COMMERCIAL IN CONFIDENCE

SUPPLEMENTARY FINAL REPORT

Review of WaterNSW's response to the Broken Hill Pipeline Draft Decision on Energy Issues

Prepared for
Independent Pricing & Regulatory Tribunal (IPART)

7 October 2022

THE CENTRE FOR INTERNATIONAL ECONOMICS
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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

Summary

Background

In July 2021, the Independent Pricing & Regulatory Tribunal (IPART) commenced its review of maximum prices to apply from 1 January 2023 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 engaged The Centre for International Economics (The CIE) to complete an independent evaluation of:

1 Essential Water's forecast customer demand[1], consisting of:
   a) customer number forecasts, and
   b) water demand forecasts for treated water, chlorinated water, untreated water sales and sewerage, and
2 the Pipeline's[2]:
   a) bulk water customer demand forecasts, and
   b) proposed efficient energy costs.

Our previous findings and recommendations for tasks 1 and 2 are covered in, The CIE 2021, 'Essential Water's water and sewerage services in Broken Hill[3] and The CIE 2022, 'Water NSW's Broken Hill Pipeline', June,[4] respectively.

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1 As presented in Essential Water 2021, 'Pricing Proposal: Submission', June, https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Pricing-Proposal-by-Essential-Water-June-2021.PDF

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

3 The CIE 2021, 'Essential Water's water and sewerage services in Broken Hill: Demand Review Final Report', December, https://www.ipart.nsw.gov.au/documents/consultant-report/consultant-report-cie-essential-waters-water-and-sewerage-services-broken-hill-june-2022?timeline_id=15008

4 The CIE 2022, 'Water NSW's Broken Hill Pipeline: Bulk Water Transport Volume Demand and Energy Review Final Report', June, https://www.ipart.nsw.gov.au/documents/consultant-report/consultant-report-cie-water-nsws-broken-hill-pipeline-bulk-water-transport-volume-demand-and-energy-june-2022?timeline_id=14993

In early 2022, IPART delayed both the Essential Water and the Pipeline reviews for 6 months, with new prices set to commence on 1 January 2023. IPART subsequently released its Draft Determinations for Essential Water[5] and the Pipeline[6] on 7 June 2022.

This task

IPART has engaged The CIE to complete a supplementary review of the Pipeline's energy costs and associated inputs, following WaterNSW's response to IPART's Draft Decisions[7] (WaterNSW's Draft Decision response).

WaterNSW's Draft Decision response identifies four areas of consideration associated with IPART's draft energy decisions:

1 Fixed and variable demand

2 Energy pumping profile

3 Updated energy price forecast, and

4 Energy Costs – End-of-period true-up mechanism.

Findings

Fixed and variable energy demand

Table 1 shows the variable and fixed energy parameters used to calculate benchmark energy costs:

- proposed by WaterNSW
- previously recommended by The CIE
- in IPART's draft decision, and
- The CIE's supplementary recommendation.

5 IPART 2022, 'Draft Determination - Maximum prices for water and wastewater services supplied by Essential Energy in Broken Hill', June, https://www.ipart.nsw.gov.au/documents/draft-determination/draft-determination-maximum-prices-water-and-wastewater-services-supplied-essential-energy-broken-hill-june-2022?timeline_id=15014

6 IPART 2022, 'Draft Determination - Maximum prices for water transportation services supplied by Water NSW for the Murray River to Broken Hill Pipeline', June, https://www.ipart.nsw.gov.au/documents/draft-determination/draft-determination-maximum-prices-water-transportation-services-supplied-water-nsw-murray-river-broken-hill-pipeline-june-2022?timeline_id=14999

7 WaterNSW 2022, 'Response to the IPART Draft Determination on the Review of Broken Hill Pipeline Prices from 1 January 2023, September

1 Forecast pipeline fixed and variable energy parameters

	Variable	Fixed	Comments
	MWh/ML	MWh/day	
Water NSW's proposal	1.64	6.39	
CIE's previous recommendation	1.64	6.39	▪ Based on the conclusion that 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, we stated future energy use parameters can be improved given an evaluation of monthly energy use data shows the fixed energy parameter is at the upper bound of the 95 per cent confidence intervals, and as such, likely to be greater than actual reported energy consumption ▪ Further, given the fixed and variable energy parameters have a significant flow on impact on the pumping profile, and ultimately the benchmark forecast electricity costs, we recommended: – WaterNSW provide substantiating evidence that the modelled 6.39 MWh/day parameter reflects actual energy use, including, but is not limited to, an engineering assessment, and – the fixed and variable energy parameters are subject to an engineering assessment at the next Pipeline review.
IPART's draft decision	1.64	0.6	▪ Based on a regression analysis of daily energy use data provided by WaterNSW.
The CIE's supplementary recommendation	**1.64**	**0.6**	▪ Analysis of daily energy use data provided by WaterNSW strongly indicates the reported fixed energy use is lower than the 6.39 MWh/day modelled value ▪ It is possible that WaterNSW's provided energy use data is incomplete, with uncertainty around the basis of the fixed energy parameter included in the provided daily energy use data [a] ▪ A lower fixed energy parameter provides an incentive for WaterNSW to provide: – verified and accurate energy use data, and – substantiating evidence to justify the 6.39 MWh/day figure.

[a] *WaterNSW provided monthly energy use data in 'Attachment 4 – WaterNSW (Pipeline) AIR SIR 2021.xls' and stated they do not have a way of separating variable and fixed energy in actual information. We used this monthly energy data to undertake our previous assessment of fixed and variable energy use and make our subsequent previous recommendations. In response to a follow-up request for information, WaterNSW provided daily energy use data (via email, Excel file 'Pumping and energy profile Jul 19 – Sept 21') split into variable and fixed components, despite previously stating they could not provide actual fixed energy use. We sought clarification from WaterNSW, regarding how the daily fixed energy use value was derived via an email dated 25 October 2021 but did not receive a written response.* After reading an advanced final draft of this Supplementary report, *WaterNSW responded that at a meeting on 27 October 2021, WaterNSW verbally advised, "the [0.4904 MWh/day figure] requires further validation and testing and was not independently verified (more analysis is needed to ensure the figure is appropriate for pricing purposes)." IPART used the daily energy use data as the basis for their draft decision lower fixed energy parameter of 0.6 MWh/day.*

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

Sources: Water NSW 2022, 'Response to the IPART Draft Determination on the Review of Broken Hill Pipeline Prices from 1 January 2023', September, p. 12; IPART 2022, 'Draft Technical Paper - Review of WaterNSW's prices for the Murray River to Broken Hill Pipeline', June, p. 29, The CIE 2022, 'Water NSW's Broken Hill Pipeline: Bulk Water Transport Volume Demand and Energy Review Final Report', June, pp. 6-7, https://www.ipart.nsw.gov.au/documents/consultant-report/consultant-report-cie-water-nsws-broken-hill-pipeline-bulk-water-transport-volume-demand-and-energy-june-2022?timeline_id=14993; The CIE analysis.

Energy pumping profile

WaterNSW has noted a range of concerns regarding the pumping profile used in the Draft Determination, although they accept the use of a benchmark pumping profile for the determination.

WaterNSW argues there are a range of factors constraints which affect the actual pumping schedule, and which may not be fully accounted for in the stylised model.

Based on consultations with WaterNSW we believe there are two key areas where the model can be improved to better reflect actual constraints:

- allowing different pipeline availability during off-peak periods compared to peak and shoulder periods. For example, if equipment fails during an off-peak period it may take longer to fix outside of business hours resulting in lower pipeline availability. WaterNSW have not provided an estimate of pipeline availability during the off-peak.
- assessing how actual pumping plans take into account storage levels. The IPART model allows storages to vary across the year; if the actual pumping plan is conditioned on storage levels, we would expect actual pumping to be similar to the smoothed profile generated by the IPART model.

As we noted in the previous review, we recognise that some determinants of an efficient pumping profile may not be characterised in the IPART model.[8] For this reason we recommend that the model is further refined in consultation with WaterNSW at the next Pipeline review, with a particular focus on the two points noted above.

Maximum demand

WaterNSW note that little information was provided in the CIE's review regarding the assumptions used to determine maximum demand. WaterNSW also identified that maximum demand values reported in the Draft Determination are too high during peak periods, given the assumed fixed and variable energy consumption assumptions and pumping capacity of the pipeline.[9] Overstated maximum demand during the peak may result in the shoulder maximum demand being understated.

For the purpose of the CIE's review, maximum demand was estimated using the energy analysis model provided by WaterNSW. This takes forecast demand and scales it by the proposed pumping profile (we recommend using the IPART pumping profile) to provide estimates of the energy electricity consumption and maximum demand for the peak, shoulder and off-peak. Maximum demand for each period is calculated by dividing MWh by the number of hours in each period.

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8 The CIE 2022, 'Water NSW's Broken Hill Pipeline: Bulk Water Transport Volume Demand and Energy Review Final Report', June, p. 36.

9 WaterNSW 2022, 'Response to the IPART Draft Determination on the Review of Broken Hill Pipeline Prices from 1 January 2023', September, p. 13.

We have made two adjustments to the energy analysis model provided by WaterNSW (compared to our earlier review):[10]

- The number of hours in each period is adjusted to allow 9 off-peak hours, 10 shoulder hours and 5 peak hours on weekdays, which is consistent with the WaterNSW pricing proposal.[11] The model previously allowed 9 off-peak hours, 12 shoulder hours and 3 peak hours per day.
- The model was adjusted to cap the total pumping volume per hour to be consistent with pipeline capabilities (i.e. 27 ML/day and 98 per cent availability). This adjustment was made to resolve an error identified by WaterNSW.

Correcting the model affects both WaterNSW and CIE estimates (table 2).

2 Maximum demand 2022/23

Period	WaterNSW Submission	WaterNSW Submission – updated by CIE	CIE Review (IPART assumptions)	CIE Review (IPART assumptions) – updated by CIE
	MW	MW	MW	MW
Off-peak	2.09	2.07	3.57	1.83
Shoulder	1.73	2.02	0.58	1.66
Peak	0.30	0.29	0.03	0.03

Note: Maximum demand varies between WaterNSW and CIE Review (IPART assumptions) due to differences in demand, pumping profile and fixed energy consumption.

Source: CIE, Water NSW 2022, 'Response to the IPART Draft Determination on the Review of Broken Hill Pipeline Prices from 1 January 2023', September, p. 37, Frontier Pipeline energy costs model.

Given maximum demand depends on demand, pumping profile and the fixed energy consumption parameter, we recommend using the value which is consistent with the full range of assumptions (shown in the rightmost column of table 2).

Updated energy price forecast

WaterNSW has used the same cost-build up approach to forecast the possible price of electricity and complying with the LRET for the upcoming determination period, with updated input data to 30 June 2022. WaterNSW contend the use of the latest available data is best practice.

Since November 2021 the forecast electricity prices for WaterNSW has increased by almost a factor of 4 for 2022-23. Prices are expected to fall in forward years, but are expected to remain around 2 times higher than was expected in November 2021.

These forecasts, based on market transactions, reflect the cost of purchasing future electricity contracts at a given point in time. This should, therefore, give an indication of expected future spot price given information available at that point in time.

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10 Note this energy analysis model provided was also used to inform the CIE's analysis for the Draft Determination.

11 WaterNSW 2021, 'WaterNSW Pricing Proposal for the Wentworth to Broken Hill Pipeline', June, p. 110.

In our previous review we concluded that Frontier Economics' wholesale electricity forecast approach is reasonable, as it accounts for historical data and publicly available future forecast contract prices.[12]

Ideally data closest to the start of the determination period would be used to inform the determination. This will reflect the most up to date estimate of the cost purchasing electricity over the determination period.

This is however complicated by the delay of the determination. IPART has indicated that WACC market observations will be sampled to using data to the end of March 2022 (data to the end of December 2021was used for the IPART Draft Determination). Noting the merit of using the most up to date information, we recognise that IPART may want to consider consistency of the approach to sampling market information within the review, as well as the approach taken by IPART in the past where determinations have been delayed.

Picking alternative historical data would change the balance of risks between WaterNSW and its customers. Using a forecast lower than current forecasts in the determination would reallocate risks from customers to WaterNSW, given current forecasts are higher.

Updated energy cost recommendation

Bringing together the supplementary recommendations noted above, we proposed the following changes to energy cost inputs:

- use a fixed energy parameter 0.6 MWh/day
- use updated maximum demand forecasts based on adjusted energy analysis model provided by WaterNSW (see table 2)
- use the most recent pricing data to inform forecast wholesale electricity prices and forecast price of large-scale generation certificates (LGCs). This would be data sampled on 28 September 2022.

Compared to our June 2022 review, we recommend no change to:

- the pumping profile, and
- the variable energy parameter 1.64 MWh/ML.

Based on these changes, the total energy costs based on the CIE's supplementary recommendations are shown in table 3 alongside previous WaterNSW proposals, the IPART draft decision and the applying CIE's supplementary recommendations with the exception of using March 2022 sampled forecast wholesale electricity prices and forecast LGCs.

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12 The CIE 2022, 'Water NSW's Broken Hill Pipeline: Bulk Water Transport Volume Demand and Energy Review Final Report', June, https://www.ipart.nsw.gov.au/documents/consultant-report/consultant-report-cie-water-nsws-broken-hill-pipeline-bulk-water-transport-volume-demand-and-energy-june-2022?timeline_id=14993, p. 43.

3 Forecast benchmark electricity costs

	2022-23	2023-24	2024-25	2025-26	Total
	$'000	$'000	$'000	$'000	$'000
WaterNSW proposal (30 June 2021)	1 563	1 551	1 544	1 537	6 194
IPART draft decision	1 188	1 183	1 177	1 170	4 718
WaterNSW revised proposal (9 September 2022)	3 538	2 483	2 131	2 091	10 242
31 March 2022 of wholesale electricity and LGCs data [a]	1 996	1 889	1 813	1 803	7 502
CIE supplementary recommendation [b]	2 846	2 294	1 986	1 983	9 108

[a] Estimates are based on CIE recommendations, with the exception of wholesale electricity and LGCs price data, which is sampled on 31 March 2022, as opposed to the CIE's recommendation to use the most recent data.

[b] Assumes forecast Essential Water bulk water transport volumes of 5 549 ML in 2022-23, 5 527 ML in 2023-24, 5 505 ML in 2024-25, 5 484 ML in 2025-26; losses at the bulk supply facility of 390 ML per annum, and other offtake bulk water transport volumes of 4 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', June; IPART 2022, 'Draft Determination - Maximum prices for water and wastewater services supplied by Essential Energy in Broken Hill', June; WaterNSW 2022, 'Response to the IPART Draft Determination on the Review of Broken Hill Pipeline Prices from 1 January 2023', September; CIE.

End-of-period energy true-up

WaterNSW's original submission proposed an end-of-period energy benchmark true-up that includes wholesale electricity costs and network charges. IPART's draft determination provided in-principle support, given that this approach is consistent with 'cost pass-through' principles.

In WaterNSW's Draft Decision response it also proposed that an **end-of-period** energy benchmark true-up also include additional cost items:[13]

- Renewable energy schemes (including large scale generation certificates ("LGCs"), small scale technology certificates ("STCs") and the costs for the NSW Energy Savings Scheme ("ESS")
- Reliability and Emergency Reserve Trader ("RERT") charges
- Compensation claims for directed generators under clause 3.15.7B of the NER (generator compensation charges), and
- Other costs / charges that may be introduced (e.g. capacity payments).

WaterNSW states that the additional cost-true-up elements are necessary due to the recent energy market events.[14]

There is a trade-off between a true-up mechanism and incentive-based regulation. Namely, implementing regulatory incentives for a utility to reveal its efficient costs over time, noting WaterNSW has some ability to influence its costs via contract

13 WaterNSW 2022, 'Response to the IPART Draft Determination on the Review of Broken Hill Pipeline Prices from 1 January 2023, September, p. 17

14 WaterNSW 2022, 'Response to the IPART Draft Determination on the Review of Broken Hill Pipeline Prices from 1 January 2023, September, p. 17

renegotiation[15], while customers have no ability to influence actual costs. As the Pipeline operation matures, revealed costs allows for an assessment of WaterNSW's cost minimisation strategies, as would be the case in a competitive environment.

At one extreme, WaterNSW's proposed benchmark energy cost build up, along with an all-encompassing true-up mechanism, provides no incentive for WaterNSW to reveal efficient costs and achieve efficiencies. Instead, WaterNSW is incentivised to maintain the status quo and possibly pay a price premium due to incumbency, as has been the case with retail customers who remained on regulated standard retail contracts and not sought to renegotiate to more competitive market retail contracts. [16] [17]

On balance, we consider an end-of-period true up mechanism for benchmark energy costs, with the inclusion of wholesale and network costs to be reasonable, given:

- the materiality of these costs and potential future price volatility
- robust, ex-ante and ex-post wholesale and network benchmark costs are widely available, and published by reputable sources, and
- exclusion of other costs facilitates incentive-based regulation.

In regards to the other items (e.g. RERT charges and generation compensation charges) suggested by WaterNSW for inclusion in the end-of-period true-up, we do not support their inclusion in the end-of-period true-up. While some of these cost elements are set by AEMO and outside WaterNSW control these costs cannot be forecast in advance for inclusion as part of WaterNSW's revenue requirement. These costs are best considered separate and WaterNSW has the opportunity to argue these case for recovering these costs at the next determination, if they eventuate during the 2022 determination period.

There is merit in considering whether a end-of-period true-up methodology can be articulated for the final determination. This may allow WaterNSW to specifically identify risks that it would need to manage which may not be fully compensated in the next determination.

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15 Or even the threat of contract renegotiation.

16 Retailers may offer retail customers two types of contracts standard retail contracts and market retail contacts. Standard retail contracts include set terms and conditions, including prices, as stated in the National Energy Customer Framework and cannot be changed by the retailer. Retail customers are most likely to be on a standard retail contract if you have never changed retailers or if you haven't contacted a retailer about an energy contract. Market retail contracts have a minimum set of terms and conditions, but other terms and conditions can vary from contract to contract, such as price. Refer to https://www.aer.gov.au/consumers/choosing-an-energy-retailer/energy-contracts.

17 In 2018, the difference between the median standing offer and the best market offer for a representative consumer was between $273 (in the ACT) and $832 (in South Australia). High tariffs associated with such standing offers are sometimes referred to as a 'loyalty tax' that is imposed on consumers who remain on, or end up on, a standing offer. Refer to, Australian Competition and Consumer Commission 2018, 'Restoring electricity affordability and Australia's competitive advantage: Retail Electricity Pricing Inquiry—Final Report', June, p. 241, https://www.accc.gov.au/system/files/Retail%20Electricity%20Pricing%20Inquiry%E2%80%94Final%20Report%20June%202018_0.pdf

IPART will also need to consider whether any costs included in the end-of-period true-up should be excluded from the efficiency carryover mechanism. The argument for including the end-of-period true-up is that the energy costs are outside WaterNSW's control. The purpose of the ECM is to incentivise utilities to achieve efficiencies and cost savings which can then be carried-forward for a specified period. Given that WaterNSW argues that it doesn't control these costs, then it is not clear why energy costs should be included in the ECM.

1 Supplementary pipeline energy assessment

Fixed and variable energy demand

WaterNSW reiterate in their Draft Decision response that the 6.39 MWh per day (fixed) and 1.64 MWh/ML (variable) energy parameters are used to determine energy use and ultimately energy price allowances. WaterNSW quotes and add emphasis to a partial sentence in our previous report to conclude we agreed with WaterNSW's proposal. The partially quoted sentence read

> "[The 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."[18]

Our full conclusions and recommendations are summarised in boxes 1.1 and 1.3 respectively.[19]

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18 The CIE 2022, 'Water NSW's Broken Hill Pipeline: Bulk Water Transport Volume Demand and Energy Review Final Report', June, p. 6, https://www.ipart.nsw.gov.au/documents/consultant-report/consultant-report-cie-water-nsws-broken-hill-pipeline-bulk-water-transport-volume-demand-and-energy-june-2022?timeline_id=14993

19 The CIE 2022, 'Water NSW's Broken Hill Pipeline: Bulk Water Transport Volume Demand and Energy Review Final Report', June, pp. 6-7, 24-29, https://www.ipart.nsw.gov.au/documents/consultant-report/consultant-report-cie-water-nsws-broken-hill-pipeline-bulk-water-transport-volume-demand-and-energy-june-2022?timeline_id=14993

1.1 Fixed and variable energy demand – CIE June 2022 conclusions

- Water NSW's assumed variable and fixed energy parameters are modelled outcomes, derived following an engineering assessment during the 2019 Pipeline price review.[20] The 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, we understand that the modelled energy parameters are based on a design concept and have not been verified by Water NSW, or the Pipeline operator, post operation commencement and, therefore, consider it prudent to assess Water NSW's assumed forecast fixed and variable energy profiles against actual data.
- Future energy use parameters can be estimated by regressing actual energy consumption data on pumping data.[21] Using monthly data provided by WaterNSW[22], this shows WaterNSW's proposed fixed energy parameter (represented by the intercept) is (table 1.2):
  - at the most upper bound of the 95 per cent confidence interval
  - not statistically significant at the 10 per cent significance level, and
  - therefore, that actual fixed energy consumption is likely to be lower than WaterNSW's proposed fixed parameter.

1.2 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.

20 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

21 $Monthly\ electricity\ consumption = \beta 0 + \beta 1\ ML\ pumped$

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

1.3 Fixed and variable energy demand – CIE June 2022 recommendations

Given the fixed and variable energy parameters have a significant flow-on impact to the pumping profile, and ultimately the benchmark forecast electricity costs, our full list of recommendations were:[23]

- WaterNSW provide substantiating evidence that the modelled 6.39 MWh/day parameter reflects actual energy use, with substantiating evidence including, but is not limited to, an engineering assessment, and
- the fixed and variable energy parameters are subject to an engineering assessment at the next Pipeline review.

Of interest, the monthly energy use data regression in table 1.2 shows a large standard error of 13.1, attributed to the low number of data points (12) used in the analysis. In turn, the large standard error explains the sizable range between the upper and lower 95% confidence intervals, and the fixed energy coefficient parameter not being statistically significant.

A linear regression[24] using daily energy use data with 823 observations provided by WaterNSW[25], produces statistically significant[26] lower and upper 95% confidence intervals of (0.2163 to 0.4968 respectively) for the fixed energy parameter (table 1.4). IPART made its energy parameter draft decisions on this daily data.

1.4 Regression analysis output for daily electricity consumption and ML pumped

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	0.357	0.071	4.991	0.000	0.216	0.497
ML pumped	1.546	0.004	386.908	0.000	1.538	1.553

Notes: Adjusted R Square is 0.9945. Coefficients calculated using daily electricity data for the period 1 July 2019 to 30 September 2021.

Sources: Water NSW 2021, 'Pumping and energy profile Jul 19 – Sept 21'; CIE.

A key issue is why analysis of both the monthly and daily actual energy use data submitted by WaterNSW results in a significantly lower fixed energy parameter, than the previously determined 6.39MWh/day?

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23 The CIE 2022, 'Water NSW's Broken Hill Pipeline: Bulk Water Transport Volume Demand and Energy Review Final Report', June, pp. 7, 31-32, https://www.ipart.nsw.gov.au/documents/consultant-report/consultant-report-cie-water-nsws-broken-hill-pipeline-bulk-water-transport-volume-demand-and-energy-june-2022?timeline_id=14993

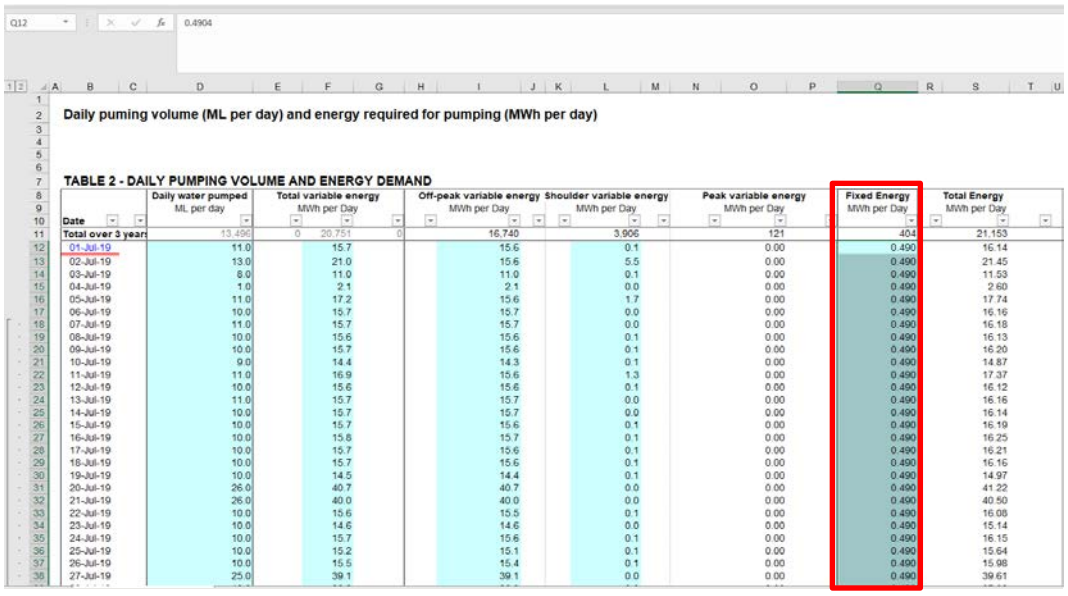
24 $Daily\ electricity\ consumption = \beta 0 + \beta 1\ ML\ pumped$

25 Via email, excel file 'Pumping and energy profile Jul 19 – Sept 21'

26 At the 5 per cent significance level

WaterNSW advise the electricity use data submitted in the Water NSW's Pipeline Annual Information Return[27] cannot be broken down to fixed and variable energy use and total electricity use is, therefore, included only in the variable section. However, a fixed energy parameter of 0.4904 MWh/day is hardcoded in the daily energy use data 'pumping and energy profile Jul 19 – Sept 21' (column Q, red box), provided by WaterNSW for all 823 days (1 July 2019 to 30 September), and used by IPART to inform their draft decision (chart 1.5).

1.5 Excerpt of WaterNSW daily energy use data



Daily puming volume (ML per day) and energy required for pumping (MWh per day)

TABLE 2 - DAILY PUMPING VOLUME AND ENERGY DEMAND

Date	Daily water pumped ML per day	Total variable energy MWh per Day	Off-peak variable energy MWh per Day	Shoulder variable energy MWh per Day	Peak variable energy MWh per Day	Fixed Energy MWh per Day	Total Energy MWh per Day
Total over 3 years	13,496	0 26,751 0	16,740	3,906	121	404	21,153
01-Jul-19	11.0	15.7	15.6	0.1	0.00	0.490	16.14
02-Jul-19	13.0	21.0	15.6	5.5	0.00	0.490	21.45
03-Jul-19	8.0	11.0	11.0	0.1	0.00	0.490	11.53
04-Jul-19	1.0	2.1	2.1	0.0	0.00	0.490	2.60
05-Jul-19	11.0	17.2	15.6	1.7	0.00	0.490	17.74
06-Jul-19	10.0	15.7	15.7	0.0	0.00	0.490	16.16
07-Jul-19	11.0	15.7	15.7	0.0	0.00	0.490	16.18
08-Jul-19	10.0	15.6	15.6	0.1	0.00	0.490	16.13
09-Jul-19	10.0	15.7	15.6	0.1	0.00	0.490	16.20
10-Jul-19	9.0	14.4	14.3	0.1	0.00	0.490	14.87
11-Jul-19	11.0	16.9	15.6	1.3	0.00	0.490	17.37
12-Jul-19	10.0	15.6	15.6	0.1	0.00	0.490	16.12
13-Jul-19	11.0	15.7	15.7	0.0	0.00	0.490	16.16
14-Jul-19	10.0	15.7	15.7	0.0	0.00	0.490	16.14
15-Jul-19	10.0	15.7	15.6	0.1	0.00	0.490	16.19
16-Jul-19	10.0	15.8	15.7	0.1	0.00	0.490	16.25
17-Jul-19	10.0	15.7	15.6	0.1	0.00	0.490	16.21
18-Jul-19	10.0	15.7	15.6	0.1	0.00	0.490	16.16
19-Jul-19	10.0	14.5	14.4	0.1	0.00	0.490	14.97
20-Jul-19	26.0	40.7	40.7	0.0	0.00	0.490	41.22
21-Jul-19	26.0	40.0	40.0	0.0	0.00	0.490	40.50
22-Jul-19	10.0	15.6	15.5	0.1	0.00	0.490	16.08
23-Jul-19	10.0	14.6	14.6	0.0	0.00	0.490	15.14
24-Jul-19	10.0	15.7	15.6	0.1	0.00	0.490	16.15
25-Jul-19	10.0	15.2	15.1	0.1	0.00	0.490	15.64
26-Jul-19	10.0	15.5	15.4	0.1	0.00	0.490	15.98
27-Jul-19	25.0	39.1	39.1	0.0	0.00	0.490	39.61

Data source: Water NSW 2021, 'Pumping and energy profile Jul 19 – Sept 21'

We previously sought clarification from WaterNSW in October 2021[28] on:

- the underlying calculations for the fixed energy use of 0.4904 MWh/day, hardcoded in column Q of the "pumping and energy profile 19 – Sept 21" excel file calculated (red box in chart 1.5), and
- the discrepancy between stated actual monthly energy use in the Annual Information Return data,[29] and implied electricity use assuming a fixed 6.39 MWh/day energy parameter. Specifically, we noted:
  - 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, with a constant discrepancy across all months (difference between the teal and red lines in chart 1.6), and

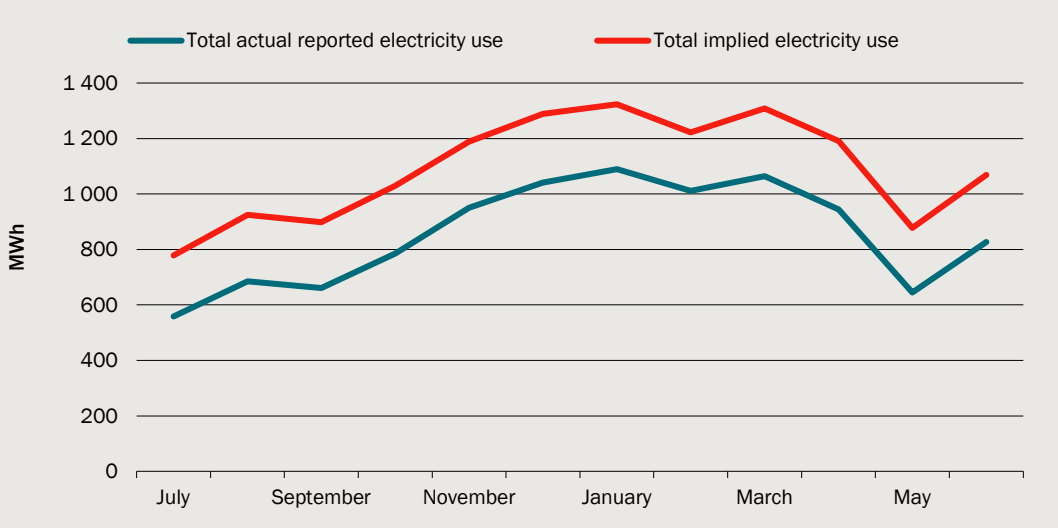
27 Water NSW 2021, 'Attachment 4 – Water NSW (Pipeline) AIR/SIR 2021'

28 Via email, 'RE: Water NSW Broken Hill Pipeline Demand Review - Electricity use', dated 25 October 2021

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

– changing the fixed energy parameter from 6.39 MWh/day to 0, reduces the overestimation significantly (to 5 per cent), including the constant monthly difference (difference between the teal and red lines in chart 1.7).

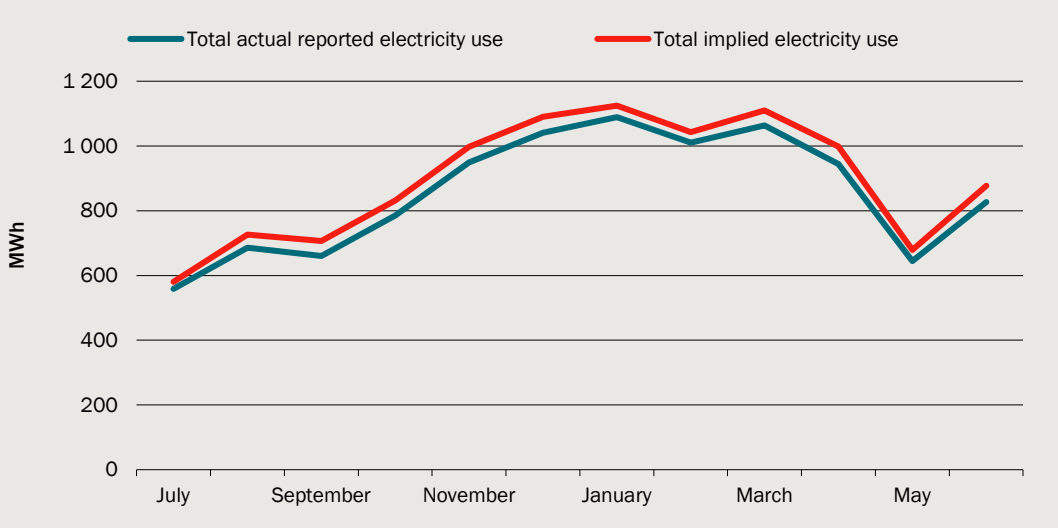
1.6 2019-20 actual reported monthly Pipeline electricity use compared to implied electricity use



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.

1.7 2019-20 actual reported monthly Pipeline electricity use compared to implied electricity use (no fixed energy use parameter)



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

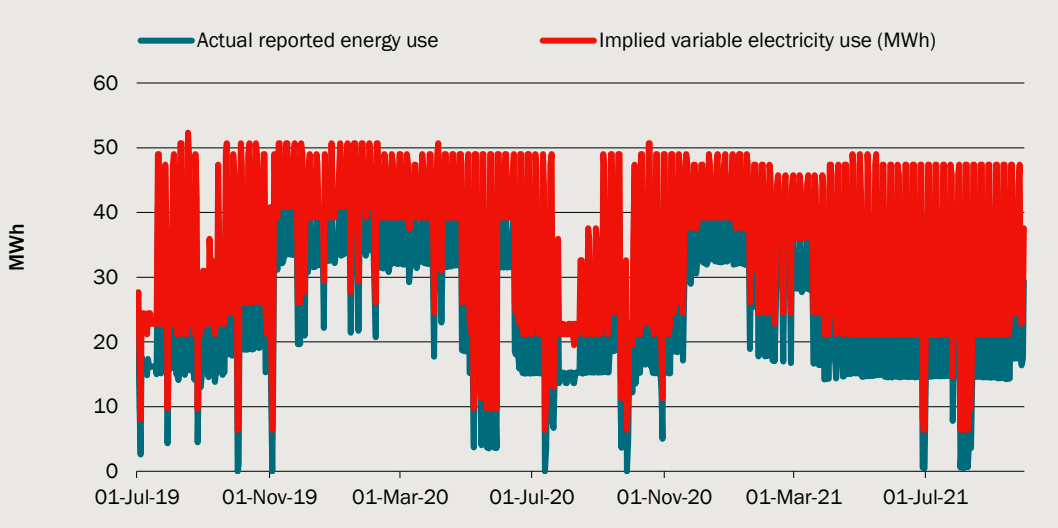
Data source: Water NSW 2021, 'Attachment 4 – Water NSW (Pipeline) AIR/SIR 2021'; CIE.

Changing the fixed energy parameter from 6.39 MWh/day to 0 in the daily energy use data provided by WaterNSW also:

- reduces the energy use overestimation from 30 per cent, to 5 per cent, and

- removes the constant difference between actual energy use and implied energy use (difference between the teal and red lines in charts 1.8 and 1.9).

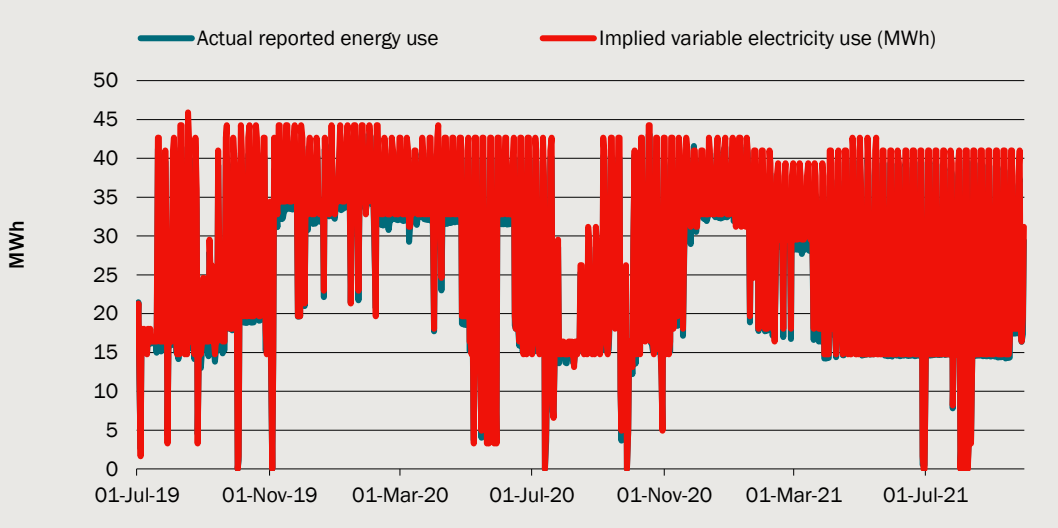
1.8 Actual reported daily Pipeline electricity use compared to implied electricity use



Note: The implied fixed electricity use calculated assuming 6.39 MWh/day and the implied variable electricity use calculated assuming 1.64MWh/ML, for the period 1 July 2019 to 1 July 2019 to 30 September.

Data source: Water NSW 2021, 'Pumping and energy profile Jul 19 – Sept 21'; CIE

1.9 Actual reported daily Pipeline electricity use compared to implied electricity use (no fixed energy use parameter)



Note: The implied fixed electricity use calculated assuming 0 MWh/day and the implied variable electricity use calculated assuming 1.64MWh/ML, for the period 1 July 2019 to 1 July 2019 to 30 September.

Data source: Water NSW 2021, 'Pumping and energy profile Jul 19 – Sept 21'; CIE

WaterNSW did not provide a written response to our queries, except to assert in their Draft Decision response that:[30] [31]

- the fixed load estimate of 6.39 MWh per day was derived using a bottom-up analysis of the energy use requirements of the equipment at the pipeline facilities and pumping stations, and
- IPART's analysis for the 2022 Draft Determination does not invalidate the prior determination's detailed bottom-up approach to determining fixed load.

We note WaterNSW's comments that an engineering assessment is more likely to produce a robust energy use parameter. It is possible that the energy use data provided by WaterNSW is incomplete, with uncertainty around the basis of the fixed energy parameter included in the daily energy use data provided. It is also telling that exclusively changing the fixed energy parameter from 6.39 MWh/day to 0, reduces the overestimation significantly using both the WaterNSW monthly and daily energy use data, including the constant monthly/daily differences.

However, the onus is on WaterNSW to provide substantiating evidence to justify the forecast energy use parameters. Instead, WaterNSW's own submitted energy use data strongly indicates that the 6.39MWh/day figure overestimates fixed forecast energy consumption, when compared to reported actual energy use. Specifically, the overestimation is due to WaterNSW's fixed energy use data inputs of 0.4904 MWh/day, for all the reported 823 days (11 July 2019 to 30 September 2021).

We communicated the data shortcomings and plausible conclusions that could be derived from them to WaterNSW in October 2021 WaterNSW is, therefore, aware of the limitations.

A lower fixed energy parameter, as per IPART's Draft Decision, therefore, provides an incentive for WaterNSW to provide:

- verified and accurate energy use data to IPART, with a supporting basis of preparation, and
- substantiating evidence to justify the 6.39 MWh/day figure.

We note WaterNSW's comment that the modelled fixed load sets the max demand (0.27MW) in the peak and shoulder periods.[32] As such, a lower fixed energy use parameter must be accounted for in the pumping profile and associated energy costs. Electricity costs are calculated in the energy analysis model provided by WaterNSW, for which we estimate electricity consumption based on the IPART pumping model and

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30 Water NSW 2022, 'Response to the IPART Draft Determination on the Review of Broken Hill Pipeline Prices from 1 January 2023', September, p. 31

31 After reading an advanced final draft of this Supplementary report, WaterNSW responded that at a meeting on 27 October 2021, WaterNSW verbally advised, "the [0.4904 MWh/day figure] requires further validation and testing and was not independently verified (more analysis is needed to ensure the figure is appropriate for pricing purposes)."

32 Water NSW 2022, 'Response to the IPART Draft Determination on the Review of Broken Hill Pipeline Prices from 1 January 2023', September, p. 31

forecast demand and electricity prices. The pumping profile is discussed in the following section.

Energy pumping profile

WaterNSW Draft Decision response reiterated their concerns around using a stylised pumping model to identify the pumping profile for the determination period, although they accept the use of a benchmark pumping profile for the determination.

They argue there are a range of factors which affect the setting the pumping schedule, which may not have been accounted for the in the stylised model. These factors include:[33]

- Contractual considerations and required minimum volumes/availability (i.e. peak day, peak week, peak months, peak season, peak year conditions);
- Operational considerations such as planned maintenance and or planned/unplanned outages;
- Demand factors including Essential Water's forecast, current usage, historical usage, current water order and trends;
- Operational factors such as flow rates, current Bulk Water Storage (BWS) volumes, forecast and current power usage and periods; and
- Algal conditions in the Murray River and water quality conditions in the BWS.

WaterNSW also notes that pumping schedules are based on weekly forecasts, while monthly and yearly forecasts are used to help scheduling asset maintenance and operator leave.[34] They note it is not possible to manage pipeline operations using annual profiles used by the IPART model. By using annual demand and smoothing the pumping profile, they argue this does not reflect the operating context.[35]

WaterNSW have not provided a response of how the IPART model could be adjusted to take into account their concerns. Without additional information it is difficult to assess their claims that their current pumping arrangements, reflected in the historical pumping profile, are efficient. While their position may be true, there is limited evidence to support their position.

The pumping profile impacts on energy demand as well as maximum demand. WaterNSW note that little information was provided in the CIE's review regarding the assumptions used to determine maximum demand. WaterNSW also identified that maximum demand values reported in the Draft Determination are too high during peak periods, given the assumed fixed and variable energy consumption assumptions and

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33 Water NSW 2022, 'Response to the IPART Draft Determination on the Review of Broken Hill Pipeline Prices from 1 January 2023', September, p. 34

34 Water NSW 2022, 'Response to the IPART Draft Determination on the Review of Broken Hill Pipeline Prices from 1 January 2023', September, p. 36

35 Water NSW 2022, 'Response to the IPART Draft Determination on the Review of Broken Hill Pipeline Prices from 1 January 2023', September, p. 34

pumping capacity of the pipeline.[36] Overstated maximum demand during the peak may result in the shoulder maximum demand being understated.

We believe the IPART pumping model is preferred to using actuals for similar reasons outlined in our original review.[37] These are:

- 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.
- We cannot easily assess whether 2019-20 actual data reflects efficient pumping. Limited information is available around how pumping is determined. The IPART model allows us to determine a simplified stylised efficient pumping profile and lay out relevant assumptions. Overtime these assumptions may be improved to more accurately reflect pipeline constraints.
- The simulated pumping profile accounts for a wide range of factors which are likely to affect pumping.

We also recognise that the pumping profile will have smaller impact on costs included in the determination compared to other assumptions, such as demand, fixed and variable energy parameters and energy cost forecasts.

IPART pumping model

To assess the pumping profile, the CIE has used a simulated pumping model which was developed by IPART for the 2019 Murray River to Broken Hill Pipeline determination. The structure of the model and assumptions used to inform the CIE's

The structure of the model used as part of the CIE's previous review is outlined in box 1.10, and key assumptions are provided in box 1.11.

36 WaterNSW 2022, 'Response to the IPART Draft Determination on the Review of Broken Hill Pipeline Prices from 1 January 2023', September, p. 13.

37 The CIE 2022, 'Water NSW's Broken Hill Pipeline: Bulk Water Transport Volume Demand and Energy Review Final Report', June, https://www.ipart.nsw.gov.au/documents/consultant-report/consultant-report-cie-water-nsws-broken-hill-pipeline-bulk-water-transport-volume-demand-and-energy-june-2022?timeline_id=14993

1.10 IPART pumping model structure[38]

The model assumes that pumping is smoothed over the year, with the model seeking to pump over the year to meet expected annual demand (including losses), subject to constraints (the pipeline flow rate and minimum and maximum storage levels).

The model, used in our June 2022 review, operates in the following steps:

- **Step 1:** determine the average pumping required each day to meet demand if pumping at a constant rate (annual demand divided by days in the year)
- **Step 2:** calculate how much water is pumped each day based on bulk water storage constraints
  - we assume that storages are maintained between 60 and 100 per cent of capacity, based on advice from WaterNSW and observed storage levels.
    - if storages equal 60 per cent, pumping is set equal to daily demand (to avoid further depletion)
    - if storages are greater than 60 per cent but less than 100 per cent, pumping equals average daily demand (annual demand divided by days in the year)
    - if storages equal 100 per cent, pumping is set to keep storages at 100 per cent
  - daily pumping and water demand is used to update the storage volume each day
  - annual demand is broken into monthly demand using seasonal demand projections provided as part of the previous review. Daily demand within a given month is assumed to be uniform
- **Step 3:** allocate demand to off-peak, shoulder and peak periods based on pumping constraints (noted below). Pumping is prioritised to the off-peak, followed by the shoulder, with any residual pumping occurring in the peak.

38 The CIE 2022, 'Water NSW's Broken Hill Pipeline: Bulk Water Transport Volume Demand and Energy Review Final Report', June, Appendix C.

1.11 IPART pumping assumption

The following assumptions are made in the IPART model used as part of the CIE in our June 2022 review:[39]

- flow rate of 27 ML/day
- 98 per cent availability
- up to 14.65 ML off peak pumping on average per day (averaged over an entire week)
  - 55 per cent of any given week being off-peak periods (i.e. the entire weekend plus 9 hours a day on weekdays). This implies:
    - maximum off-peak pumping of 26.46 ML/day on weekends
    - maximum off-peak pumping of 9.92 ML/day on weekdays
- up to 7.88 ML shoulder pumping on average per day (averaged over an entire week which is based on:
  - 30 per cent of an entire week being shoulder periods (i.e. 10 hours a day on weekdays). This implies:
    - maximum shoulder pumping of 11.03 ML/day on weekdays
    - no shoulder pumping on weekends
- up to 3.94 ML peak pumping on average per day (averaged over an entire week) which is based on:
  - on average 15 per cent of a given week being peak periods (i.e. 5 hours a day on weekdays). This implies:
    - maximum peak pumping of 5.51 ML/day on weekdays
    - no peak pumping on weekends

As we noted in the previous review, we recognise that some determinants of an efficient pumping profile may not be characterised in the IPART model.[40] For this reason we recommended that the model is further refined in consultations with WaterNSW at the next Pipeline review.

Table 1.12 summarises the key factors which affect pumping identified by WaterNSW and how they are accounted for in the IPART pumping model. We believe that most of the factors which affect pumping can be accommodated in a stylised model. When these factors can be quantified, they should be included in the model. However no additional quantitative information has been provided by WaterNSW to allow us to adjust the assumptions used in our June 2022 review (see box 1.11). We recognise that in the future additional information may become available which would allow modelled constrained to more accurately reflect actual constraints or operational considerations.

39 The CIE 2022, 'Water NSW's Broken Hill Pipeline: Bulk Water Transport Volume Demand and Energy Review Final Report', June, Appendix C.

40 The CIE 2022, 'Water NSW's Broken Hill Pipeline: Bulk Water Transport Volume Demand and Energy Review Final Report', June, p. 36.

1.12 IPART pumping model – factors which affect pumping

Key factors to be reflected in pumping model	Treatment in IPART pumping model	Remaining gap
Contractual considerations and required minimum volumes/availability	Reflected by pumping and storage constraints, namely: ▪ 27 ML/day pumping ▪ 98 per cent availability ▪ Storage capacity and storage starting values ▪ Storages maintained between 60 and 100 per cent of capacity	
Operational considerations (maintenance and outages)	Reflected by: ▪ 98 per cent availability	Discussions with WaterNSW have implied that the pipeline availability may be lower on weekends
Demand factors including Essential Water's forecast, current usage, historical usage, current water order and trends	Annual demand is directly incorporated into pumping forecasts, including evaporation Annual demand is broken into monthly demand using seasonal demand projections provided as part of the previous review. Daily demand within a given month is assumed to be uniform	Within a month demand may not be uniformly distributed Actual pumping is planned from week to week, based on weekly water orders. It is not clear in practice how this information is combined with storage levels to determine pumping for WaterNSW, and how this could be incorporated in the IPART pumping model.
Operational factors such as flow rates, current Bulk Water Storage (BWS) volumes, forecast and current power usage and periods; and	Reflected by pumping and storage constraints, namely: ▪ 27 ML/day pumping ▪ 98 per cent availability ▪ Storage capacity and starting values ▪ Storages maintained between 60 and 100 per cent)	Discussions with WaterNSW have implied that operational factors on weekends may affect pipeline availability
Algal conditions in the Murray River and water quality conditions in the BWS	Reflected by pumping constraints, namely: ▪ Storages maintained between 60 and 100 per cent of capacity (allows cell 1 to remain full)	Unknown whether there are other requirements to manage water quality

Source: CIE

We believe there are two gaps which could affect results:

- During consultations WaterNSW indicated that there may be operational factors, not accounted in the IPART model which may affect pipeline availability on weekends or off-peak periods more generally. For example, if equipment fails during an off-peak period, it may take longer to fix outside of business hours resulting in lower pipeline availability. WaterNSW have not provided an estimate or how these would affect the 98 per cent pipeline availability.
  - We have undertaken sensitivity analysis to consider how changing pipeline availability during off-peak periods affects the pumping profile. To match the actual 2019-20 off-peak pumping would require a pipeline availably of around 90 per cent during off-peak periods. This would require disruption during off-peak

periods to take 5 times longer to resolve. We do not currently have any data or information to inform whether this difference in availability between off-peak and other times is reasonable.

- The IPART model smooths pumping over a year, while the pumping plan for the pipeline is set on a weekly basis. Whether this has an impact on the pumping profile depends on how the weekly pumping plan takes into account storage levels. The IPART model allows storages to vary across the year. If actual pumping plan is conditioned on storage levels, we would expect actual pumping to be similar to the smoothed profile.

1.13 2019-20 pumping profile by

	Actuals	IPART model				
		98% off-peak availability	96% off-peak availability	94% off-peak availability	92% off-peak availability	90% off-peak availability
	Per cent of total	Per cent of total	Per cent of total	Per cent of total	Per cent of total	Per cent of total
Peak	0.09	0.95	1.15	1.35	1.55	1.75
Shoulder	24.50	18.23	19.47	20.71	21.95	23.26
Off-peak	75.41	80.82	79.38	77.94	76.50	74.99
Demand, ML	**6149**	**6149**	**6149**	**6149**	**6149**	**6149**

Source: 2019-20 based on actuals, CIE.

Maximum demand estimate

For the purpose of the CIE's review, maximum demand was estimated using the energy analysis model provided by WaterNSW. This takes forecast demand and scales it by the proposed pumping profile (we recommend using the IPART pumping profile) to provide estimates of the energy electricity consumption and maximum demand for the peak, shoulder and off-peak. Maximum demand for each period is calculated by dividing MWh by the number of hours in each period.

We have made two adjustments to the energy analysis model provided by WaterNSW (compared to our earlier review):[41]

- The number of hours in each period is adjusted to allow 9 off-peak hours, 10 shoulder hours and 5 peak hours on weekdays, which is consistent with the WaterNSW pricing proposal.[42] The model previously allowed 9 off-peak hours, 12 shoulder hours and 3 peak hours per day.
- The model was adjusted to cap the total pumping volume per hour to be consistent with pipeline capabilities (i.e. 27 ML/day and 98 per cent availability). This adjustment was made to resolve an error identified by WaterNSW.

41 Note this energy analysis model provided was also used to inform the CIE's analysis for the Draft Determination.

42 WaterNSW 2021, 'WaterNSW Pricing Proposal for the Wentworth to Broken Hill Pipeline', June, p. 110.

Based on these adjustments the maximum demand values are reported in table 1.14, for the WaterNSW submission estimates and CIE Review estimates. Updated values, which include the two adjustments noted above are shaded in teal.

The correction for the number of periods in the peak and shoulder result in a higher shoulder and lower peak maximum demand than WaterNSW's submission estimate. Correcting for the designed pumping capacity also reduces WaterNSW off-peak estimated maximum. The CIE review numbers change significantly as a result for correcting for hourly pumping constraint. The gap between the updated CIE Review estimates and updated WaterNSW estimates are due to differences in demand, pumping profile and fixed energy consumption parameter.

1.14 Maximum demand 2022/23

Period	WaterNSW Submission	WaterNSW Submission – updated by CIE	CIE Review (IPART assumptions)	CIE Review (IPART assumptions) – updated by CIE
	MW	MW	MW	MW
Off-peak	2.09	2.07	3.57	1.83
Shoulder	1.73	2.02	0.58	1.66
Peak	0.30	0.29	0.03	0.03

Note: Maximum demand varies between WaterNSW and CIE Review (IPART assumptions) due to differences in demand, pumping profile and fixed energy consumption.

Source: CIE, Water NSW 2022, 'Response to the IPART Draft Determination on the Review of Broken Hill Pipeline Prices from 1 January 2023', September, p. 37, Frontier Pipeline energy costs model.

Given maximum demand depends on demand, pumping profile and the fixed energy consumption parameter, we recommend using the value which is consistent with the full range of assumptions (the rightmost column in table 1.14).

Updated energy price forecast

WaterNSW has used the same cost-build up approach to forecast the possible cost of electricity and complying with the LRET for the upcoming determination period, with updated input data to 30 June 2022. WaterNSW contend the use of the latest available data is best practice.

WaterNSW has provided estimates for future prices, based on market data sampled at different points in time.

- Wholesale costs are shown in table 1.15, compared to the 2021 WaterNSW submission and the values recommended in the CIE review. They are estimated using the same approach which is described in the CIE Review.[43]
- The cost of complying with the LRET is shown in table 1.16. The costs is estimated based on the forecast price of large-scale generation certificates (LGCs).

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43 The CIE 2022, 'Water NSW's Broken Hill Pipeline: Bulk Water Transport Volume Demand and Energy Review Final Report', June, https://www.ipart.nsw.gov.au/documents/consultant-report/consultant-report-cie-water-nsws-broken-hill-pipeline-bulk-water-transport-volume-demand-and-energy-june-2022?timeline_id=14993, pp. 40-43.

Since November 2021 the forecast electricity cost for WaterNSW has increased by almost a factor of 4 for 2022-23. Costs are expected to fall in forward years, but are expected to remain around 2 times higher than was expected in November 2021.

These forecasts, based on market transactions, reflect the cost of purchasing future electricity contracts at a given point in time. This should therefore give an indication of expected future spot price given information available at that point in time.

In our previous review we concluded that Frontier Economics' wholesale electricity forecast approach is reasonable, as it accounts for historical data and publicly available future forecast contract prices.[44]

1.15 Forecast wholesale electricity costs

Scenario	2022-23	2023-24	2024-25	2025-26
	$/MWh	$/MWh	$/MWh	$/MWh
WaterNSW 2021 submission (based on May 2021 data)	51.80	52.99	52.99	52.99
CIE review recommendation (based on 2 November 2021 data)	51.17	52.33	52.33	52.33
31 March 2022	114.93	102.82	94.44	92.13
WaterNSW revised proposal (based on 30 June 2022 data)	193.72	117.11	92.15	90.95
Most recent forecast (based on 28 September 2022 data)	192.32	137.74	107.93	105.95

Source: Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE - STC"; WaterNSW 2022, "22-09-28-DJP BH Pipeline energy costs - CIE scenarios", CIE.

The fluctuations in costs of complying with the LRET vary somewhat overtime, but by considerably less than wholesale costs. Accordingly, the impact of when to sample LGC contracts has a much smaller impact on total costs.

1.16 Estimated cost of complying with LRET

Scenario	2022-23	2023-24	2024-25	2025-26
	$/MWh	$/MWh	$/MWh	$/MWh
WaterNSW 2021 submission	4.21	2.62	2.62	2.62
CIE review recommendation	6.74	5.86	5.86	5.86
31 March 2022	8.54	7.66	6.48	5.11
WaterNSW revised proposal (based on 30 June 2022 data)	9.61	8.44	7.21	6.12
Most recent forecast (based on 28 September 2022 data)	10.63	9.72	8.16	7.01

Note: 31 March 2022, WaterNSW revised proposal (based on 30 June 2022 data) and Most recent forecast (based on 28 September 2022 data) are based on the 2022 renewable power percentage (RPP) is 18.64 per cent, which differs from the values used in the WaterNSW 2021 submission (18.83 per cent) and CIE review recommendation (18.54 per cent).

Source: Water NSW 2021, "RFI 2-3 BH Pipeline energy costs - Data request for IPART CIE - STC"; WaterNSW 2022, "22-09-28-DJP BH Pipeline energy costs - CIE scenarios", CIE.

44 The CIE 2022, 'Water NSW's Broken Hill Pipeline: Bulk Water Transport Volume Demand and Energy Review Final Report', June, https://www.ipart.nsw.gov.au/documents/consultant-report/consultant-report-cie-water-nsws-broken-hill-pipeline-bulk-water-transport-volume-demand-and-energy-june-2022?timeline_id=14993, p. 43.

Ideally data closest to the start of the determination period would be used to inform the determination. This will reflect the most up to date estimate of the cost purchasing electricity over the determination period.

This is however complicated by the delay of the determination. IPART has indicated that WACC market observations will be sampled to using data to the end of March 2022 (data to the end of December 2021was used for the IPART Draft Determination). Noting the merit of using the most up to date information, we recognise that IPART may want to consider consistency of the approach to sampling market information within the review, as well as the approach taken by IPART in the past where determinations have been delayed.

Picking alternative historical data would change the balance of risks between WaterNSW and its customers. Using a forecast lower than current forecasts in the determination would reallocate risks from customers to WaterNSW, given current forecasts are higher. Discussion of the end-of-period true-up for wholesale electricity prices is presented below. This approach would reduce the risks for NSW, given that these prices are outside its control.

End-of-period energy true-up

WaterNSW's Draft Decision response proposes an **end-of-period** energy benchmark true-up that includes:[45]

1 Wholesale electricity costs

2 Network Charges

3 Renewable energy schemes (including large scale generation certificates ("LGCs"), small scale technology certificates ("STCs") and the costs for the NSW Energy Savings Scheme ("ESS")

4 Reliability and Emergency Reserve Trader ("RERT") charges

5 Compensation claims for directed generators under clause 3.15.7B of the NER (generator compensation charges), and

6 Other costs / charges that may be introduced (e.g. capacity payments).

WaterNSW's proposed true-up differs to its original proposal of an **end -of-year true up** that only included wholesale and network charges. WaterNSW state the additional cost-true-up elements:

- are necessary due to the recent national electricity market (NEM) events,[46] which we interpret to be:
  - the Australian Energy Market Operator's (AEMO's):

45 WaterNSW 2022, 'Response to the IPART Draft Determination on the Review of Broken Hill Pipeline Prices from 1 January 2023, September, p. 17

46 WaterNSW 2022, 'Response to the IPART Draft Determination on the Review of Broken Hill Pipeline Prices from 1 January 2023, September, p. 17

    - temporary 9-day suspension of the National Electricity Market Wholesale spot market (for the period 15 June 2022,[47] to 24 June 2022[48]), and
    - reliability interventions over the period 12 June 2022, to 23 June 2023
  - electricity generation reliability gaps in the transition to renewable energy,[49] and
  - large increases to electricity generators input coal and natural gas prices.[50]
- are beyond WaterNSW's control as they are determined by independent regulators, or AEMO and levied on market participants on the occurrence of uncertain and uncontrollable events, [51] and
- meet IPART's cost pass through thresholds, including whether the costs have potentially high volatility.[52]

For all regulated utilities, there are a range of inputs to the regulatory determinations which are not known with certainty. Regulatory determinations require forecast estimates to be made, for example, on costs, customer numbers, customer demand and the weighted cost of capital.

In most cases the regulatory determinations are explicitly structured so that there are clear incentives for utilities to achieve efficiencies which they can retain for the regulatory period. If actuals, rather than efficiency benchmark forecasts, are adopted then there is limited incentive for utilities to deliver services in an efficient manner.

Over the time there has been acceptance by regulators that some regulatory inputs are challenging to forecast and that adopting benchmark forecasts can sometimes have perverse outcomes (e.g. impact on utilities' financeability). In some cases, therefore, regulators have adopted true-up mechanisms which allow *actual* costs to be passed

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47 'Australian Energy Market Operator (AEMO) 2022, 'AEMO suspends NEM Wholesale Market', https://aemo.com.au/newsroom/media-release/aemo-suspends-nem-wholesale-market

48 'Australian Energy Market Operator (AEMO) 2022, 'AEMO lifts market suspension',https://aemo.com.au/newsroom/media-release/aemo-lifts-market-suspension

49 AEMO identifies periods when electricity supply won't meet demand due associated with a combination of unavailability of generation/transmission, delays in commissioning of new generation, storage and transmission, generation retirements and increasing demand (electrification). Refer to, Australian Energy Market Operator (AEMO) 2022, '2022 Electricity Statement of Opportunities: A report for the National Electricity Market', August, https://www.aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/nem_esoo/2022/2022-electricity-statement-of-opportunities.pdf?la=en&hash=AED781BE4F1C692F59B1B9CB4EB30C4C

50 For example wholesale gas prices across the east coast markets averaged $28.40 per gigajoule (GJ), compared to $8.20/GJ in Q2 2021, as stated in AEMO 2022, 'High international commodity pricing, coal outages, and rising gas-fired generation drives record prices for Q2 2022', https://aemo.com.au/newsroom/media-release/quarterly-energy-dynamics-report-for-q2-2022

51 WaterNSW 2022, 'Response to the IPART Draft Determination on the Review of Broken Hill Pipeline Prices from 1 January 2023, September, p. 17

52 WaterNSW 2022, 'Response to the IPART Draft Determination on the Review of Broken Hill Pipeline Prices from 1 January 2023, September, p. 17

through to customers. For example, IPART has refined its approach to accounting for changes in the cost of debt in the application of the WACC.[53] IPART has also considered a 'demand volatility mechanism' in its regulatory decisions for urban water utilities.[54]

These decisions have typically focused on the materiality of the item, the potential volatility of the item and the extent to which the utility can control it. The treatment of energy costs in IPART's 2017 price determination for the Sydney Desalination Plant provides a useful reference point. Box 1.17 presents IPART's view on the treatment of energy costs in the determination.

1.17 IPART 2017 Sydney Desalination Plant Determination[55]

"We do not agree that passing through SDP's actual energy costs (in part or in full) would achieve an efficient allocation of risk between SDP and customers and, as a result, our view is that setting energy cost allowances based on SDP's energy contract prices is unlikely to be in the best long-term interests of SDP's customers.

We have decided to maintain our approach of setting energy cost allowances based on an efficient market-based benchmark for the following reasons:

- Our market-based energy cost allowances will better reflect the market price of energy over time. With our approach, customers can expect to pay the efficient market price of energy required to efficiently run the plant over time rather than SDP's contract costs which may or may not be efficient. While SDP's contract prices are fixed and are therefore less volatile than market price, the more relevant consideration is whether SDP's contracts are higher or lower than market prices, on average, over the long term.
- Under our approach, which we maintain over the 2012 and 2017 determination periods, SDP has a strong incentive to meet or beat our estimate of the market price because it is able to keep any gains it is able to generate by doing this. Under SDP's approach, SDP would no longer have a strong incentive to prudently manage its energy costs because these costs would be passed through to customers. We consider SDP's approach would result in an inefficient allocation of risk between SDP and customers and could lead to SDP's customers being exposed to inefficient costs."

However, for the 2012 and 2017 determinations for SDP, IPART has developed a methodology to pass-through variable and fixed network charges determined by the AER to SDP's customers. SDP passes through:

53 https://www.ipart.nsw.gov.au/sites/default/files/documents/final-report-review-of-our-wacc-method-february-2018_0.pdf

54 https://www.ipart.nsw.gov.au/sites/default/files/cm9_documents/Draft-Technical-Paper-Demand-for-water-services-Central-Coast-water-prices-March-2022.PDF

55 See page 103, https://www.ipart.nsw.gov.au/sites/default/files/documents/final-report-sydney-desalination-plant-pty-ltd-review-of-prices-from-1-july-2017-to-30-june-2022_0.pdf

- energy network costs via two pass-through mechanisms: a Variable Network Charge (VNC)and
- a Fixed Network Charge (FNC).[56]

SDP's energy adjustment methodology is, however underpinned by a set of rules (terms of reference) that was specific to SDP.

There is an argument to adopt some form of energy pass-through mechanism for WaterNSW Broken Hill pipeline determination, given that these are material cost items which are volatile and the charges are outside WaterNSW's control (either driven by market forces or regulated by the AER).

For the draft determination, IPART agreed in principle to applying an end-of- period true-up which would make an adjustment to the revenue requirements to reflect differences in wholesale and network components of benchmark energy prices adopted for the 2022 determination and changes (in each year of the determination period) to the benchmarking energy price components. This would result in the cumulated changes in benchmark energy cost being passed-through at subsequent price review. IPART did not, however, set an explicit methodology for implementing this. IPART also noted that it could not bind a future Tribunal and, therefore, there is some uncertainty as to whether or how any cumulative changes would be passed-through into a future determination.[57]

We support IPART's decision in the draft report given that the wholesale and network energy prices are material, potentially volatile in the current market environment and largely outside WaterNSW control. However, we believe that there is merit in IPART considering further whether a true-up methodology can be developed for the final determination so as to provide clarity to WaterNSW. This may assist WaterNSW to clearly identify any risks that need to be managed.

As noted above WaterNSW's Draft Decision response also requested that additional energy cost elements should also be included in the end-of-period true-up. Our understanding is that items such as the RERT and generation compensation charges are highly uncertainty and cannot be forecasted upfront for inclusion as part of WaterNSW's revenue requirements. Therefore, they should not form part of the true-up adjustment but WaterNSW has scope to argue for recovering these costs as part of the next determination, if these costs eventuate during the 2022 determination period.

IPART will also need to consider whether any costs included in the end-of-period true-up should be excluded from the efficiency carryover mechanism. The argument for including the end-of-period true-up is that the energy costs are outside WaterNSW's control. The purpose of the ECM is to incentivise utilities to achieve efficiencies and cost savings which can then be carried-forward for a specified period. Given that WaterNSW argues that it doesn't control these costs, then it is not clear why energy costs should be included in the ECM. We, therefore, recommend excluding energy costs from the ECM.

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56 See page 113, https://www.ipart.nsw.gov.au/sites/default/files/documents/final-report-sydney-desalination-plant-pty-ltd-review-of-prices-from-1-july-2017-to-30-june-2022_0.pdf

57 IPART (2022), Draft Technical Report, p.33.

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