the intercept in table 2.8, however noting the fixed energy parameter is not statistically significant at 10% level. This suggests the assumed fixed energy parameter used to set prices in 2019 could have been set at the high end of the range. When comparing the actual energy use and the implied energy use based on assumed parameters used to set prices, we observed a material difference which supports our statistical finding. If the assumed fixed energy parameter is materially reduced, the implied energy use gets closer to actual energy use.

A memo provided by Water NSW from the Pipeline operator states the fixed Pipeline electricity demand under the Operations & Maintenance Contract is for the following at the River Murray, Wentworth and Silver City pumping stations:[28]

28 Memo: Information for IPART regarding the development of the Electricity Payment under the Operations & Maintenance Contract for the Murray to Broken Hill Pipeline, To Norman

- lights
- control systems
- security systems
- uninterruptible power supply (UPS) systems
- sampling equipment
- air conditioning, and
- aeration and mixing at the Bulk Water supply Storage.

Table B.1 shows the assumed maximum fixed electricity consumption for the three pumping stations, as well as the Bulk Water Storage, submitted by Water NSW for the 2019 Pipeline review.

We understand, table B.1 figures are based on a design concept and have not been verified by Water NSW, or the Pipeline operator, post operation commencement. We conclude Water NSW should undertake further assessment and provide substantiating evidence that the assumed 6.39 MWh/day reflects actual fixed energy use. This should include an engineering assessment of the fixed energy consumption at the three pumping stations, and bulk water storage, which in turn are influenced by a range of operational engineering considerations. For example:

- planned maintenance and or planned/unplanned outages
- operational factors such as flow rates, current BWS volumes, forecast and current power usage and periods, and
- algal conditions in the River Murray and water quality conditions in the Bulk Water Storage.

Fixed and variable energy parameter conclusion

Table 2.13 presents Water NSW's proposed forecast pipeline variable and fixed energy parameters used to calculate benchmark energy costs, and CIE's recommendation.

2.13 Forecast pipeline fixed and variable energy parameters

	Variable	Fixed
	MWh/ML	MWh/day
Water NSW's proposal	1.64	6.39
CIE's recommendation	1.64	6.39

Notes: MWh/ML (Megawatt hours per megalitre); MWh/day (Megawatt hours per day).

Source: Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 37, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF; CIE

Esber (WaterNSW) From Robran Cock (John Holland TRILITY Joint Venture), 29 November 2018, pp. 2-3

Water NSW's assumed variable and fixed energy parameters are modelled outcomes, derived following an engineering assessment during the 2019 Pipeline price review.[29] These modelled energy parameters are the most robust energy use estimates currently available for the Pipeline, as they consider the Pipeline's specific engineering inputs and configuration.

However, an evaluation of the Pipeline's actual monthly electricity use and water pumped data provided by Water NSW indicates the assumed energy parameters are greater than actual energy use. Regression analysis indicates the assumed 1.64 MWh/ML variable parameter is an upper bound value within the 95 per cent confidence interval, with a possible lower bound estimate of 1.17 MWh/ML. Further, if the assumed fixed energy parameter is materially reduced, the implied electricity use gets closer to actuals. Water NSW should undertake further assessment and provide substantiating evidence that the assumed 6.39 MWh/day reflects actual fixed energy use.

Given the fixed and variable energy parameters have a significant flow on impact to the pumping profile, and ultimately the benchmark forecast electricity costs, we recommend the variable and fixed energy parameters are subject to an engineering assessment at the next Pipeline review that incorporates several years of actual electricity meter read data and adjusted if necessary.

Pumping profile

Water NSW converted the annual water consumption forecasts into a daily profile using the 2019-20 historical pumping profile. The pumping profile is also used to apportion pumping to the peak, shoulder and off-peak periods which is required to calculate energy costs, as prices vary across the day. This is then converted to a half hourly profile by assuming that uniform pumping during each period of a specific day.[30]

Water NSW argue this approach of using actual data, as opposed to an estimated or simulated efficient profile, ensures the pumping profile incorporates the Pipeline's operational constraints.[31] Water NSW indicates that these constraints include, unplanned outages, avoiding blooms of blue-green algae and additional water pumping due to evaporation.

---

29 Synergies Economic Consulting 2019, 'Expenditure review of WaterNSW's Wentworth to Broken Hill Pipeline: Final; Report', Table 30 Recommended efficient energy volume, p. 119, January; IPART 2019, 'Murray River to Broken Hill Pipeline WaterNSW: Final Report', p. 29, https://www.ipart.nsw.gov.au/sites/default/files/documents/final-report-murray-river-to-broken-hill-pipeline-waternsw-may-2019_0.pdf

30 For example, during the off-peak period of a specific day, the volume pumped during each half hour block is assumed to be the same.

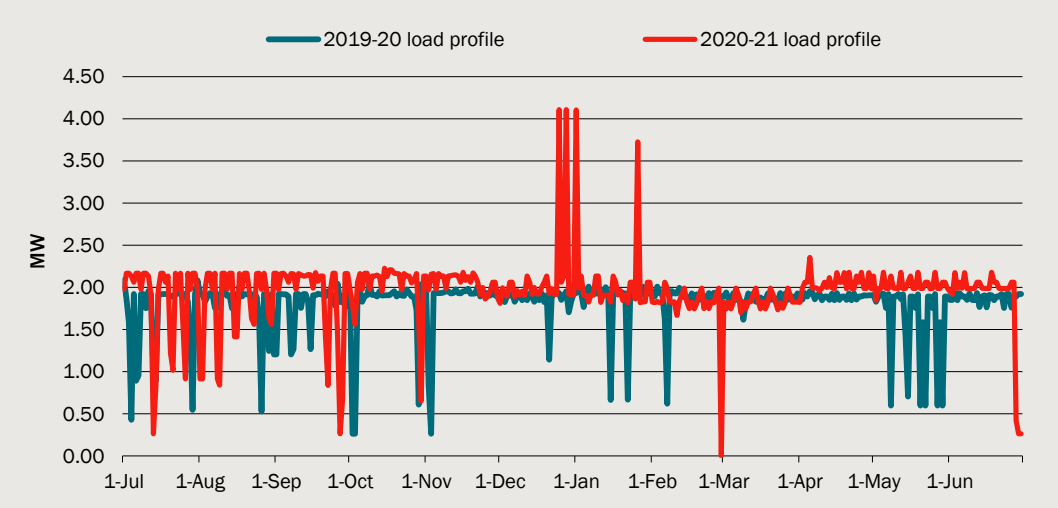
31 Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 37, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF

In response to information requests, Water NSW provided:

- the Excel spreadsheet used to estimate the annual pumping profiles[32], and
- daily Pipeline pumping energy profile data for the period 1 July 2019 to 30 September 2021[33].

Charts 2.14 to 2.16 show the 2019-20 and 2020-21 daily off-peak, Shoulder and Peak variable energy use respectively.[34] [35]

2.14 Variable off-peak daily energy use



Note: Data is adjusted for pigging. Off-peak period are 10pm to 7am on weekdays and all weekend.

Data source: Water NSW 2021, 'Pumping Profile Update', 15 October 2021.

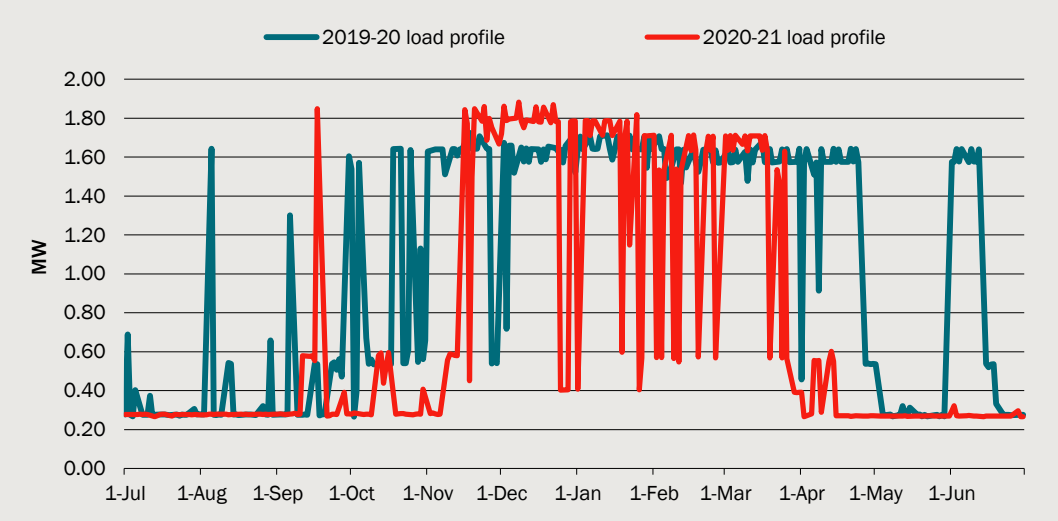
32 Water NSW 2021, 'RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE – STC

33 Water NSW 2021, 'Pumping Profile Update', 15 October 2021.

34 We note, the 2019-20 daily variable use data differs to that originally provided by Water NSW in response to an initial information request. We assume the latest electricity load profile data provided by Water NSW supersedes the that previously provided.

35 Provided by Water NSW in the Excel file, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE - STC

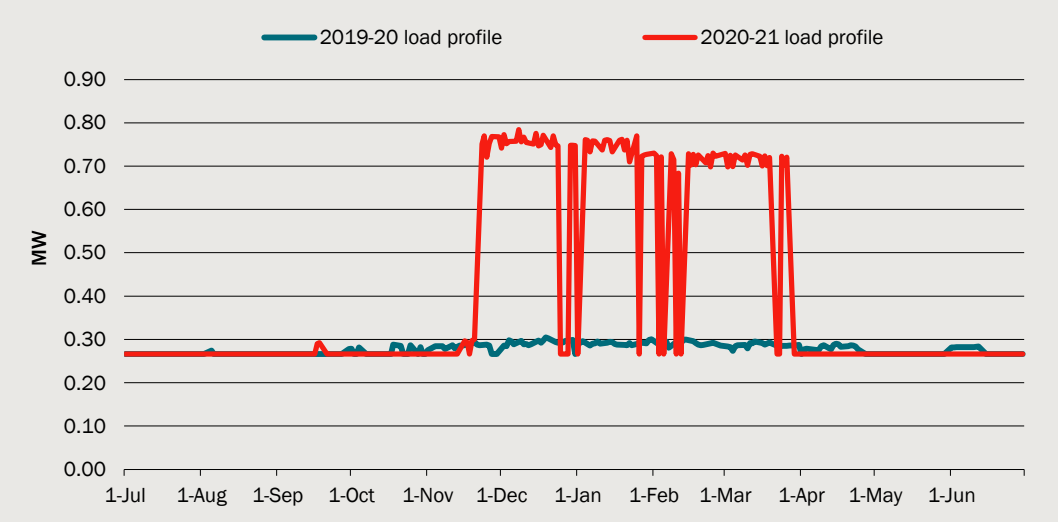
2.15 Variable shoulder daily energy use



Note: Data is adjusted for pigging. Shoulder periods are 7am to 5pm and 8pm to 10pm on weekdays.

Data source: Water NSW 2021, 'Pumping Profile Update', 15 October 2021.

2.16 Variable peak daily energy use



Note: Data is adjusted for pigging. Peak periods are 5pm to 8pm on weekdays.

Data source: Water NSW 2021, 'Pumping Profile Update', 15 October 2021.

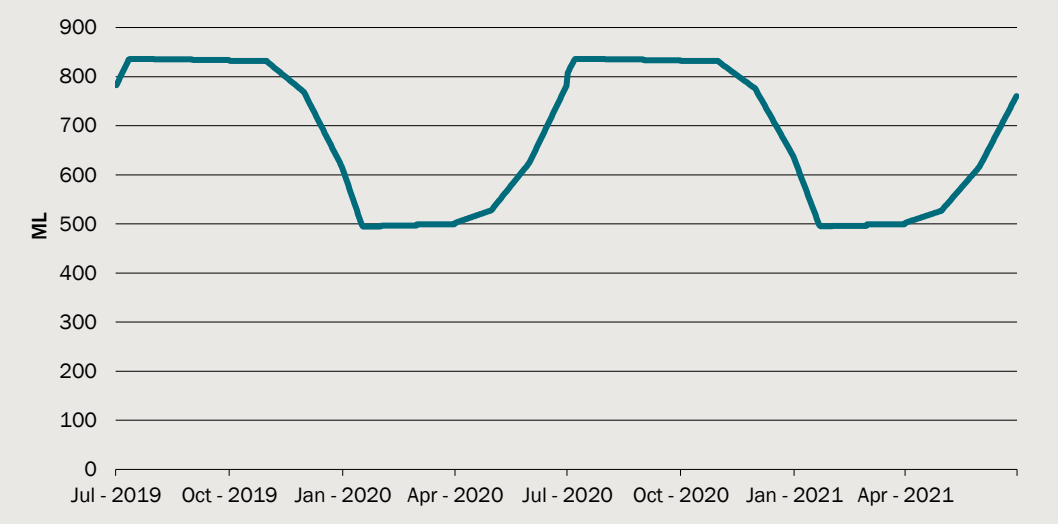
The charts show:

- Almost all pumping occurs during the off-peak and shoulder periods.
- Off-peak pumping is relatively constant across the year, while shoulder usage tends to mainly occur from November to April. This seasonal pattern appears to reflect water demand, which tends to be higher during summer compared to winter.
- Pumping profiles change somewhat from year to year:
  - 2019-20 appears to have a longer period of shoulder electricity use compared to 2020-21, and
  - 2020-21 has significantly higher peak electricity use.

In addition to considering historical pumping profiles, we have also considered a simulated pumping profile. This takes a pumping model which was developed by IPART for the 2019 Murray River to Broken Hill Pipeline determination. The model assumes that pumping is smoothed over the year, with the model seeking to pump constantly over the year to meet expected annual demand (including losses), subject to constraints (chart 2.17). The constraints in the model include the pipeline flow rate and minimum (the storage is assumed to never go below 60 per cent capacity) and maximum storage levels. Pumping is then first allocated to off-peak, then shoulder and finally peak period, based on the maximum amount of pumping which can occur during each of those periods per day. A model of pumping which meets demand and minimises electricity costs is assumed to be efficient in this model. The key assumptions of the model are summarised in appendix C.

The key driver pumping in the shoulder and peak periods are demand. Where demand is high more pumping will spill over into shoulder and peak periods, while lower demand allows proportionally more pumping to occur in the off-peak. The mapping profile is also slightly affected by starting volumes, as where capacity is reached, the pumping requirement is lower.

2.17 Bulk water storage volume



Note: Storage volumes are based on the IPART pumping model. Starting volumes is set at 777 ML which was the storage level at the end of 2018-19. The model assumes storage levels fluctuate between 60 and 100 per cent.

Data source: CIE.

We have compared the share of pumping occurring across peak, shoulder and off-peak periods implied by the IPART model, against the shares implied by 2019-20 actuals (table 2.18).

2.18 Pumping by period

	2019-20 actuals	2019-20, IPART model	2020-21, IPART model	2021-22, IPART model	2022-23, IPART model
	Per cent of total	Per cent of total	Per cent of total	Per cent of total	Per cent of total
Peak	0.09	0.94	0.08	0.14	0.38
Shoulder	24.50	18.23	12.49	13.81	15.08

	2019-20 actuals	2019-20, IPART model	2020-21, IPART model	2021-22, IPART model	2022-23, IPART model
	Per cent of total	Per cent of total	Per cent of total	Per cent of total	Per cent of total
Off-peak	75.41	80.83	87.43	86.05	84.55
Demand, ML	**6 149**	**6 149**	**5 624**	**5 599**	**5 796**

Note: 2019-20 based on actuals, 2021-21 based on partial data extrapolated to the entire year, while 2021-22 and 2022-23 data is based on CIE forecasts.

Source: CIE.

The share of pumping during the shoulder is higher for the IPART model in 2019-20, using actual demand data. This implies that the 2019-20 pumping profile was not efficient with too much pumping occurring in the shoulder period. In addition to the constraints noted by Water NSW, this may reflect a preference to maintain flatter storage profile across the year. The IPART model allows storage volumes to fall during summer (down to around 500ML or 60 per cent of total storage capacity), before being replenished during winter. A flatter storage profile across the year would be consistent with more pumping during shoulder, and potential peak periods.

In future years, as demand is expected to fall, the share of pumping during shoulder periods is expected to fall such that over the forecast period, we would expect around 85 per cent of pumping to occur in the off-peak, 15 per cent of pumping to occur in the shoulder and close to 0 per cent in the peak.

We consider using an efficient pumping profile to be preferred to using actual data as:

- The pumping profile depends on the level of demand. As demand is expected to fall over the determination period, we would expect the pumping profile to change – using actual data does not allow the profile to change with demand.
- 2019-20 actual data may not reflect efficient pumping. Against the cost minimisation profile estimated from the IPART model, pumping during the year was not efficient.
- The simulated pumping profile accounts for losses, pipeline downtime, and Water NSW advice that the storage levels generally do not go below 60 per cent (they are maintained at between 60 per cent and 80 per cent capacity[36]).

We recognise there may be some determinants of an efficient pumping profile which is not characterised in the IPART model, such as labour costs or operation risks. Also, daily data on actual storage levels was not available, which would help better understand how the pipeline is currently operated. We recommend that the model is further refined in consultations with Water NSW at the next Pipeline review.

We have applied the simulated shoulder and off-peak pumping share of total estimated for each of the forecast periods. Table 2.19 compares the estimated annual electricity consumption over the 2022 determination period under the 2019-20 and IPART model load profiles. For comparison purposes, we have used the following, as per the latest information provided by Water NSW and their price submission:

- bulk water transport volumes:
  - Essential Water's forecast bulk water transport volumes of:

36 Water NSW response to IPART Stylised Pumping Profile.

- 5 575 ML in 2022-23
- 5 553 ML in 2023-24
- 5 532 ML in 2024-25
- 5 510 ML in 2025-26, and
- 5 488 ML in 2026-27.

– losses at the bulk water supply facility of 435 ML per annum, and
– other offtake customer bulk water transport volumes of 3 ML per annum.

- fixed electricity load of 6.39 MWh per day, and
- variable electricity load of 1.64 MWh per ML.

2.19 Estimated total annual electricity consumption under different pumping profile scenarios

	2022-23	2023-24	2024-25	2025-26	2026-27
	MWh	MWh	MWh	MWh	MWh
2019-20 load profile					
Off-peak	8 737	8 710	8 684	8 657	8 630
Shoulder	3 239	3 230	3 222	3 213	3 204
Peak	218	218	218	218	218
Total	**12 194**	**12 158**	**12 124**	**12 088**	**12 052**
	Share of total	Share of total	Share of total	Share of total	Share of total
Off-peak	73%	73%	73%	73%	73%
Shoulder	27%	27%	27%	27%	27%
Peak	2%	2%	2%	2%	2%
	MWh	MWh	MWh	MWh	MWh
IPART model					
Off-peak	9 824	9 855	9 819	9 812	9 806
Shoulder	2 002	1 939	1 947	1 914	1 885
Peak	359	357	356	354	353
Total	**12 186**	**12 150**	**12 122**	**12 080**	**12 044**
	Share of total	Share of total	Share of total	Share of total	Share of total
Off-peak	81%	81%	81%	81%	81%
Shoulder	16%	16%	16%	16%	16%
Peak	3%	3%	3%	3%	3%

[a] Calculated using data provided by Water NSW in the Excel file, "Pumping and energy profile Jul 19 - 21.xlsx"

Note: Assumes electricity volumes of 6.39 MWh/day and 1.64MWh/ML and Essential Water's forecast volumes extracted of 5 575ML in 2022-23, 5 553 ML in 2023-24, 5 532 ML in 2024-25, 5 510 ML in 2025-26, and 5 488 ML in 2026-27; losses at the bulk supply facility of 435 ML per annum, and usage by Pipeline offtake customers of 3 ML per annum. Note the model provided by Water NSW, to estimate electricity incorrectly assumes 12 hours in the shoulder and 3 hours in the peak – this should instead be 10 hours in the shoulder and 5 hours in the peak. This results in the peak electricity consumption (primarily due to fixed consumption) being understated and shoulder electricity being overstated for the 2019-20 pumping profile.

Sources: Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE - STC"; Water NSW 2021, Email 'Pumping Profile Update', 15 October 2021; CIE.

Table 2.20 compares the estimated annual electricity consumption over the 2022 determination period under the 2019-20 and IPART model load profiles, with CIE's water demand recommendations:

- bulk water transport volumes:
  - Essential Water's forecast bulk water transport volumes of:
    - 5 792 ML in 2022-23
    - 5 769 ML in 2023-24
    - 5 746 ML in 2024-25
    - 5 723 ML in 2026-27, and
    - 5 700 ML in 2026-27.
  - losses at the bulk supply facility of 389.8 ML per annum, and
  - other offtake customer bulk water transport volumes of 3 ML per annum.

2.20 Estimated annual electricity consumption under different pumping profile scenarios and CIE forecast water demand

	2022-23	2023-24	2024-25	2025-26	2026-27
	MWh	MWh	MWh	MWh	MWh
2019-20 load profile					
Off-peak	8 951	8 923	8 894	8 866	8 837
Shoulder	3 308	3 299	3 289	3 280	3 271
Peak	218	218	218	218	218
Total	**12 477**	**12 440**	**12 401**	**12 364**	**12 326**
	Share of total	Share of total	Share of total	Share of total	Share of total
Off-peak	73%	73%	73%	73%	73%
Shoulder	27%	27%	27%	27%	27%
Peak	2%	2%	2%	2%	2%
	MWh	MWh	MWh	MWh	MWh
IPART model					
Off-peak	9 871	9 893	9 857	9 848	9 842
Shoulder	2 225	2 167	2 169	2 141	2 112
Peak	386	371	375	367	365
Total	**12 482**	**12 431**	**12 401**	**12 356**	**12 319**
	Share of total	Share of total	Share of total	Share of total	Share of total
Off-peak	79%	80%	79%	80%	80%
Shoulder	18%	17%	17%	17%	17%
Peak	3%	3%	3%	3%	3%

[a] Calculated using data provided by Water NSW in the Excel file, "Pumping and energy profile Jul 19 - 21.xlsx".

Note: Assumes electricity volumes of 6.39 MWh/day and 1.64MWh/ML and forecast Essential Water volumes extracted of 5 792 ML in 2022-23, 5 769 ML in 2023-24, 5 746 ML in 2024-25, 5 723 ML in 2025-26, 5 700 ML in 2026-27 and losses at the bulk supply facility of 389.8 ML per annum, and usage by Pipeline offtake customers of 3 ML per annum. Note the model provided by Water NSW, to estimate electricity incorrectly assumes 12 hours in the shoulder and 3 hours in the peak – this should instead be 10 hours in the shoulder and 5 hours in the peak. This results in the peak electricity consumption (primarily due to fixed consumption) being understated and shoulder electricity being overstated for the 2019-20 pumping profile.

Sources: Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE - STC"; Water NSW 2021, Email 'Pumping Profile Update', 15 October 2021; CIE.

We therefore recommend the pumping profile shown in table 2.21.

2.21 CIE recommended pumping profile

	2022-23	2023-24	2024-25	2025-26	2026-27
	MWh	MWh	MWh	MWh	MWh
Off-peak	9 871	9 893	9 857	9 848	9 842
Shoulder	2 225	2 167	2 169	2 141	2 112
Peak	386	371	375	367	365
Total	**12 482**	**12 431**	**12 401**	**12 356**	**12 319**
	Share of total	Share of total	Share of total	Share of total	Share of total
Off-peak	79%	80%	79%	80%	80%
Shoulder	18%	17%	17%	17%	17%
Peak	3%	3%	3%	3%	3%

Note: Assumes electricity volumes of 6.39 MWh/day and 1.64MWh/ML and forecast Essential Water volumes extracted of 5 792 ML in 2022-23, 5 769 ML in 2023-24, 5 746 ML in 2024-25, 5 723 ML in 2025-26, 5 700 ML in 2026-27 and losses at the bulk supply facility of 389.8 ML per annum, and usage by Pipeline offtake customers of 3 ML per annum.

Sources: Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE - STC"; Water NSW 2021, Email 'Pumping Profile Update', 15 October 2021; CIE.

Benchmark energy prices

Water NSW engaged Frontier Economics to provide forecast energy prices for the five-year determination period. A cost build-up approach was used, incorporating:[37]

- wholesale electricity costs for the assumed demand profile
- costs of complying with state and federal government policies
- costs associated with the New South Wales Energy Savings Scheme
- National Electricity Market fees, ancillary services charges and costs of meeting prudential requirements
- energy losses incurred during the transmission and distribution of electricity to customers
- network costs (including the Climate Change Fund Levy)
- retail margin, and
- retail operating cost.

Water NSW noted several potentially material assumptions in the placeholder forecasts, which they anticipate will change and require updating over time (table 2.22).

37 Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 130, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF

2.22 Energy data inputs and potential changes

Element	Water NSW submission placeholder assumption	Potential updated assumption	Volatility and/or materiality
Wholesale costs	▪ Future prices as at 31/05/2021 ▪ 19-20 load profile	▪ Updated futures prices ▪ 20-21 load profile	High
Network costs	▪ Essential energy 2021-22 pricing proposal	▪ Essential Energy 2022-23 pricing proposal	High
Renewable energy costs	▪ LGC prices as at 14/01/2021 ▪ RPP from CER ▪ Non-binding STP estimate from CER	▪ Updated LGC prices ▪ Updated RPP from CER ▪ Updated STP from CER	Medium
Losses	AEMO published DLF and TLF from 2020-21 estimates	Update to 2021-22 estimates	Medium
Market fees	From AEMO 2021-22 budget	Updated estimate from AEMO's 2022-23 budget	Medium
Ancillary services	Ancillary services data up to April 2021	Updated Ancillary services data	Medium
Retail operating cost	Escalated from 2018-19 IPART determination	Update escalation values for inflation	Low
Retail operating margin	From QCA and IPART determinations	Likely no update	Low

Source: Email from Water NSW (Stevan Munic) 15 October 2021.

To account for the potential changes, Water NSW propose a true-up mechanism where movements in the wholesale and network cost components of the benchmark electricity price are assessed at the end of the 2022 determination period, with true-up for movements in the wholesale and network components of the benchmark electricity price over the 2022 Determination period.[38]

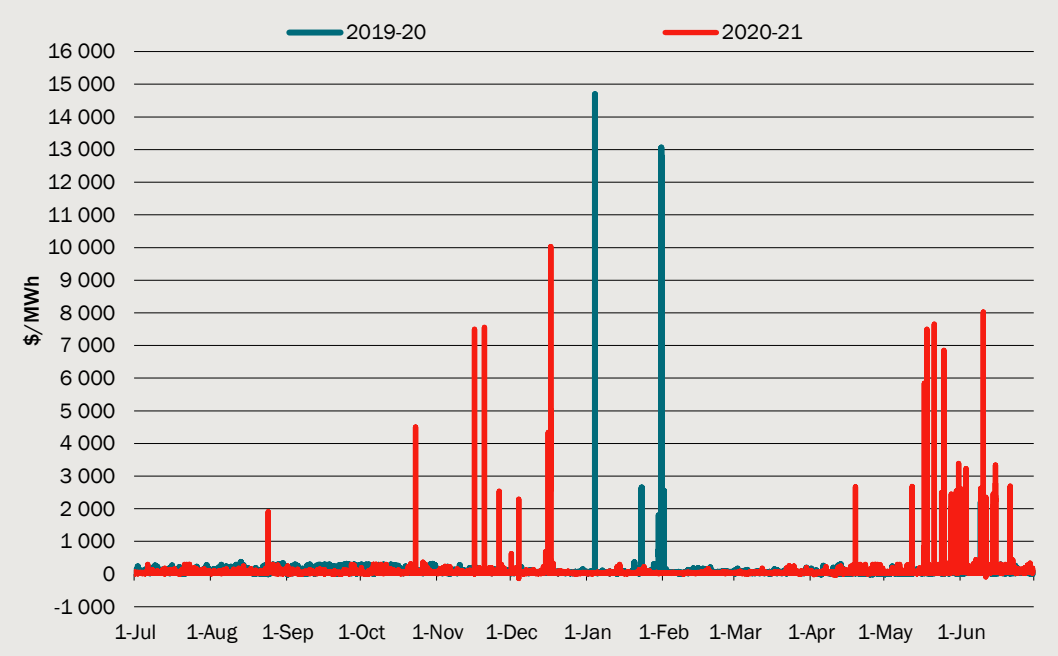
We assess each of these in the following sections.

Wholesale costs

Wholesale electricity purchase costs are highly volatile as the price balances electricity supply and demand in real time. Chart 2.23 shows the 30-minute wholesale electricity spot price for 2019-20 and 2020-21.

38 Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 130, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF

2.23 30-minute electricity purchase costs for 2019-20 and 2020-21



Data source: Australian Energy Market Operator 2021, 'Aggregated price and demand data', https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/data-nem/aggregated-data

Large electricity purchases use future wholesale contracts to manage the wholesale electricity market financial risk, by fixing the wholesale price paid for electricity over the course of the contract. This in turn reduces the buyer's exposure to the highs and lows of the spot market. Wholesale contract prices are broadly based on expectations of average future spot prices.[39]

We understand Frontier Economics has estimated future wholesale electricity purchase costs as follows:

- taken the NSW 30-minute historical spot price for 2019-20[40]
- matched the 30-minute historical price to the respective estimated 30-minute load profile, and
- forecast future 30-minute wholesale costs by scaling to wholesale futures contracts traded on the ASX.[41] [42]

---

39 Australian Energy Market Commission 2021, 'Spot and contract markets', https://www.aemc.gov.au/energy-system/electricity/electricity-market/spot-and-contract-markets

40 Australian Energy Market Operator 2021, 'Aggregated price and demand data', https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/data-nem/aggregated-data

41 ASX 2021, 'Electricity NSW', https://www.asxenergy.com.au/futures_au

42 Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 130, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF

- Wholesale contracts are currently available for the 2022-23 and 2023-24 financial years.
- Frontier Economics has assumed that future contract prices remain constant in real terms for the period to 2026-27.

This effectively applies a scaling factor to map prices from futures contracts to average prices for off-peak, shoulder and peak periods. The ratio of peak to off-peak, shoulder and peak prices to annual average prices varies considerable from year to year (table 2.24) due to the high volatility in wholesale prices (chart 2.23).

Using the 2019-20 profile is relatively conservative as off-peak and shoulder prices are relatively low compared to 2020-21. The volatility in wholesale prices, supports the use of a wholesale electricity price true up, for average wholesale prices paid across off-peak, shoulder and peak periods respectively.

2.24 Ratio of off-peak, shoulder and peak prices to average annual wholesale electricity price

	Off-peak Ratio to average price	Shoulder Ratio to average annual price	Peak Ratio to average annual price
	Per cent	Per cent	Per cent
2019-20	88.4	95.4	152.0
2020-21	71.9	94.4	217.4

Source: CIE.

Future wholesale energy contracts have increased by 17 and 9 per cent per cent for 2023-24 and 2024-25 respectively since Water NSW submitted its proposal (table 2.25).

2.25 Wholesale energy contract prices

	Water NSW submission		Current		Difference	
	2022-23	2023-24	2022-23	2023-24	2022-23	2023-24
	$/MWh	$/MWh	$/MWh	$/MWh	Per cent	Per cent
Contract price ($/MWh)	57.47	60.25	67.12	65.91	17	9
Equivalent spot price ($/MWh)	54.73	57.38	63.92	62.77	17	9

Note: Assumes annual 2.5 per cent inflation rate. Current ASX energy future contract prices retrieved 5 November 2021.

Sources: ASX 2021, 'Electricity NSW', https://www.asxenergy.com.au/futures_au, accessed 2 November 202; Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE - STC"; CIE.

However, it is unclear if the recent higher wholesale energy contract prices will continue, and therefore if current wholesale energy contract prices are the best forecast with which to calculate benchmark energy costs. The Australian Energy Market Commission anticipate NSW's wholesale electricity costs will:[43]

- fall in 2021-22

[43] Compared to 2020-21.

- increase in 2022-23, and
- finally fall again in 2023-24.

The Australian Energy Market Commission's forecast wholesale electricity price variations are due to: [44]

- 2022-23 price increase:
  - higher natural gas prices, and
  - reduction to electricity generation supply, with coal fired power stations coming offline in 2022-23
- 2023-24 price decrease, anticipated addition of new wind, solar and gas fired electricity generation capacity, expanding overall electricity generation supply.

Further, we note to account for wholesale energy contract variation, Water NSW propose an annual wholesale electricity cost true up as follows:

- the movement in annual wholesale electricity price above/below the "benchmark wholesale electricity price" set for the 2022 determination period is measured
- the movement in the wholesale electricity price is then applied to the energy use profile to calculate the true up amount for each year in the determination period, and
- the annual true up amounts are accounted for at the end of the determination period.

We therefore maintain Water NSW's submitted contract price values.

In summary, Frontier Economics' wholesale electricity forecast approach is reasonable, as it accounts for historical data and publicly available future forecast contract prices. The proposed forecast approach, combined with a true-up process also accounts for the variable nature of wholesale electricity prices. However, we update the estimated energy purchase costs for our recommended pumping profile and forecast bulk water transport volumes.

Table 2.26 shows:

- forecast unit wholesale electricity costs submitted by Water NSW's, which use:
  - Water NSW submitted contract prices in table 2.25, and
  - the 2019-20 actual load profile, and
  - Water NSW's proposed bulk water transport volumes.
- CIE's recommended forecast unit wholesale electricity costs, which use:
  - Water NSW's submitted contract prices in table 2.25
  - our recommended load profile, and
  - our recommended bulk water transport volumes.

44 Australian Energy Market Commission 2021, 'Residential Electricity Price Trends 2021: Final Report, pp. 4 & 10-11, November, https://www.aemc.gov.au/sites/default/files/2021-11/2021_residential_electricity_price_trends_report.pdf

2.26 Forecast wholesale electricity costs

	2022-23	2023-24	2024-25	2025-26	2026-27
	$/MWh	$/MWh	$/MWh	$/MWh	$/MWh
Water NSW submission	51.80	52.99	52.99	52.99	52.99
CIE recommended	51.17	52.33	52.33	52.33	52.33

Sources: ASX 2021, 'Electricity NSW', https://www.asxenergy.com.au/futures_au, accessed 2 November 202; Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE - STC"; CIE.

Network costs

We understand Frontier Economics estimated placeholder future network costs as follows:[45]

- take network tariffs from Essential Energy's pricing proposal 2020-21 (tariff BHND3AO):
  - The Pipeline is located within Essential Energy's distribution network
  - An assessment of electricity bills determined that the pumping stations are on the high voltage time of use monthly demand tariff (tariff code: BHND3AO)
- multiply by respective energy consumption and peak demand by peak/shoulder/off-peak taken from the load profile, and
- add daily fixed charge.

The Australian Energy Regulator (AER) have since approved Essential Energy's annual pricing proposal for the period 1 July 2021 to 30 June 2022.[46] The respective BHND3AO tariffs are shown in table 2.27.

2.27 Essential Energy network tariffs (Tariff BHND3AO)

Network access charge	Energy Peak	Energy shoulder	Energy off peak	Demand peak	Demand shoulder	Demand off peak
($/day)	($/MWh)	($/MWh)	($/MWh)	($/kVA/M)	($/kVA/M)	($/kVA/M)
19.16	37.26	31.94	26.42	9.10	8.23	2.46

Note: Usage charges converted from $/kWh to $/MWh.

Source: Essential Energy 2021, 'Essential Energy Network Price List (Excluding GST): Effective 1 July 2021, Tariff Code BHND3AO', https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/pricing-proposals-tariffs/essential-energy-annual-pricing-2021-22

45 Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 132, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF

46 Australian Energy Regulator 2021, 'Essential Energy - Annual pricing 2021-22', https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/pricing-proposals-tariffs/essential-energy-annual-pricing-2021-22

Frontier Economics made the placeholder assumption that future network tariffs will remain constant in real terms over the projection period from 2021-22 to 2026-27. Essential Energy are likely to change the current network tariffs in its submission to the AER for revenue to be earned beyond 1 July 2024. As such, Water NSW propose an annual network cost true up where the benchmark electricity price is updated with reference to actual network charges over the 2022 Determination period.

Frontier Economics network electricity forecast approach and Water NSW's proposed network cost true up are reasonable, as the latest published data has been used and will be used in the true-up process, with network charges independently regulated.

Renewable energy costs

Frontier Economics have forecast renewable energy costs associated with the Large-scale Renewable Energy Target (LRET) and Small-scale Renewable Energy Scheme (SRET), both of which place obligations on electricity retailers to obtain and surrender renewable certificates.[47]

LRET

Frontier Economics have calculated LRET costs as follows:

- certificate price multiplied by the renewable power percentages (RPP)
- The LRET certificate price has been sourced from Mercari[48], taking the average of two calendar years to get a financial year, and held constant after 2024-25
- An RPP value of 18.83 per cent has been sourced from the Clean Energy Regulator[49] and held constant over the modelling period.

Table 2.28 shows the forward certificate prices have increased post Water NSW lodging its submission. Calendar year data has also become available for calendar year 2025, allowing for an estimated financial year 2024-25.

2.28 Large-Scale Generation Certificates forward prices

Product	Price	Product	Price
	$		$
Submitted by Water NSW			
Spot	40.25		
Calendar 2020	41.30	Financial Year 2020-21	38.78

47 Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 131, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF

48 http://lgc.mercari.com.au/

49 Australian Government 2021, 'The renewable power percentage', Clean Energy Regulator, March, http://www.cleanenergyregulator.gov.au/RET/Scheme-participants-and-industry/the-renewable-power-percentage#Renewable-electricity-required-for-the-year

Product	Price	Product	Price
	$		$
Calendar 2021	36.25	Financial Year 2021-22	31.44
Calendar 2022	26.63	Financial Year 2022-23	22.94
Calendar 2023	19.25	Financial Year 2023-24	14.64
Calendar 2024	10.03		
Updated			
Spot	41.50		
Calendar 2020	41.30	Financial Year 2020-21	$40.65
Calendar 2021	40.00	Financial Year 2021-22	$39.31
Calendar 2022	38.63	Financial Year 2022-23	$37.29
Calendar 2023	35.95	Financial Year 2023-24	$33.23
Calendar 2024	30.50	Financial Year 2024-25	$26.06
Calendar 2025	21.63		

Note: Financial year estimated values are the average of the corresponding calendar year.

Source: Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE – STC; http://lgc.mercari.com.au/; CIE.

The RRP is recommended by the Clean Energy Agency to the Minister for Energy and Emissions Reduction (the Minister) using actual data or estimates for the matters the Minister must consider, as set out by legislation. The 2021 RPP is 18.54 per cent,[50] which we assume carries forward over the determination period. This differs slightly to the 18.83 per cent value used by Frontier Economics.

Table 2.29 shows the cost of complying with the LRET submitted by Water NSW and the value calculated using the updated certificate and RRP values.

2.29 Estimated cost of complying with LRET

	2022-23	2023-24	2024-25	2025-26	2026-27
Submitted by Water NSW					
Certificate price ($/MWh, nominal)	22.94	14.64			
Certificate price ($/MWh, 2021-22)	22.38	13.93	13.93	13.93	13.93
Renewable power percentage (RPP)	18.83	18.83	18.83	18.83	18.83
Cost of complying with the LRET ($/MWh, 2021-22)	**4.21**	**2.62**	**2.62**	**2.62**	**2.62**
Updated					
Certificate price ($/MWh, nominal)	37.29	33.23	26.06	26.06	26.06

50 Australian Government 2021, 'The renewable power percentage', Clean Energy Regulator, March, http://www.cleanenergyregulator.gov.au/RET/Scheme-participants-and-industry/the-renewable-power-percentage#Renewable-electricity-required-for-the-year

	2022-23	2023-24	2024-25	2025-26	2026-27
Certificate price ($/MWh, 2021-22)	36.38	31.62	31.62	31.62	31.62
Renewable power percentage (RPP)	18.54	18.54	18.54	18.54	18.54
Cost of complying with the LRET ($/MWh, 2021-22)	**6.74**	**5.86**	**5.86**	**5.86**	**5.86**

Note: Assumes forecast 2.5 per cent annual inflation rate.

Source: Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE – STC; http://lgc.mercari.com.au/; CIE.

SRET

Frontier Economics have calculated SRET costs as follows:

- certificate price multiplied by the small-scale technology percentage (STP):
  - The SRET certificate price has been assumed to be $40 (nominal) for each year, based on the Clean Energy Regulator's fixed clearing house price
  - An STP value of 21.78 per cent has been sourced from the Clean Energy Regulator[51] and held constant over the modelling period.

The STP is recommended by the Clean Energy Agency to the Minister for Energy and Emissions Reduction (the Minister) using actual data or estimates for the matters the Minister must consider, as set out by legislation. The 2021 STP is 28.8 per cent,[52] with non-binding values of 17.92 and 21.15 for 2022 and 2023 respectively. We assume the 2023 non-binding value carries forward across the determination period. This differs slightly to the 21.78 per cent value used by Frontier Economics.

Table 2.30 shows the cost of complying with the SRET submitted by Water NSW and the value calculated using the updated STP values.

2.30 Estimated cost of complying with SRET

	2022-23	2023-24	2024-25	2025-26	2026-27
Submitted by Water NSW					
Certificate price ($/MWh, nominal)	40.00	40.00	40.00	40.00	40.00
Certificate price ($/MWh, 2021-22)	39.02	38.07	37.14	36.24	35.35
Small-scale technology percentage (STP)	21.78	21.78	21.78	21.78	21.78
Cost of complying with the SRET ($/MWh, 2021-22)	**8.50**	**8.29**	**8.09**	**7.89**	**7.70**

51 Australian Government 2021, 'The renewable power percentage', Clean Energy Regulator, March, http://www.cleanenergyregulator.gov.au/RET/Scheme-participants-and-industry/the-renewable-power-percentage#Renewable-electricity-required-for-the-year

52 Australian Government 2021, 'The renewable power percentage', Clean Energy Regulator, March, http://www.cleanenergyregulator.gov.au/RET/Scheme-participants-and-industry/the-renewable-power-percentage#Renewable-electricity-required-for-the-year

	2022-23	2023-24	2024-25	2025-26	2026-27
Updated					
Certificate price ($/MWh, nominal)	40.00	40.00	40.00	40.00	40.00
Certificate price ($/MWh, 2021-22)	39.02	38.07	37.14	36.24	35.35
Renewable power percentage (RPP)	21.15	21.15	21.15	21.15	21.15
Cost of complying with the LRET ($/MWh, 2021-22)	**8.25**	**8.05**	**7.86**	**7.66**	**7.48**

Note: Assumes forecast 2.5 per cent annual inflation rate.

Source: Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE – STC; http://lgc.mercari.com.au/; CIE.

NSW Energy Savings Scheme

We understand Frontier Economics has used a value of $4.10 $/MWh ($2018-19), held constant in real terms to estimate the cost of complying with the NSW Energy Savings Scheme (ESS). We understand Frontier Economics sourced this value from the 'Australian Energy Market Commission, 2017 Residential Electricity Price Trends Final Report'[53] The 2021 Residential Electricity Price Trends Final Report shows Energy Savings Scheme costs are forecast to be lower in 2022-23, than that previously estimated for 2019-20.[54]

Table 2.31 shows the Energy Savings Scheme unit costs submitted by Water NSW and the CIE's updated values using the 2021 Residential Electricity Price Trends Final Report.

2.31 Forecast costs of complying with the NSW Energy Savings Scheme

	2022-23	2023-24	2024-25	2025-26	2026-27
	$/MWh, $2021-22	$/MWh, $2021-22	$/MWh, $2021-22	$/MWh, $2021-22	$/MWh, $2021-22
Submitted by Water NSW[a]	4.29	4.29	4.29	4.29	4.29
Updated [b]	2.87	2.87	2.87	2.87	2.87

[a] Sourced from Australian Energy Market Commission, '2017 Residential Electricity Price Trends Final Report'. $4.10 $/MWh ($2018-19), inflated to $2021-22 using actual 2019 and 2020 June to June inflation (CPI) figures from the ABS, and assuming 2.5 per cent inflation for June 2021 and June 2022.

[b] Sourced from Australian Energy Market Commission 2021, 'Residential Electricity Price Trends 2021: Final Report'. 0.28 c/kWh ($2020-21), multiplied by 1 000 and divided by 100 to calculate $/MWh of $2.80 and assumed 2.5 per cent June 2022 inflation.

Source: Australian Energy Market Commission 2017, '2017 Residential Electricity Price Trends: Final Report', December, https://www.aemc.gov.au/sites/default/files/content/bf56a5d5-e2b2-4c21-90ed-79dda97eb8a4/2017-Residential-Electricity-Price-Trends.pdf; Australian Energy Market Commission 2021, 'Australian Energy Market Commission 2021, Residential Electricity Price Trends 2021: Final Report', November p. 10, https://www.aemc.gov.au/sites/default/files/2021-11/2021_residential_electricity_price_trends_report.pdf.

53 Australian Energy Market Commission 2017, '2017 Residential Electricity Price Trends: Final Report', December, https://www.aemc.gov.au/sites/default/files/content/bf56a5d5-e2b2-4c21-90ed-79dda97eb8a4/2017-Residential-Electricity-Price-Trends.pdf

54 Australian Energy Market Commission 2020, '2020 Residential Electricity Price Trends: Final Report', December p. 9, https://www.aemc.gov.au/sites/default/files/2020-12/2020%20Residential%20Electricity%20Price%20Trends%20report%20-%2015122020.pdf

Losses

Energy is lost due to electrical resistance and the heating of conductors as electricity flows through the transmission and distribution networks. The impact of network losses on spot prices is represented as transmission and distribution loss factors, calculated annually, and reported by the Australian Energy Market Operator.[55]

We understand Frontier Economics has used the published 2020-21 (the latest available at the time of Water NSW's submission):[56]

- distribution loss factors (DLF) for the Essential Energy zone, as the pipeline is located within Essential Energy's distribution network, and
- transmission loss factor (TLF) for Red Cliff, quoted as the relevant connection point based on the Pipeline's electricity bill.

Frontier Economics estimate a combined annual loss factor by multiplying the DLF and TLF and assume the combined loss factor remains constant throughout the 2022 determination period.

We have made the following changes:

- updated the DLF and TLF with 2021-22 published data, and
- applied a demand weighted average TLF to include Red Cliff and Broken Hill connection points, based on the approach used for the 2019 determination.

Table 2.32 shows the DLF and TLF calculated for Water NSW's submission and our annual forecast. Note, a loss factor below 1 reduces the wholesale electricity cost and vice versa, a loss factor above 1 increases the wholesale electricity cost.

2.32 Forecast annual distribution and transmission loss factors

	Weight	Region	TNI	Loss factor
	Per cent			
Water NSW submission				
DLF	**N/A**	**Essential Energy**	**N/A**	**1.0301**
River Murray Pumping station	0	Red Cliff	VRC2	0.9406
Wentworth Pumping Station	100	Red Cliff	VRCA	0.9406
Silver City Pumping Station	0	Broken Hill	NBKH	0.8317
Bulk Water Storage	0	Broken Hill	NBKH	0.8317
TLF	**100**			**0.9406**[a]

55 Australian Energy Market Operator 2021, 'Loss factors and regional boundaries', https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/market-operations/loss-factors-and-regional-boundaries

56 Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE – STC

	Weight	Region	TNI	Loss factor
	Per cent			
Combined DLF and TLF[b]				**0.9689**
CIE recommendation				
DLF	**N/A**	**Essential Energy**	**N/A**	**1.0309**
River Murray Pumping station	9	Red Cliff	VRC2	0.9721
Wentworth Pumping Station	57	Red Cliff	VRCA	0.9730
Silver City Pumping Station	31	Broken Hill	NBKH	0.8423
Bulk Water Storage	3	Broken Hill	NBKH	0.8423
TLF	**100**			**0.9281[c]**
Combined DLF and TLF[b]				**0.9568**

[a] TLF for Red Cliff, quoted as the relevant connection point based on the Pipeline's electricity bill

[b] DLF multiplied by TLF.

[c] Applied a demand weighted average TLF to include Red Cliff and Broken Hill connection points, based on the approach used for the 2019 determination.

Note: TNI is transmission node identifier.

Sources: Australian Energy Market Operator 2020, Distribution Loss Factors for the 2020/21 Financial Year, July, https://aemo.com.au/-/media/files/electricity/nem/security_and_reliability/loss_factors_and_regional_boundaries/2020-21/dlf-2020-2021.pdf; Australian Energy Market Operator 2020, 'Regions and Marginal Loss Factors: FY 2020-21: A report for the National Electricity Market', July, https://www.aemo.com.au/-/media/files/electricity/nem/security_and_reliability/loss_factors_and_regional_boundaries/2020-21/marginal-loss-factors-for-the-2020-21-financial-year.pdf?la=en; *Australian Energy Market Operator 2021, Distribution Loss Factors for the 2021/22 Financial Year, July,* p. 20, *https://aemo.com.au/-/media/files/electricity/nem/security_and_reliability/loss_factors_and_regional_boundaries/2021-22/distribution-loss-factors-for-the-2021-22-financial-year.pdf?la=en; Australian Energy Market Operator 2021,* 'Regions and Marginal Loss Factors: FY 2021-22: A report for the National Electricity Market', July, pp, 17 and 25, https://aemo.com.au/-/media/files/electricity/nem/security_and_reliability/loss_factors_and_regional_boundaries/2021-22/marginal-loss-factors-for-the-2021-22-financial-year.pdf?la=en; Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE – STC; CIE.

We assume the 2021-22 combined loss factor remains constant throughout the 2022 determination period (table 2.33).

2.33 Forecast determination combined distribution and transmission loss factors

	2022-23	2023-24	2024-25	2025-26	2026-27
Submitted by Water NSW	0.9689	0.9689	0.9689	0.9689	0.9689
CIE recommended	0.9568	0.9568	0.9568	0.9568	0.9568

Note: A loss factor below 1 reduces the wholesale electricity cost and vice versa, a loss factor above 1 increases the wholesale electricity cost.

Source: Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE – STC; CIE.

Market fees

Australian Energy Market Operator's 2019-2020 budget statement[57] and forecast growth rates have been used to estimate market fees. The recently released 2021-22 Australian Energy Market Operator's budget statement suggests market fees will be slightly lower than that previously indicated and forecast by Frontier Economics, as shown in table 2.34.

2.34 Australian Energy Market Operator National Electricity Market fees

	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27
	$/MWh, nominal	$/MWh, nominal	$/MWh, nominal	$/MWh, nominal	$/MWh, nominal	$/MWh, nominal	$/MWh, nominal	$/MWh, nominal
Submitted by Water NSW[a]	0.50	0.55	0.61	0.68	0.70	0.72	0.74	0.75
Updated[b]			0.59	0.60	0.62	0.64	0.65	0.67

[a] The 2019-20 fee is sourced from the Australian Energy Market Operator's 2019-2020 budget statement. A 9 per cent growth rate has been applied for 2021-22, 12 per cent growth rate applied for 2021-22 and 2022-23, with fees held constant in real terms afterwards (assuming 2.5 per cent forecast inflation). [b] The 2021-22 fee is sourced from the Australian Energy Market Operator's 2021-2022 budget statement, with fees held constant in real terms afterwards (assuming 2.5 per cent forecast inflation).

Source: Australian Energy Market Operator 2019, '2019-20 AEMO Final Budget and Fees', June, p. 9, https://aemo.com.au-media/files/about_aemo/energy_market_budget_and_fees/2019/final-2019-20-aemo-final-budget-and-fees.pdf?la=en; Australian Energy Market Operator 2021, '2021-22 AEMO Final Budget and Fees', June, p. 7, https://aemo.com.au-media/files/about_aemo/energy_market_budget_and_fees/2019/final-2019-20-aemo-final-budget-and-fees.pdf?la=en

Ancillary service fees

Frontier Economics used the average of historical ancillary service payment data[58], calculated over the 5-year period 2015-16 to 2019-20 and inflated to $2021-22 using the Australian Bureau of Statistics all groups Australian Consumer Price Index[59], to forecast ancillary service costs. The forecast ancillary service fee has been held constant in $nominal over the determination period. Using recent data as a basis to forecast future ancillary service costs is reasonable, given historical ancillary services costs have been volatile, as shown in chart 2.35.

We have updated the ancillary service data to include 2020-21, as well as updated for actual 2020-21 inflation, to estimate forecast ancillary service costs based on a 7-year period 2014-17 to 2020-21. The two forecast estimates are shown in table 2.36.

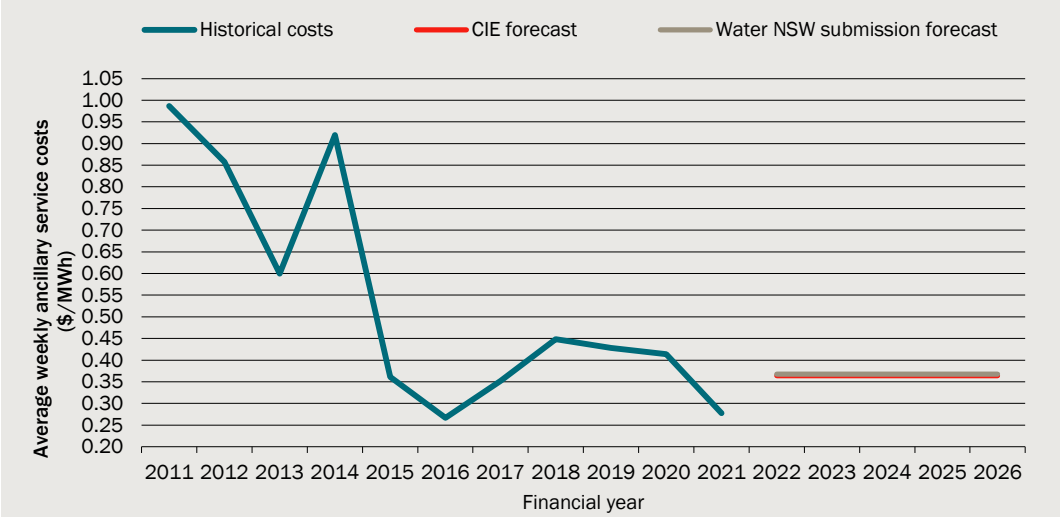
---

57 Australian Energy Market Operator 2019, '2019-20 AEMO Final Budget and Fees', June, p. 7, https://aemo.com.au-media/files/about_aemo/energy_market_budget_and_fees/2019/final-2019-20-aemo-final-budget-and-fees.pdf?la=en

58 Available at http://www.nemweb.com.au/REPORTS/CURRENT/Ancillary_Services_Payments/

59 2.5 per cent annual inflation was assumed for 2021-22 and 2022-23.

2.35 Historical and forecast ancillary service costs



Note: Frontier Economics used a 5-year average (2015-16 to 2019-2020), actual June 2019, and 2020 CPI and assumed 2.5 per cent inflation for June 2021 and June 2022 to inflate to $2021-22. CIE have used a 7-year average (2014-15 to 2020-21), actual June 2019, 2020 and 2021 CPI and assumed 2.5 per cent inflation for June 2022.

Data source: http://www.nemweb.com.au/REPORTS/CURRENT/Ancillary_Services_Payments/; Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE – STC; CIE.

2.36 Forecast ancillary service fees

	2022-23	2023-24	2024-25	2025-26	2026-27
	$/MWh $2021-22	$/MWh $2021-22	$/MWh $2021-22	$/MWh $2021-22	$/MWh $2021-22
Submitted by Water NSW	0.366	0.366	0.366	0.366	0.366
Updated	0.362	0.362	0.362	0.362	0.362

Note: Frontier Economics used a 5-year average (2015-16 to 2019-2020), actual June 2019, and 2020 CPI and assumed 2.5 per cent inflation for June 2021 and June 2022 to inflate to $2021-22. CIE have used a 7-year average (2014-15 to 2020-21), actual June 2019, 2020 and 2021 CPI and assumed 2.5 per cent inflation for June 2022.

Source: http://www.nemweb.com.au/REPORTS/CURRENT/Ancillary_Services_Payments/; Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE – STC; CIE.

Retail margin

Frontier Economics state they included an allowance for the retail margin of 5.7 per cent[60] of total costs, based on analysis of regulatory allowances by the

60 The 5.70 per cent retail margin in dollar terms is calculated by multiplying all energy costs (including the retail operating margin) by 6.04 per cent.

Queensland Competition Authority, the Independent Competition and Regulatory Commission - ACT, Office of the Tasmanian Economic Regulator and IPART.[61]

We consider this approach reasonable.

Retail operating costs

Water NSW state they did not include a separate allowance for retail operating costs, as retail operating costs account for a very small proportion of total retail prices for large customers.[62]

However, an assessment of their spreadsheet model[63] suggests a retail operating cost allowance of $2 387 per annum ($2021-22) has been included in estimated electricity costs. In response to our Draft Report[64], Water NSW state there is precedence to include a retail operating cost allowance in the estimated electricity cost, namely Queensland Competition Authority's[65] and IPART's historical approach to regulating retail electricity prices and in setting energy allowances in water sector.

We have included a retail operating cost allowance of $2 418 per annum ($2021-22), as per Frontier Economics' methodology, which includes a fixed annual amount of $2,279.60 ($2018-19), determined by the Queensland Competition Authority[66], updated for inflation.

Our estimate is slightly higher than Frontier Economics' estimate, due to the actual June 2021 CPI figure released by the Australian Bureau of Statistics, being higher than that assumed for Water NSW's submission.

---

61 Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 132, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF

62 Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 132, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF

63 RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE – STC

64 Email from Stevan Munic, 'RE: WaterNSW expenditure and demand review - draft reports', 26 November 2021.

65 Queensland Competition Authority 2021, 'Regulated retail electricity prices for 2021–22: Technical Appendices', p. 32, https://www.qca.org.au/wp-content/uploads/2021/03/qca-regulated-retail-electricity-prices-for-2021-22-draft-determination-technical-appendices.pdf

66 As quoted in Frontier Economics 2019, 'WaterNSW's Energy Purchase Costs – Broken Hill Pipeline: Final Report For IPART, February, p. 31, https://www.ipart.nsw.gov.au/sites/default/files/documents/consultant-report-by-frontier-waternsw-energy-purchase-costs-broken-hill-pipeline-8-february-2019.pdf

Summary

We consider Frontier Economics electricity forecast approach and Water NSW's proposed cost true up are reasonable as:

- all energy cost components likely to be included in the Pipeline's electricity bill have been incorporated
- the latest published data at the time of Water NSW's submission has been used, and will be used to estimate electricity costs in the true-up process, and
- both wholesale and network charges are largely exogenous.

However, in summary we have made the following amendments to the forecast energy costs, with further details in tables 2.37 to 2.39:

- updated benchmark energy price components where new information has become available since Water NSW lodged its submission, and
- amended wholesale and network prices associated with the recommended bulk water transport volumes and pumping profile.

2.37 Summary of energy price amendments

	2022-23 forecast	2023-24 forecast	2024-25 forecast	2025-26 forecast	2026-27 forecast	Comment	Energy price impact[a]
	($/MWh, 2021-22)	($/MWh, 2021-22)	($/MWh, 2021-22)	($/MWh, 2021-22)	($/MWh, 2021-22)		
Wholesale energy purchase costs[b]							
Water NSW's submission	51.80	52.99	52.99	52.99	52.99	Impacted by: ▪ amended bulk water transport volumes and pumping profile	Decrease
CIE's recommendation[c]	51.17	52.33	52.33	52.33	52.33		
Network costs							
Water NSW's submission							
Network access charge	19.16	19.16	19.16	19.16	19.16	▪ No change to the **unit prices** recommended.	No change
Energy peak	37.26	37.26	37.26	37.26	37.26		
Energy shoulder	31.94	31.94	31.94	31.94	31.94		
Energy off-peak	26.42	26.42	26.42	26.42	26.42		
Demand peak	9.10	9.10	9.10	9.10	9.10		
Demand shoulder	8.23	8.23	8.23	8.23	8.23		
Demand off-peak	2.46	2.46	2.46	2.46	2.46		

	2022-23 forecast	2023-24 forecast	2024-25 forecast	2025-26 forecast	2026-27 forecast	Comment	Energy price impact[a]
	($/MWh, 2021-22)	($/MWh, 2021-22)	($/MWh, 2021-22)	($/MWh, 2021-22)	($/MWh, 2021-22)		
						▪ However, estimated **total network costs** impacted by the change to the pumping profile and bulk water transport volumes.	
CIE's recommendation							
Network access charge	19.16	19.16	19.16	19.16	19.16		
Energy peak	37.26	37.26	37.26	37.26	37.26		
Energy shoulder	31.94	31.94	31.94	31.94	31.94		
Energy off-peak	26.42	26.42	26.42	26.42	26.42		
Demand peak	9.10	9.10	9.10	9.10	9.10		
Demand shoulder	8.23	8.23	8.23	8.23	8.23		
Demand off-peak	2.46	2.46	2.46	2.46	2.46		
LRET							
Water NSW's submission	4.21	2.62	2.62	2.62	2.62	▪ Higher forward certificate prices. ▪ Slight decrease to the RRP	Increase
CIE's recommendation	6.74	5.86	5.86	5.86	5.86		
SRET							
Water NSW's submission	8.50	8.29	8.09	7.89	7.70	▪ Slight decrease to the STP	Decrease
CIE's recommendation	8.25	8.05	7.86	7.66	7.48		
NSW ESS							
Water NSW's submission	4.29	4.29	4.29	4.29	4.29	▪ Decrease to the AEMC's forecast published in the 2021 Residential Electricity Price Trends.	Decrease
CIE's recommendation[d]	2.87	2.87	2.87	2.87	2.87		

	2022-23 forecast	2023-24 forecast	2024-25 forecast	2025-26 forecast	2026-27 forecast	Comment	Energy price impact[a]
	($/MWh, 2021-22)	($/MWh, 2021-22)	($/MWh, 2021-22)	($/MWh, 2021-22)	($/MWh, 2021-22)		
Market fees							
Water NSW's submission[e]	0.65	0.65	0.65	0.65	0.65	▪ Decrease to AEMO's forecast fees.	Decrease
CIE's recommendation[e]	0.58	0.58	0.58	0.58	0.58		
Ancillary service fees							
Water NSW's submission[e]	0.366	0.366	0.366	0.366	0.366	▪ Applied a longer averaging period of 7 years, compared to 5 years ▪ Updated June 2021 inflation values	Decrease
CIE's recommendation[e]	0.362	0.362	0.362	0.362	0.362		

[a] Compared to Water NSW's submission.

[b] CIE's recommended total wholesale electricity costs also differ to Water NSW's proposal due to a lower combined distribution and transmission loss factor of 0.9568 per annum, compared to Water NSW's proposed 0.9689 per annum.

[c] Figures differ to Draft Report due to amendments to the recommended pumping profile, following new information provided by Water NSW. For example, accounting for pipeline downtime and Water NSW advice that the storage levels generally do not go below 60 per cent.

[d] Figures differ to the Draft Report due to updated AEMC's forecast published residential electricity price trends, released on 25 November 2021.

[e] Minor adjustments made to Draft Report figures following final review.

Notes: LRET is Large-scale Renewable Energy Target; SRET is Small-scale Renewable Energy Scheme; RRP is renewable power percentages; STP is Small-scale Renewable Energy Scheme; AEMC is the Australian Energy Market Commission; AEMO is the Australian Energy Market Operator; ESS is the NSW Energy Savings Scheme.

Source: Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE – STC; CIE

2.38 Summary of energy price amendments (retail margin)

	2022-23 forecast	2023-24 forecast	2024-25 forecast	2025-26 forecast	2026-27 forecast	Comment	Energy price impact[a]
	Per cent of total costs	Per cent of total costs	Per cent of total costs	Per cent of total costs	Per cent of total costs		
Water NSW's submission	5.70	5.70	5.70	5.70	5.70	No change	No change
CIE's recommendation	5.70	5.70	5.70	5.70	5.70		

[a] Compared to Water NSW's submission.

Source: Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE – STC; CIE.

2.39 Summary of energy price amendments (retail operating costs)

	2022-23 forecast	2023-24 forecast	2024-25 forecast	2025-26 forecast	2026-27 forecast	Comment	Energy price impact[a]
	$2021-22	$2021-22	$2021-22	$2021-22	$2021-22		
Water NSW's submission	2 387	2 387	2 387	2 387	2 387	▪ Updated inflation figures.	Increase
CIE's recommendation [b]	2 418	2 418	2 418	2 418	2 418		

[a] Compared to Water NSW's submission.

[b] Figures differ to the Draft Report following new information provided by Water NSW.

Source: Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE – STC; CIE.

Table 2.40 shows Water NSW's submitted benchmark electricity costs and our recommendation.

2.40 Forecast benchmark electricity costs

	2022-23	2023-24	2024-25	2025-26	2026-27	Total
	$'000	$'000	$'000	$'000	$'000	$'000
Water NSW proposal[a]						
Wholesale	612	624	622	621	619	3 098
Renewable	203	181	178	175	172	908
Market fees and ancillary services	12	12	12	12	12	12
Network charges	644	643	641	639	637	3 204
Retail operating cost & margin	91	91	90	90	90	452
Total electricity costs	**1 563**	**1 551**	**1 544**	**1 537**	**1 530**	**7 724**
CIE's recommendation [b]						
Wholesale	611	622	621	619	617	3 090
Renewable	213	200	197	194	191	995
Market fees and ancillary services	11	11	11	11	11	56
Network charges	616	612	611	608	606	3 053
Retail operating cost & margin	90	90	90	89	89	447
Total electricity costs	**1 542**	**1 536**	**1 529**	**1 521**	**1 513**	**7 640**

[a] Assumes electricity volumes of 6.39 MWh/day and 1.64MWh/ML and Essential Water's forecast bulk water transport volumes of 5 575ML in 2022-23, 5 553 ML in 2023-24, 5 532 ML in 2024-25, 5 510 ML in 2025-26, and 5 488 ML in 2026-27; losses at the bulk supply facility of 435 ML per annum, and other offtake bulk water transport volumes of 3 ML per annum. [b] Assumes electricity volumes of 6.39 MWh/day and 1.64MWh/ML and forecast Essential Water bulk water transport volumes of 5 792 ML in 2022-23, 5 769 ML in 2023-24, 5 746 ML in 2024-25, 5 723 ML in 2025-26, and 5 700 ML in 2026-27; losses at the bulk supply facility of 389.8 ML per annum, and other offtake bulk water transport volumes of 3 ML per annum.

Source: Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', p. 130, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF; CIE.

Note, the figures in table 2.40 assume the variable and fixed electricity loads of 6.39 MWh per day and 1.64 MWh per ML respectively. Therefore, updates to these figures will change the forecast electricity costs.

A Essential Water's and Water NSW's Broken Hill Pipeline customer and water demand forecasts

Essential Water

A.1 Essential Water forecast customer numbers for potable water (excl mines)

Number of customers	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27
Total population	17 819	17 652	17 485	17 318	17 152	16 974
Total residential billable entities	9 952	9 958	9 963	9 969	9 974	9 980
Number of non-residential customers	798	798	798	798	798	798
Number of non-residential customers 20mm meter equivalents	1 957	1 957	1 957	1 957	1 957	1 957

Source: Essential Water 2021, 'Pricing Proposal: Submission', table 24: forecast customer numbers for potable water (excl mines), p. 71, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-Proposal-by-Essential-Water-June-2021.PDF

A.2 Essential Water forecast sewerage customer numbers (excl mines)

Number of customers	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27
Total population	17 148	16 987	16 827	16 666	16 506	16 335
Total residential billable entities	9 375	9 377	9 379	9 381	9 383	9 385
Number of non-residential customers	675	675	675	675	675	675
Number of non-residential customers 20mm meter equivalents	1 602	1 602	1 602	1 602	1 602	1 602

Source: Essential Water 2021, 'Pricing Proposal: Submission', table 28: Forecast sewerage customer numbers (excl. mines), p. 72, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-Proposal-by-Essential-Water-June-2021.PDF

A.3 Essential Water forecast treated water sales (ML)

Consumption Volumes	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27
Residential	2 362	2 342	2 323	2 303	2 283	2 263
Non-residential (excl. mines)	305	305	305	305	305	305
Mines	1 055	1 055	1 055	1 055	1 055	1 055
Exempt customers	337	337	337	337	337	337
Total	**4 059**	**4 040**	**4 020**	**4 000**	**3 981**	**3 961**

Source: Essential Water 2021, 'Pricing Proposal: Submission', table 25: forecast treated water sales (ML), p. 71, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-Proposal-by-Essential-Water-June-2021.PDF

A.4 Essential Water forecast chlorinated water sales (ML)

Consumption Volumes	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27
Total chlorinated	**43**	**43**	**43**	**43**	**43**	**43**

Source: Essential Water 2021, 'Pricing Proposal: Submission', table 26Chlorinated water sales (ML), p. 72, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-Proposal-by-Essential-Water-June-2021.PDF

A.5 Essential Water forecast untreated water sales (ML/year)

Consumption Volumes	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27
Pipeline customers	70	70	70	70	70	70
Mines	520	520	520	520	520	520
Other non-residential	416	416	416	416	416	416
Total	**1 006**	**1 006**	**1 006**	**1 006**	**1 006**	**1 006**

Source: Essential Water 2021, 'Pricing Proposal: Submission', table 29: forecast untreated water sales (ML/year), p. 72, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-Proposal-by-Essential-Water-June-2021.PDF

A.6 Essential Water forecast sewerage volumes (ML)

Consumption Volumes	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27
Residential[a]	844	938	938	938	938	939
Non-residential (excl. mines)	249	249	249	249	249	249
Mines	30	30	30	30	30	30
Exempt customers	280	280	280	280	280	280
Total	**1 403**	**1 497**	**1 497**	**1 497**	**1 497**	**1 498**

[a] Deemed usage amount of 90kL in 2021-22 and 100kL in the 2022 determination period, multiplied by the forecast residential billable sewerage entities.

Note: Residential customers are charged a deemed sewerage usage amount - currently 90kL per annum multiplied by the sewerage usage price, which Essential Water propose to increase to 100kL per annum for the 2022 determination period.

Source: Essential Water 2021, 'Essential Water Pricing Proposal: Submission', table 25: Forecast non-residential sewerage volumes (ML), p. 73, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-Proposal-by-Essential-Water-June-2021.PDF; CIE.

Water NSW Broken Hill Pipeline

A.7 Water NSW Broken Hill Pipeline forecast customer and offtake numbers

	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27
Essential Water	1	1	1	1	1	1
Offtakes	5	5	5	5	5	5
Total	**6**	**6**	**6**	**6**	**6**	**6**

Note: Water NSW currently has five offtakes (Kudgee Station, Netley Cattle Yards, Netley Station, Pinepoint /Sunnydale and Balaclava). Netley Cattle Yards and Netley Station are not taking any water and have not entered into a Water Agreement. All the other Offtakes are taking water. The Offtake Structure Pinepoint/Sunnydale is one structure but two customers who share the costs 50:50 for that offtake. Water NSW therefore refers to five offtakes with four offtake customers.

Source: Water NSW 2021, 'Pricing Proposal to the Independent Pricing and Regulatory Tribunal: Regulated prices for the Wentworth to Broken Hill Pipeline', pp. 65-66, June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-proposal-by-Water-NSW-June-2021.PDF.

A.8 Water NSW projected annual pipeline bulk water transport volumes

Consumption Volumes	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27
	ML	ML	ML	ML	ML	ML
Essential Water	5 596.3	5 574.7	5 553.1	5 531.5	5 509.9	5 488.1
Offtakes	2.8	2.8	2.8	2.8	2.8	2.8
Evaporation losses	435.3	435.3	435.3	435.3	435.3	435.3
Total	**6 034.4**	**6 012.8**	**5 991.2**	**5 969.6**	**5 948.0**	**5 926.2**

Source: Water NSW 2021, 'Attachment 4 – Water NSW (Pipeline) AIR/SIR 2021.

B Pipeline operator assumed maximum fixed electricity consumption by Pipeline assets

B.1 Pipeline operator assumed maximum fixed electricity consumption by Pipeline assets

Site	Assumed Maximum Fixed Electricity Consumption (Independent of Flow)
	MWh/day[a]
River Murray PS	[redacted]
Wentworth PS	[redacted]
Silver City PS	[redacted]
Bulk Water Storage	[redacted]
Total	[redacted]

[a] Converted from kWh/day by dividing by 1 000.

Source: Memo: Information for IPART regarding the development of the Electricity Payment under the Operations & Maintenance Contract for the Murray to Broken Hill Pipeline, To Norman Esber (Water NSW) From Robran Cock (John Holland TRILITY Joint Venture), 29 November 2018, pp. 2-3.

C IPART pumping model

We have developed a pumping model to estimate an efficient pumping profile. This is based on a model developed by IPART for the 2019 Murray River to Broken Hill Pipeline determination.

The model assumes that pumping is smoothed over the year, with the model seeking to pump constantly over the year to meet expected annual demand (including losses), subject to constraints.[67] Constraints are summarised in table C.1.

Pumping is first allocated to off-peak, then shoulder and finally peak period, based on the maximum amount of pumping which can occur during each of those periods per day (table C.2). A model of pumping which meets demand and minimises electricity costs is assumed to be efficient in this model. The model does not consider other costs, such as labour.

C.1 Constraints in IPART pumping model

	Parameter	Source	Comments
Pipeline flow rate	27 ML/day	Water NSW AIR	
Peak, shoulder, and off-peak periods	See table C.2	Water NSW correspondence	
Maximum pumped during off-peak	14.65 ML/day	CIE calculation	Calculated as: $\left(\frac{27}{24} \times 0.98 \times 9\right) \times \frac{93}{168}$
Maximum pumped during shoulder	7.88 ML/day	CIE calculation	Calculated as: $\left(\frac{27}{24} \times 0.98 \times 10\right) \times \frac{50}{168}$
Pipeline availability	98 per cent	Water NSW correspondence	Each day only 27 ML ×98 per cent of pumping capacity is available.
Storage capacity	836 ML	Water NSW AIR	
Minimum storage	502 ML (60 per cent of storage capacity)	CIE, based on Water NSW correspondence	Based on observation that storages are maintained at between 60 and 80 per cent.
Storage opening volume	Based on actuals	Water NSW AIR	

Source: Provided in the table.

67 We understand that Water NSW plans its pumping schedule on a weekly basis (using weekly demand forecasts). The IPART model is based on annual demand forecasts.

C.2 Peak, shoulder, and off-peak periods

	Time periods	Hours per business day	Hours per weekend/public holiday	Hours per week (assume 5 business days and 2 weekend days)
		No.	Hours	Hours
Off-Peak	All times outside of shoulder periods and peak periods	9	24	93
Shoulder	9am to 5pm and 8pm to 10pm AEST/AEDT business days	10	0	50
Peak	7am to 9am and 5pm to 8pm AEST/AEDT business days	5	0	25

Source: CIE, Water NSW correspondence.

THE CENTRE FOR INTERNATIONAL ECONOMICS
www.TheCIE.com.au