Seed Advisory

Surplus Electricity Sales Analysis

Report for Sydney Desalination Plant

1 September 2022

Contents

1 Executive Summary

1.1 Introduction

Sydney Desalination Plant Pty Ltd (SDP) has been deemed a monopoly supplier of non-rainfall dependent water. Consequently, the prices it charges to Sydney Water are determined every five years by the Independent Pricing and Regulatory Tribunal (IPART). SDP's current determination expires on 30 June 2023.

To assist SDP in their pricing determination for the next regulatory period they have engaged Seed Advisory Pty Ltd (Seed) to undertake an independent expert perspective of the potential risks and benefits of forward selling surplus electricity under their electricity supply agreement. The analysis and conclusions in this report are based on historic data,

This report summarises the findings of our analysis.

1.2 Overview of scope

In brief, the scope of this project was to prepare a report that discusses and advises on the risks and benefits of forward trading surplus electricity informed by actual historic data and relevant assumptions for the period 1 January 2017 to 30 June 2022.

This historic data analysis assists in understanding the extent to which SDP could reasonably expect to achieve improved outcomes by forward selling surplus electricity, and what this implies about SDP's ability to influence the potential size of gains and losses from the sale of surplus electricity.

Section 2.1 outlines the scope of work in further detail including the specific exclusions.

1.3 Overview of approach

Our approach involved calculating quarterly historic forward premiums for the period 1 January 2017 to 30 June 2022 based on actual spot prices and actual forward prices.

We also calculated the potential range of financial costs or benefits for hypothetical surplus sales strategies trading during four (4) quarters based on actual spot prices, forward prices and SDP consumption data. The quarters were chosen based on recent examples of events where SDP was requested to turn on at short notice to meet a production request from Sydney Water.

1.4 SDP's operating context

Our assessment involved consideration of the environment within which SDP operates. This includes SDP's electricity supply contract, it's operating regime and IPART's energy adjustment mechanism.

SDP is not an electricity trading business

Electricity trading can and does occur with some businesses actively buying and / or selling forward electricity. Actively buying and / or selling electricity is a risky and complex activity which requires specific capabilities, systems and processes.

Large energy users who participate directly in the electricity market typically either buy from the spot and manage their usage to avoid high prices or buy forward electricity to provide a price hedge against their expected usage. Many of them do so via their energy retailer and with the assistance of advisers.

Parties who typically sell forward electricity are those who have predictable surplus electricity volume and are seeking to secure price certainty. Rarely do large energy users with variable usage patterns actively sell forward electricity.

Electricity trading is not a core competency of SDP, nor is it likely appropriate given SDP's objective of delivery of water.

Operating regime

SDP's operating regime has evolved from a relatively predictable operation in water security mode (pre January 2019) to currently a highly unpredictable regime with 14 emergency response requests (some at very short notice) from Sydney Water between March 2020 to July 2022.

Going forward, from July 2023 SDP will be subject to a new network operator's licence where it is expected to be in flexible full-time operation, available to respond to varying production requests from Sydney Water.

Accordingly, SDP's electricity usage and therefore surplus electricity under its supply agreement is highly unpredictable both from a timing and volume perspective.

Further detail on SDP's requirements is as outlined in Section 3.

1.5 Assessment methodology

Forward premiums

Our methodology calculated quarterly forward premiums, where the forward premium is the difference between the average forward price and the average spot price.

If the average spot price is above the average forward price, the forward premium is negative, conversely it is positive.

Forward premiums were calculated for three assumed trading periods or sales timeframes for each quarter:

- One month ahead: i.e. SDP forward sold electricity for a quarter one month prior to the quarter commencing. For example, for Q2 2022 which commences on 1 April 2022 SDP forward sold the electricity by approximately 1 March 2022.
- One quarter ahead: i.e. SDP forward sold electricity for a quarter one quarter ahead of the quarter commencing. For example, for Q2 2022 which commences on 1 April 2022 SDP forward sold the electricity by approximately 1 January 2022.
- Two quarters ahead: i.e. SDP forward sold electricity for a quarter two quarters ahead of the quarter commencing. For example, for Q2 2022 which commences on 1 April 2022 SDP forward sold the electricity by approximately 1 October 2021.

Hypothetical sales analysis

We calculated an estimate of the potential costs or benefits to SDP assuming they hypothetically sold forward electricity in four specific quarters: Q1 2021, Q2 2021, Q1

2022 and Q2 2022. These are four recent quarters where SDP received emergency response notices from Sydney Water.

In calculating the costs or benefits we used the following key inputs:

- Actual contract prices and minimum volume requirements under SDP's electricity supply agreement.
- Actual half hourly spot prices.
- Actual quarterly forward prices.
- Actual half hourly SDP electricity consumption.
- Actual dates of receipt of emergency response notices from Sydney Water.
- Assumed forward sales volumes – for simplicity we assumed 35MW was forward sold, based on 80% of SDP's nominal maximum average capacity of 44MW.
- Assumed forward trading period or sales dates – consistent with the forward premium analysis: one month ahead, one quarter ahead and two quarters ahead. In addition we also do not assume that the forward sales occur on a specific date, rather we use the average price in a sales window approximately one week before and after each period. This intends to reflect what may actually occur in practice with SDP not always selling on a specific date but rather within a small range of the target date.
- Assumed forward trading volume and buyback volumes. For simplicity we assumed 35 MW forward sales volumes based on 80 per cent of SDP's theoretical average maximum demand. We also assumed the buyback volume was the same as the sales volume.
- Assumed nominal transaction costs ($2 / MWh or ~2 to 3 per cent) to allow for items such as brokerage, buy / sell spreads and margin requirements.

We then calculated the potential costs and benefits for three scenarios:

- **Scenario one:** SDP forward sold electricity for a quarter, but then bought the same volume back when Sydney Water issued an emergency response notice.
- **Scenario two:** SDP forward sold electricity for a quarter, but did not buy back the volume after Sydney Water issued an emergency response notice.
- **Scenario three:** SDP did not forward sell electricity and all surplus electricity was sold to the spot market. This is consistent with what actually occurred in each quarter.

Section 4 provides further detail on our methodology, key inputs and assumptions.

1.6 Key results

Our key results and conclusions from our analysis are summarised below, Sections 5 and 6 provide further detail.

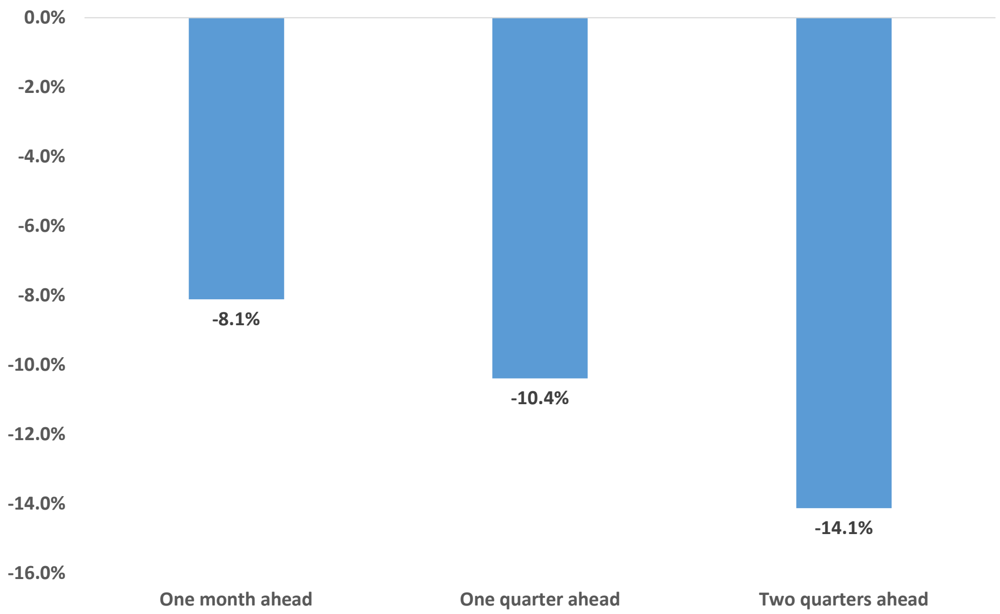
1.6.1 Forward premiums

Figure 1.1 highlights the actual quarterly forward premium for the period 1 January 2017 to 30 June 2022. It demonstrates that the forward premium is highly unpredictable and volatile. There are clearly quarters where the forward premium is positive, sometimes significantly so, however there are also quarters where the forward premium is negative and also significantly so. Other than the fact that the forward premium for one month ahead, one quarter ahead and two quarters ahead are reasonably and unsurprisingly correlated there is no other discernible pattern or sequence to the variability of the forward premiums.

Figure 1.1: Quarterly NSW forward premium by sales strategy (Jan 2017 - Jun 2022)

Figure 1.2 on the following page highlights that for the total period the average forward premium for all three time periods is negative.

Figure 1.2: Total period average NSW forward premium by sales strategy (Jan 2017 - Jun 2022)



1.6.2 Costs and benefits of hypothetical sales

Table 1.1 provides a summary of the costs and benefits for each hypothetical sales scenario by period. For scenarios one and two there are maximum and minimum values which reflect the fact that forward sales can occur during any one of the relevant sales windows e.g. one month ahead, one quarter ahead or two quarters ahead. Since the forward price changes daily, so too does the potential cost or benefit of a forward sale. For scenario three there is no minimum or maximum, only an 'actual' value as there are no forward sales, only spot sales.

Positive values in the table represent gains to SDP, i.e. benefits accruing due to the relevant strategy from the forward price being higher than the spot price (a positive forward premium). Negative values represent costs to SDP from implementing the relevant strategy from the forward price being lower than the spot price (a negative forward premium).

Table 1.1: Costs and benefits of hypothetical forward sales by scenario and quarter, $m

Period	Scenario one (forward sale & buyback)		Scenario two (forward sale no buyback)		Scenario three (no forward sale)
	Max	Min	Max	Min	'Actual'
Q1 2021	$0.51	-$0.09	$0.66	$0.07	-$2.23
Q2 2021	$2.92	$2.10	-$2.06	-$2.88	$2.60
Q1 2022	$0.66	-$0.62	$0.48	-$0.80	$0.66
Q2 2022	-$2.21	-$5.66	-$2.97	-$6.42	$11.93

The results highlight that:

- There is variability in the outcome for scenario three, in other words SDP is exposed to the spot price which will impact the level of gain or loss. This reflects the uncertainty in spot prices.
- The outcomes for scenarios two and three also exhibit variability, in other words they are not risk free. This reflects the uncertainty in spot prices but also forward prices, and therefore the forward premium that SDP may make from forward selling surplus electricity. They are also related to the assumed forward sales volume relative to SDP's consumption.
- In addition scenarios two and three have a maximum and minimum range reflecting additional uncertainty associated with the variability in forward prices as well as a decision on how far in advance of a quarter should SDP sell its surplus electricity.
- Had SDP sold forward in one of these four quarters, there are periods where SDP could have made a gain relative to the actual outcome, for example Q1 2021 SDP may have made up to ~$0.66m by forward selling compared to the actual cost of $2.23m. This is consistent with the forward premium being positive in that quarter.
- There are also periods where SDP could have just as easily made a significant loss relative to the actual outcome for example Q2 2022 SDP could have lost in excess of $6.4m compared to a predicted or potential gain of ~$11.9m. This is consistent with the forward premium being negative in that quarter.
- Given the unpredictable nature of the forward premium the expected outcome from undertaking a forward sales strategy is unknown at the time SDP would make the forward sales decision. Therefore it is speculative and entirely unpredictable to determine in advance if SDP would make a gain or a loss on a forward sale.

1.7 Conclusions

Under the most recent operating conditions as well as the new operating rules commencing July 2023, SDP will not know:

- when it will be called upon to meet Sydney Water's requests (i.e. the timing of any request)
- how much water SDP will be required to produce under each request, and how much surplus electricity SDP will be holding in future periods (i.e. the volume of each request)
- whether the forward premium for the quarter will be positive or negative (i.e. will SDP be better off or worse off selling forward electricity) including whether or not SDP is better off or worse off forward selling one month ahead or one quarter ahead or two quarters ahead. They all display similar unpredictability and volatility.

Therefore, under the most recent operating conditions and the new network operator's licence, it will be impossible for SDP to predict when and how much energy would likely be surplus to requirements. At the same time, energy markets remain highly volatile, making speculation about market prices risky where SDP can theoretically make a gain from forward selling electricity but equally can make a large loss.

This activity is therefore highly speculative in nature and not prudent nor efficient for SDP to undertake. Given the uncertainties in forward premiums and the speculative nature of this activity it is not reasonable for SDP to expect to achieve improved outcomes from forward selling electricity. However it is reasonable to expect SDP to have increased risk from forward sales versus spot sales due to the additional uncertainties in forward sales discussed above. It is therefore prudent and efficient for SDP to sell any surplus electricity to the spot market.

2 Scope and approach

2.1 Scope of work

Our scope of work involved preparing an independent report that that discusses and advises on the risks and benefits of forward trading surplus electricity informed by analysis using actual historic data and relevant assumptions for the period 1 January 2017 to 30 June 2022.

This includes calculating historic quarterly forward premiums and the potential range of costs and benefits to SDP under hypothetical surplus electricity sales strategies.

This report will assist in understanding the extent to which SDP could reasonably expect to achieve improved outcomes by forward selling surplus electricity, and what this implies about SDP's ability to influence the potential size of gains and losses from the sale of surplus electricity.

The scope excluded:

- Undertaking any electricity market price modelling. Our approach utilised actual historic spot and forward market prices.
- Auditing or validating information provided by SDP.
- Estimating network, market and other charges payable by SDP – we have only estimated the electricity wholesale market related costs.

2.2 Approach

Our approach involved:

- Understanding key elements of SDP's operating context. This includes SDP's electricity supply contract, its operating regime and IPART's energy adjustment mechanism.
- Calculating historic forward premiums for the period 1 July 2017 to 30 June 2022
- Developing a high level Excel model to calculate the hypothetical gain or loss from potential surplus electricity sales strategies
- Identifying relevant inputs and assumptions to calculate the potential range of costs and benefits to SDP from these potential surplus electricity sales strategies.
- Understanding the implications of the analysis undertaken.
- Preparing this report.

Where required we discussed and clarified any issues with SDP.

2.2.1 Information provided by SDP

To prepare this analysis SDP provided us with the following information:

- An overview of specific elements of SDP's operating context and electricity requirements.
- Actual dates for the receipt of emergency response notices from Sydney Water during Q1 2021, Q2 2021, Q1 2022 and Q2 2022.
- Actual half hourly consumption, Iberdrola contract price and half hourly surplus electricity under its electricity contract for the same four quarters noted above.
- SDP's surplus electricity and LGC sales policy dated March 2021.

3 SDP's operating context

Our assessment involved consideration of the environment within which SDP operates. This includes SDP's electricity supply contract and SDP's operating regime. This section also briefly discusses the broad approaches that SDP could consider in selling any surplus electricity.

Given the commercial sensitivities this section only provides a very high-level overview of the elements relevant for our review.

3.1 SDP's electricity contract

SDP has an electricity supply contract with Iberdrola. We understand that the conditions of the Electricity Supply Agreement (ESA)[1] include:

- A contracted minimum annual electricity volume apportioned on a monthly basis. If SDP's electricity consumption is below this minimum volume SDP must pay Iberdrola for any shortfall. This payment is a formula based on the difference between the electricity spot price for each half hour of the month and the contract price. In other words, if the spot price is above the contract price Iberdrola will pay SDP, conversely if the spot price is below the contract price SDP will pay Iberdrola.
- SDP has an average maximum demand of ~44MW, it can use up to ~47MW however for the purposes of this report and our analysis we assume the average maximum of ~44MW.
- The ability for SDP to forward sell electricity in quarterly or annual blocks back to the wholesale market (via Iberdrola) if SDP believes they will not require all the electricity volume.

3.2 SDP's operating regime

Prior to January 2019, SDP was in water security mode. In January 2019, SDP restarted because dam levels dropped below 60% and Sydney entered into drought.

In March 2020, even though dam levels had risen above 70% following substantial rain events in February 2020, Sydney Water requested SDP to continue operating in emergency response mode. The Emergency Response Notice issued to SDP requested it to produce 50ML/day (approximately 20% of SDP's full production capacity) to ensure SDP would remain available to ramp up production should an acute water quality/public health concern arise due to extreme weather events, algal blooms, or dam turnover.

This was the first time Sydney Water had issued an Emergency Response Notice to SDP and under the terms of the Notice, it was highly uncertain when, at what production level, and for how long SDP would be required to ramp up production in this new mode of operation.

Since the initial emergency response request, and up until July 2022, SDP received a further 13 emergency response requests for differing levels of production and different

[1] Energy Supply Agreement dated 28 July 2008 as amended on 23 April 2012 between Sydney Desalination Plant (SDP) and Infigen Energy Markets Pty Limited.

Post July 2023, SDP will be subject to a new network operator's licence where it will be in flexible full time operation. SDP will be required to meet annual production requests, which can be changed unilaterally by Sydney Water at 6-monthly intervals. SDP will also be obliged to use its best endeavours to respond to other shorter-term production requests issued by Sydney Water, including emergency production requests.

That is, SDP may be called on by Sydney Water to ramp up or down its water production at short notice. In this new operating environment, the expected 'default' operating mode for SDP is one of partial production.

3.2.1 Recent emergency response notices from Sydney Water

As noted above, between March 2020 and July 2022 SDP received 14 emergency response notices from Sydney Water. As evidenced below, some of these were received by SDP at very short notice and it would not be possible for SDP to predict the timing in advance of any single notice.

The table below summarises key aspects of the emergency response notices received in Q1 2021, Q2 2021, Q1 2022 and Q2 2022. Aspects of these emergency response notices are used in our analysis of the costs and benefits of hypothetical forward sales.

Table 3.1: Emergency response notice further details

Period	Key aspects relevant for our analysis
Q1 2021	• SDP was at ~20% production since March 2020. • On 21 March 2021 SDP was requested to shut down to zero (0) production. • On 22 March 2021 SDP was requested to ramp up to 100% production by the next day for seven (7) days.
Q2 2021	• SDP was at 20% production. • On 29 March 2021 SDP was requested to ramp up to ~40% production by the next day for seven (7) days.
Q1 2022	• SDP was at 20% production. • On 3 March 2022 SDP was requested to ramp up to >50% production by the next day. • Between 11 March and 16 March 2022 SDP received various notices to change production. • On 16 March 2022 SDP was requested to reduce production to 20% by the next day until further notice.
Q2 2022	• SDP was at 20% production. • On 30 May 2022 SDP was requested to increase to 50% production by the next day until further notice.

3.3 SDP's potential electricity sales strategies

As noted above, at times SDP may have surplus electricity under its contract and SDP has two broad options to sell any surplus electricity:

- **Spot sales:** under its contract SDP sells surplus electricity at the spot price. In other words this is the current and default position. SDP does not need to develop any new capabilities, nor does it require any changes to its contract, processes or systems to implement this strategy.
- **Forward sales:** SDP could sell surplus electricity in the forward market. In doing so, it would expose SDP to new risks, in particular the relative movement and value of forward prices to spot prices, referred to as the forward premium (refer Section 5.1).

  Electricity trading is not a current core competency of SDP. To prudently and effectively implement this strategy would require SDP to develop new capabilities to forecast forward and spot prices and manage the associated risks.

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  In addition, SDP would need to be prepared to buy back any forward sold electricity if it is asked to increase its production by Sydney Water. This reflects the fact that any increase in water production will increase electricity usage and therefore reduce SDP's surplus electricity. In some instances, if SDP does not buy back forward sold electricity it may be short to the electricity spot market. This is a potentially material risk. We also note that there is no regulatory mechanism for recovering losses or dealing with gains that come from buy back situations exposing SDP to risk and windfall gains and losses from any buyback activities.

  By way of comparison, large energy users who participate directly in the forward market typically <u>buy</u> forward electricity to provide a price hedge against their expected usage. Many of them do so via their energy retailer and with the assistance of advisers.

  Parties who typically <u>sell</u> forward electricity are those who have predictable surplus electricity volume and are seeking to secure price certainty for their forward volumes. The most common type of participant are generators, or users who have access to onsite generation or battery storage. It is uncommon for large energy users to sell variable volume and unpredictable electricity that may be surplus to their contractual requirements.

It is acknowledged that neither strategy outlined above is risk free, with both approaches having exposure to spot price risk, however the forward sales approach comes with additional exposure to forward price risk and buy back related risks.

These approaches are further analysed and discussed via some practical examples in Sections 4 and 5.

4 Methodology, assumptions and key inputs

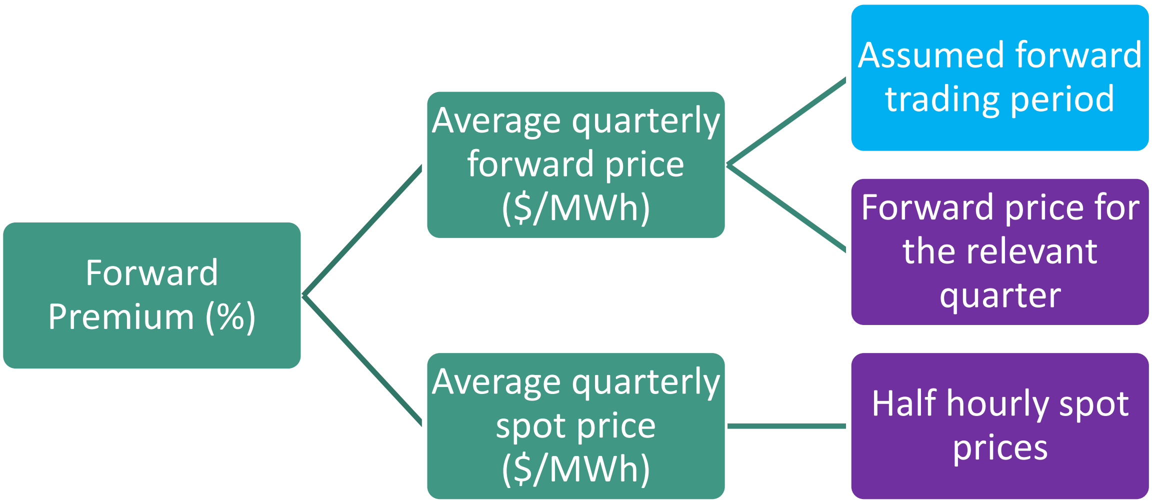
This section discusses the methodologies, key inputs and assumptions for the calculation of the forward premiums and the potential range of costs and benefits to SDP under hypothetical surplus electricity sales strategies.

4.1 Methodologies

4.1.1 Forward premium

The forward premium methodology is summarised in Figure 4.1. It highlights that the forward premium is the percentage difference between the average forward price for the relevant quarter and the average spot price for the quarter.

Figure 4.1: Forward premium methodology



In the figure above green boxes represent calculations, purple boxes represent actual data inputs and blue boxes represent key assumptions.

If the average spot price is above the average forward price, the forward premium is negative, conversely it is positive.

Forward premiums were calculated for three assumed trading periods or sales timeframes for each quarter:

- **One month ahead:** i.e. SDP forward sold electricity for a quarter one month prior to the quarter commencing. For example, for Q2 2022 which commences on 1 April 2022 SDP forward sold the electricity by approximately 1 March 2022.
- **One quarter ahead:** i.e. SDP forward sold electricity for a quarter one quarter ahead of the quarter commencing. For example, for Q2 2022 which commences on 1 April 2022 SDP forward sold the electricity by approximately 1 January 2022.
- **Two quarters ahead:** i.e. SDP forward sold electricity for a quarter two quarters ahead of the quarter commencing. For example, for Q2 2022 which commences on 1 April 2022 SDP forward sold the electricity by approximately 1 October 2021.

In addition, we made an allowance for the fact that sales activity may not occur on any one specific day, for example the one month ahead sales strategy may not occur exactly one month ahead as it may not be a work day, or the market liquidity may not be favourable on that day, or the relevant SDP personnel may not be available on that specific day. In practice SDP would seek to trade within approximately one (1) week on either side of the targeted sales date. We have allowed for this window on either side of the target sales date in our analysis.

Figure 4.2 below illustrates a negative forward premium for Q1 2022. It contains the daily forward price (which varies on a day by day basis reflecting market dynamics), the average spot price for the quarter and the three relevant trading periods. Since the spot price was above the average forward price for each relevant trading period the forward premium is negative. It also shows that the forward price increased over time and that in the one month ahead trading period it was closest to the average spot price, i.e. the forward premium was less negative in this trading period than in the one quarter ahead or two quarters ahead examples.

Figure 4.2: Example negative forward premium Q1 2022

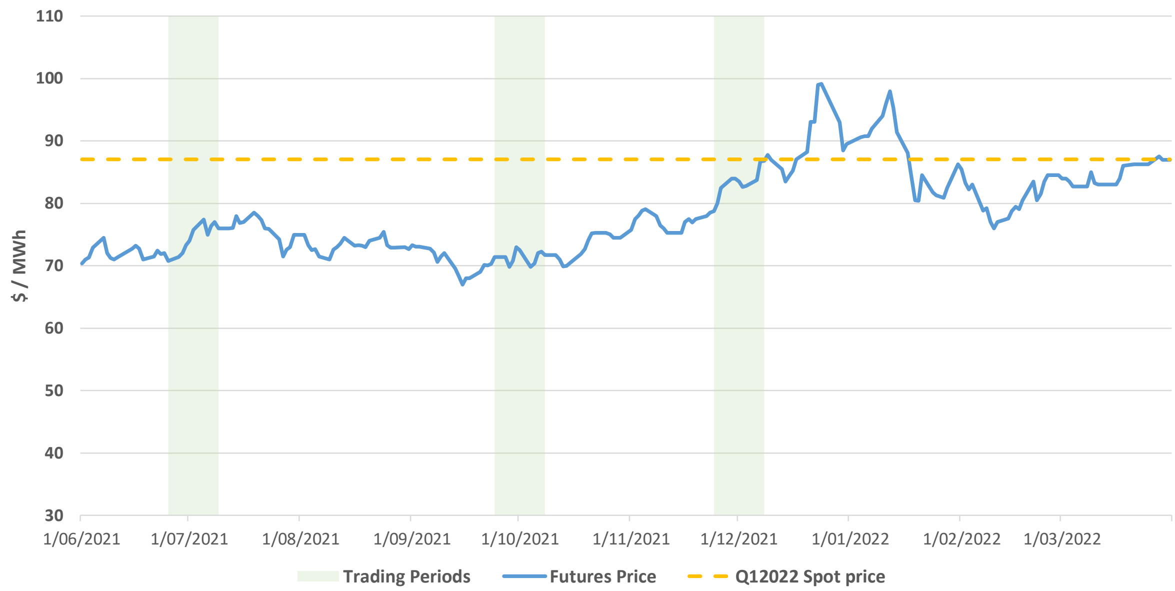
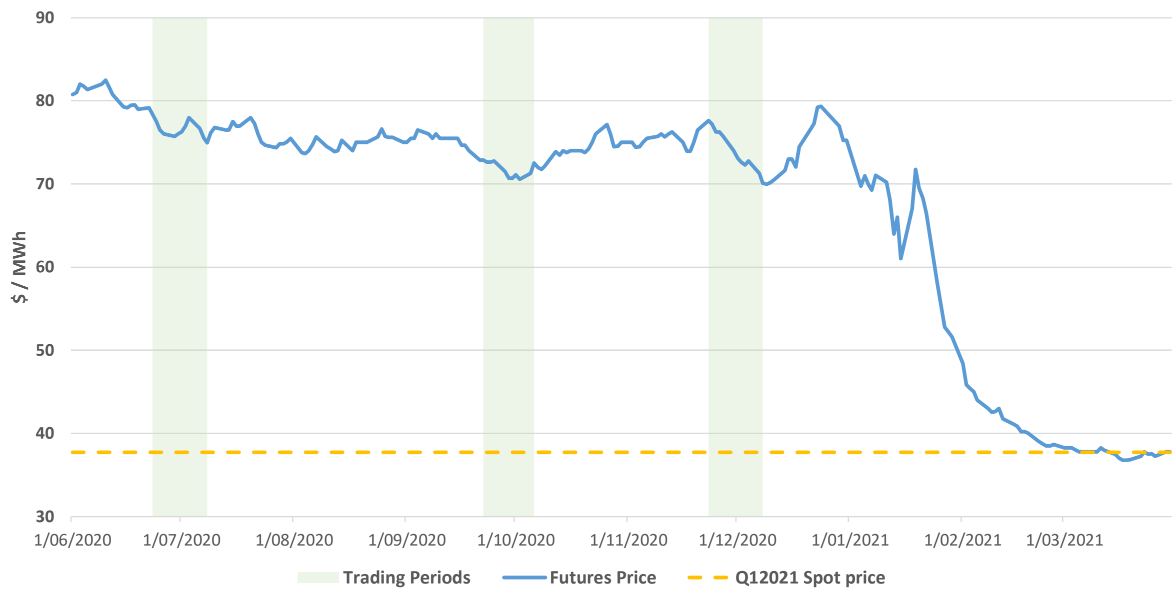


Figure 4.3 on the following page illustrates a positive forward premium for Q1 2021. It again illustrates the daily varying forward price, the average spot price for the quarter and the three relevant trading periods. Since the forward price was above the average spot price for each relevant trading period the forward premium is positive. In this case the forward price was reducing over time, so the forward premium for the one month ahead strategy would be lower than the forward premium for the one quarter ahead strategy.

Figure 4.3: Example positive forward premium Q1 2021



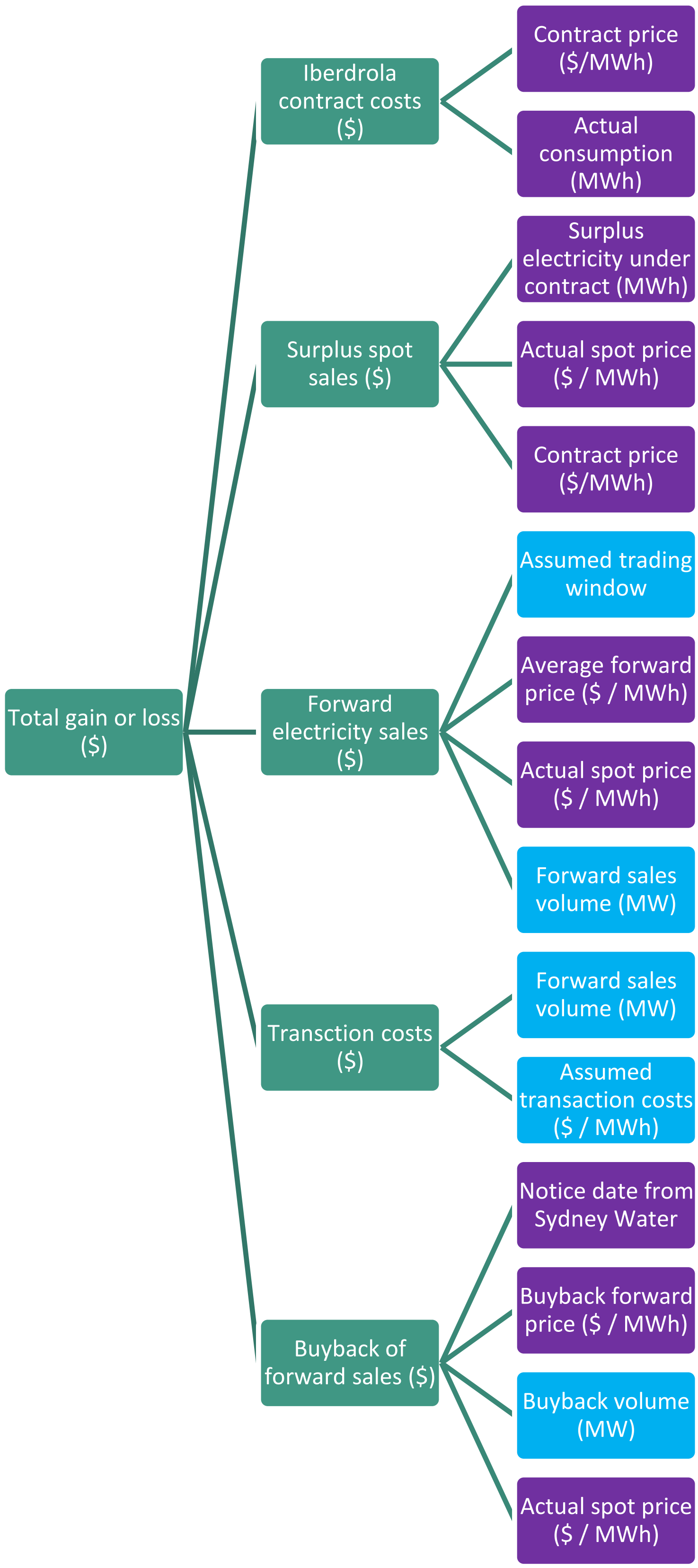
4.1.2 Costs and benefits of hypothetical forward sales

The methodology for calculating the costs (loss) and benefits (gain) from hypothetical forward sales is highlighted in Figure 4.4 on the following page. In the figure green boxes represent calculations, purple boxes represent actual data inputs and blue boxes represent key assumptions.

We calculated the potential costs and benefits using half hourly data and then aggregated those values to a quarterly level for three scenarios:

- **Scenario one:** SDP forward sold electricity for a quarter but then bought the same volume back when Sydney Water issued an emergency response notice. In this case the total gain or loss includes all the components in the figure on the following page, i.e. the Iberdrola contract costs, surplus spot sales costs (or benefits), forward sales, buyback of forward sales and transaction costs. Noting that in this scenario SDP pays transaction costs on the forward sale and the buyback.
- **Scenario two:** SDP forward sold electricity for a quarter but did not buy back the volume after Sydney Water issued an emergency response notice. In this case the total gain or loss includes the Iberdrola contract costs, surplus spot sales costs (or benefits), forward sales, transaction costs. There is no allowance for buyback of forward sales.
- **Scenario three:** SDP did not forward sell electricity and all surplus electricity was sold to the spot market. In this case the total gain or loss only includes the Iberdrola contract costs and the surplus spot sales costs (or benefits). There is no allowance for forward sales, buyback of forward sales or transaction costs. This is broadly consistent with what actually occurred as SDP did not actually undertake forward sales.

Figure 4.4: High level overview of costs and benefits of hypothetical sales methodology



4.2 Key inputs

This section discusses the key inputs used in developing the calculations. Where possible we sourced electricity market based data from credible independent sources, in particular:

- The ASX Energy website for closing electricity settlement prices for the relevant quarterly forward periods.
- The Australian Energy Market Operator's (AEMO) website for actual spot market prices.

4.2.1 Forward premium inputs

The calculation of the forward premium only required two inputs:

- Actual half hourly spot prices
- Actual forward prices for the relevant quarter

These were sourced from the sources noted above.

4.2.2 Costs and benefits of hypothetical forward sales inputs

As noted in Figure 4.4 the calculation of the costs and benefits of hypothetical forward sales utilised a number of inputs, these are described in further detail in the table below.

Figure 4.5: Key inputs: costs and benefits of hypothetical forward sales calculations

Input	Comment
Iberdrola contract price	This is a confidential input based on the actual price payable by SDP under the Iberdrola contract. It was provided by SDP.
Actual SDP consumption	This is the actual half hourly consumption for the relevant quarter as provided by SDP.
Surplus electricity under Iberdrola contract	This is the surplus electricity by half hour based on the minimum volume requirements under the Iberdrola contract (refer Section 3.1). These surplus sales are sold at the spot price.
Actual half hourly spot price	This is the actual half hourly spot price sourced from the AEMO website.
Average forward price	This is based on the actual forward prices sourced from the ASX website for the relevant quarter. Our calculations assumed SDP sold forward the electricity in the relevant trading period (e.g. one month ahead, one quarter ahead or two quarters ahead). We also allowed for a one week period before and after the target trading date. This input was then based on the average actual forward price for the relevant trading period.
Notice date from Sydney Water	This is the date SDP received the notice from Sydney Water to amend production (refer

Input	Comment
	Section 3.2.1). For simplicity our modelling assumed that SDP bought back any sold energy the day after it received the notice from Sydney Water at the relevant forward price on the day.
Buyback forward price	This is based on the actual forward price the day after SDP received the emergency response notice from Sydney Water.

4.3 Key assumptions

This section discusses the key assumptions used in developing the calculations.

4.3.1 Forward premium assumptions

As noted in Figure 4.1 the only assumption required for the forward premium calculation is the assumed forward sales period, i.e. one month ahead, one quarter ahead or two quarters ahead. This is discussed in Section 4.1.1.

4.3.2 Costs and benefits of hypothetical forward sales assumptions

As noted in Figure 4.4 the calculation of the costs and benefits of hypothetical forward sales utilised a number of assumptions, these are described in further detail in the table below.

Figure 4.6: Key assumptions: costs and benefits of hypothetical forward sales calculations

Assumption	Comment
Forward sales window	Our methodology assumed three forward sales (or trading) periods / windows (refer Section 4.1.1). In calculating the costs and benefits of the hypothetical forward sales we used the same sales windows. As previously noted we utilised a one week period before and after each target trading date to allow for practical reasons why SDP may not trade on a specific date each quarter.
Forward sales volume	Our forward sales volume was based on a simplifying assumption where the default operating regime has SDP notionally consuming 20 per cent of their average maximum demand of ~44MW (refer Section 3.2). So the surplus sales volume on average would be 80 per cent of their average maximum demand or approximately 35MW = 80% * 44MW available for forward sale. The 80 per cent value is chosen as SDP has historically been asked to maintain production at approximately 20 per cent of its capacity.

Assumption	Comment
	The forward sales volume assumption was also chosen on the basis that if SDP had a belief that the forward premium was positive it would be incetivised to sell as much of its electricity forward as possible. Conversely if SDP had a belief that the forward premium was negative it would aim to sell no forward electricity. Clearly if the forward sales volume assumption changes, so too would the costs / benefits in this analysis.
Transaction costs	When SDP forward sells (and buyback of any previously forward sold volume) they will incur transaction costs. Transaction costs can include items such as brokerage, buy / sell spreads and margin calls (initial and variation) for the ASX. Whilst transaction costs are time and trade specific, we have assumed a notional transaction cost of ~$2 / MWh for each trade undertaken. Approximately 50 per cent of the transaction costs relate to the buy / sell spread. Typical spreads in the NSW market are 1 per cent to 3 percent of the face value of a contract. A mid-point of 2 per cent on a face value of $80 / MWh = ~$1.60 / MWh.
Buyback volume	For simplicity we have assumed the buyback volume is the same as the forward sales volume, or 35MW. In practice we appreciate SDP may not always buy back the full volume. However since we are calculating results for the scenario where SDP buys back the volume (Scenario one) and where SDP does not buy back any volume (Scenario two) the actual result for a partial buy back will necessarily lie in the range of the results for these two scenarios.

5 Key results

This section details the results of our calculations of the forward premiums and the costs / benefits of hypothetical forward sales strategies.

5.1 Forward premiums

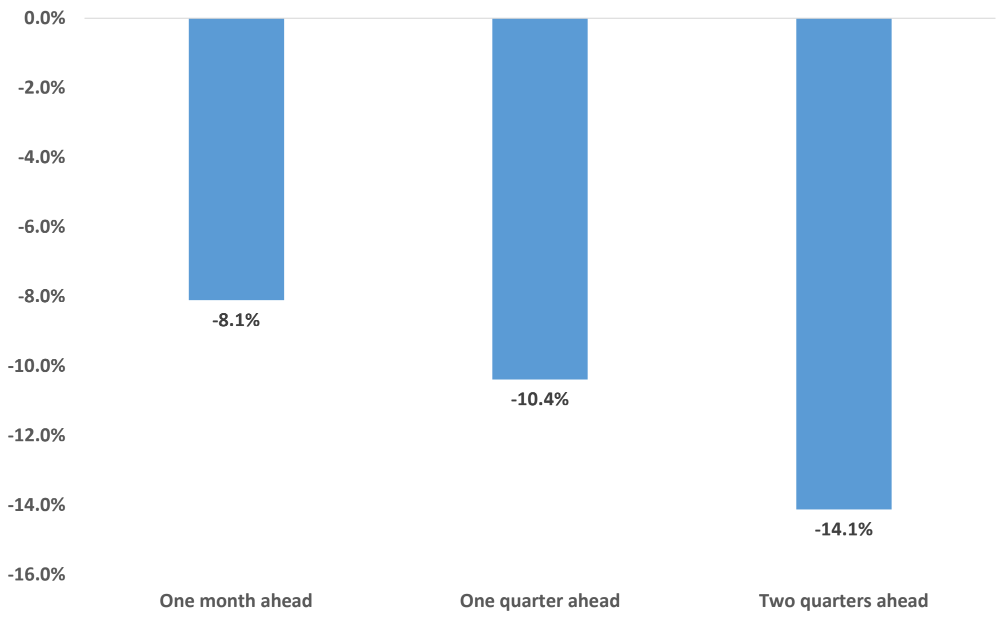
We calculated quarterly forward premiums for the period 1 January 2017 to 30 June 2022, these are highlighted in Figure 5.1. Noting again that a positive forward premium is when the forward price is higher than the spot price, and a negative forward premium is when the forward price is lower than the spot price.

Our analysis demonstrates that the forward premium is not stable, highly unpredictable and volatile. There are clearly quarters where the forward premium is positive, and quarters that it is negative. The forward premium is a function of not only spot prices, but the relativity of spot prices and forward prices. Given the electricity market is imperfect and relatively illiquid, the forward premium is naturally unstable. The market sentiment and expectations can be impacted quickly and by the actions of a small number of parties.

Figure 5.1: Quarterly NSW forward premium by sales strategy (Jan 2017 - Jun 2022)

Figure 5.2 on the following page highlights that for the total period the average forward premium for all three timeframes modelled is negative. In other words, had SDP traded forward for each quarter in the period 1 January 2017 to 30 June 2022 it would have made a loss relative to a purely spot sales strategy. The loss would have been between 8 per cent and 14 per cent excluding transaction costs.

Figure 5.2: Total period average NSW forward premium by sales strategy (Jan 2017 - Jun 2022)



The table below provides further detail on the quarterly forward premiums by time period as well as aggregated forward premiums by year. Noting again that a positive forward premium is when the forward price is higher than the spot price, and a negative forward premium is when the forward price is lower than the spot price.

It highlights that the forward premiums can at times be significantly negative or significantly positive. Of the 66 quarterly forward premiums in the table below, 25 have negative forward premiums larger than -10 per cent, and 26 have forward premiums larger than 10 per cent. In other words more than 75 per cent of the forward premiums are outside of a +/- 10 per cent band.

Table 5.1: Historic NSW quarterly forward premiums

Time Period	Forward Premium		
	One month ahead	One quarter ahead	Two quarters ahead
Q1 2017	-47%	-46%	-49%
Q2 2017	31%	-18%	-34%
Q3 2017	23%	39%	-17%
Q4 2017	28%	12%	40%
Q1 2018	51%	44%	30%

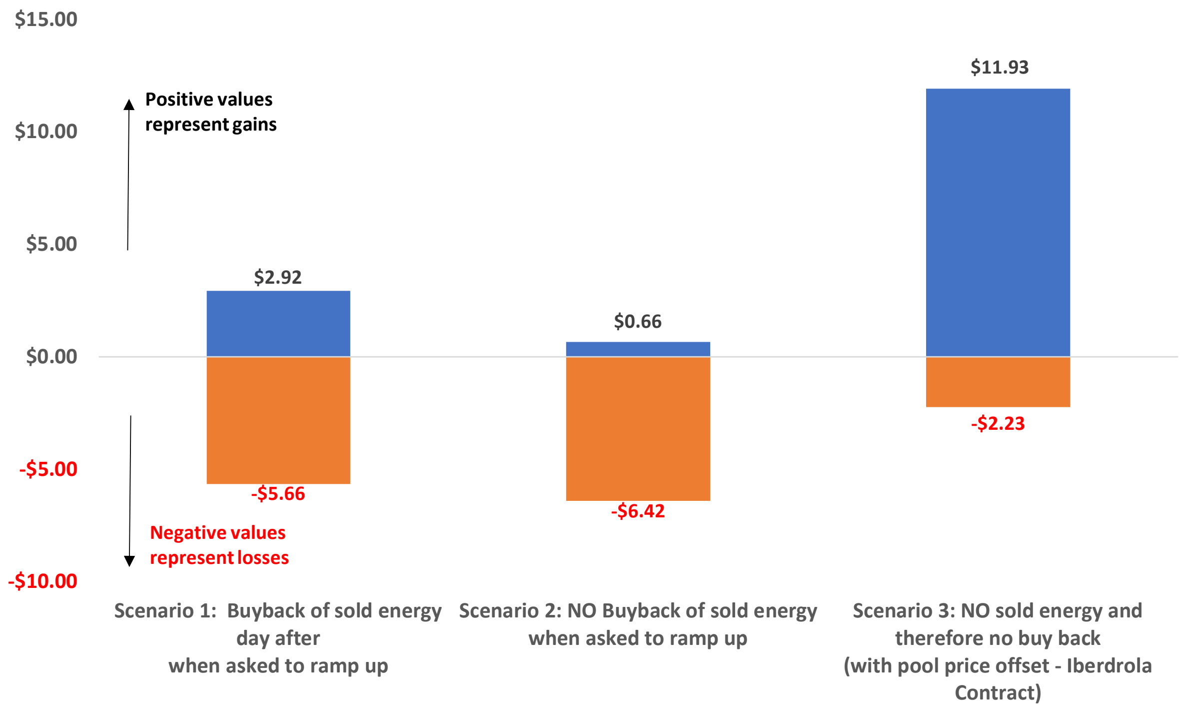
Time Period	Forward Premium		
	One month ahead	One quarter ahead	Two quarters ahead
Q2 2018	1%	16%	17%
Q3 2018	-13%	-10%	7%
Q4 2018	-5%	-17%	-18%
Q1 2019	7%	9%	-8%
Q2 2019	14%	9%	7%
Q3 2019	6%	8%	3%
Q4 2019	14%	16%	15%
Q1 2020	10%	33%	23%
Q2 2020	46%	62%	84%
Q3 2020	16%	16%	50%
Q4 2020	-21%	-26%	-14%
Q1 2021	96%	90%	102%
Q2 2021	-62%	-54%	-56%
Q3 2021	-25%	-40%	-33%
Q4 2021	2%	7%	-23%
Q1 2022	-4%	-18%	-14%
Q2 2022	-67%	-72%	-79%
2017	4.9%	-6.2%	-19.2%
2018	6.6%	6.8%	8.0%
2019	10.2%	10.3%	3.5%
2020	9.3%	19.5%	29.7%
2021	-17.4%	-18.1%	-22.2%
2022 (to 30 June)	-53.1%	-59.7%	-64.1%

Time Period	Forward Premium		
	One month ahead	One quarter ahead	Two quarters ahead
All years	-8.1%	-10.4%	-14.1%

5.2 Costs and benefits of hypothetical sales

The results of our analysis are summarised in the figure below which highlight that:

Figure 5.3: Range of costs and benefits of hypothetical forward sales by scenario, $m



- There is variability in the outcome for scenario three, i.e. the 'actual' outcome. In this scenario SDP sold surplus electricity once it was known to be surplus to the spot market. It had outcomes between a loss of ~**-$2.2m** and a gain of ~**$11.9m**. This reflects the fact that SDP is exposed to the spot price which will impact the level of gain or loss. This is driven by the uncertainty in spot prices.
- The outcomes for scenarios one and two similarly exhibit variability, in other words they demonstrate that forward selling electricity is not risk free and clearly speculative. In these cases the outcomes range between a loss of ~**-$6.5m** to a gain of ~**$2.9m**, in other words a larger potential loss and a lower potential gain. This reflects the uncertainty in not only spot prices but also forward prices, and therefore the forward premium that SDP may make from forward selling surplus electricity. They are also related to the assumed forward sales volume relative to SDP's consumption.

- In addition scenarios one and two necessarily are not single values, i.e. they have a maximum and minimum range reflecting additional uncertainty associated with the variability in forward prices including the decision on how far in advance of a quarter should SDP sell its surplus electricity. In some instances this range between maximum and minimum values can be more than $1m. This further highlights the unpredictable nature of forward selling electricity, and that decisions to sell or not sell on a specific day can impact the outcome by up to $1m for a single quarter's worth of electricity.
- In only one of the four quarters modelled (Figure 5.4, Q1 2021) would SDP almost certainly have been better off selling forward electricity. In this quarter the range of outcomes from scenarios one and two are always greater than the outcome from scenario three.

In all other quarters, SDP would have almost certainly been worse off from selling forward electricity. In Q2 2022 (Figure 5.7) for example SDP would have made a loss of up to -$6.4m from forward selling electricity compared to a gain of ~$11.9m from selling its surplus electricity to the spot market.

Figure 5.4 to Figure 5.7 on the following pages detail the costs and benefits from SDP undertaking a hypothetical forward sales scenario in Q1 2021, Q2 2021, Q1 2022 and Q2 2022 respectively. Above each figure is also an extract from Table 3.1 outlining the request from Sydney Water to ramp up production.

Each figure is identical in structure and contains the following information:

- Positive values in the charts represent gains to SDP, i.e. benefits accruing due to the relevant strategy. Negative values represent costs to SDP from implementing the relevant strategy.
- A reasonable estimate of the upper and lower bound range of costs or benefits for each trading scenario.
- For scenarios one and two there are maximum and minimum values which reflect the fact that forward sales can occur during any one of the relevant sales windows e.g. one month ahead, one quarter ahead or two quarters ahead. Since the forward price changes daily, so too does the potential cost or benefit of a forward sale.
- For scenario three there is no minimum or maximum, only an 'actual' value as there are no forward sales, only spot sales.

Table 5.2: Emergency response notice request, Q1 2021

- SDP was at ~20% production since March 2020.
- On 21 March 2021 SDP was requested to shutdown to zero (0) production.
- On 22 March 2021 SDP was requested to ramp up to 100% production by the next day for seven (7) days.

Figure 5.4: Costs and benefits of hypothetical sales by scenario, Q1 2021

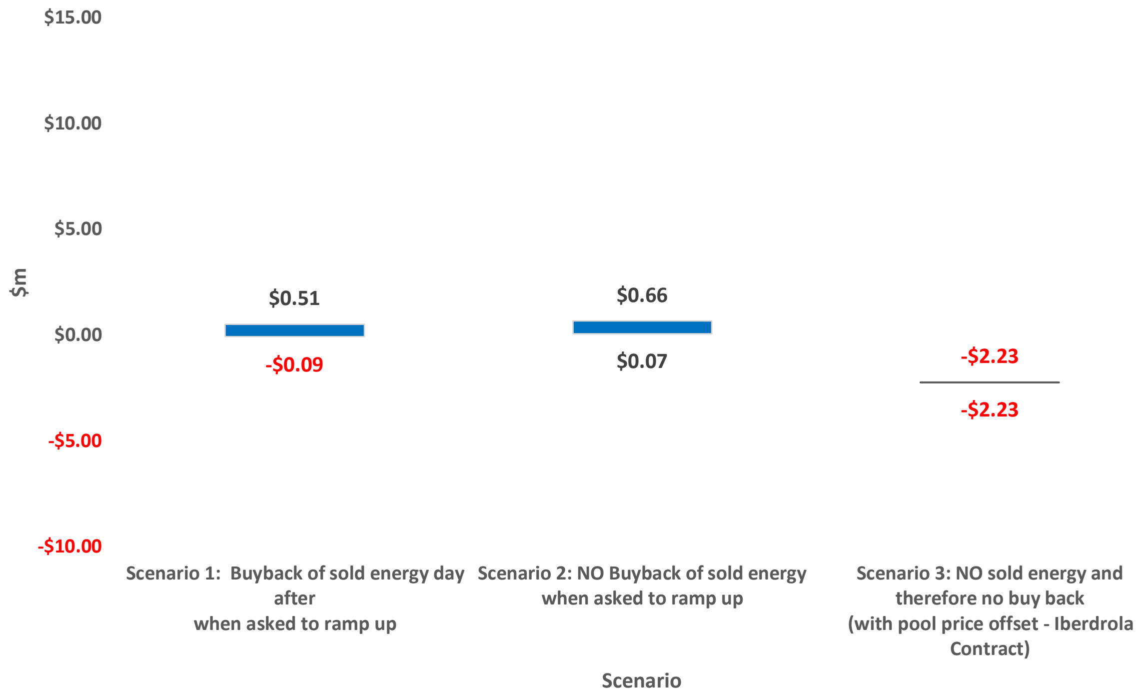


Table 5.3: Emergency response notice request, Q2 2021

• SDP was at 20% production. • On 29 March 2021 SDP was requested to ramp up to ~40% production by the next day for seven (7) days.

Figure 5.5: Costs and benefits of hypothetical sales by scenario, Q2 2021

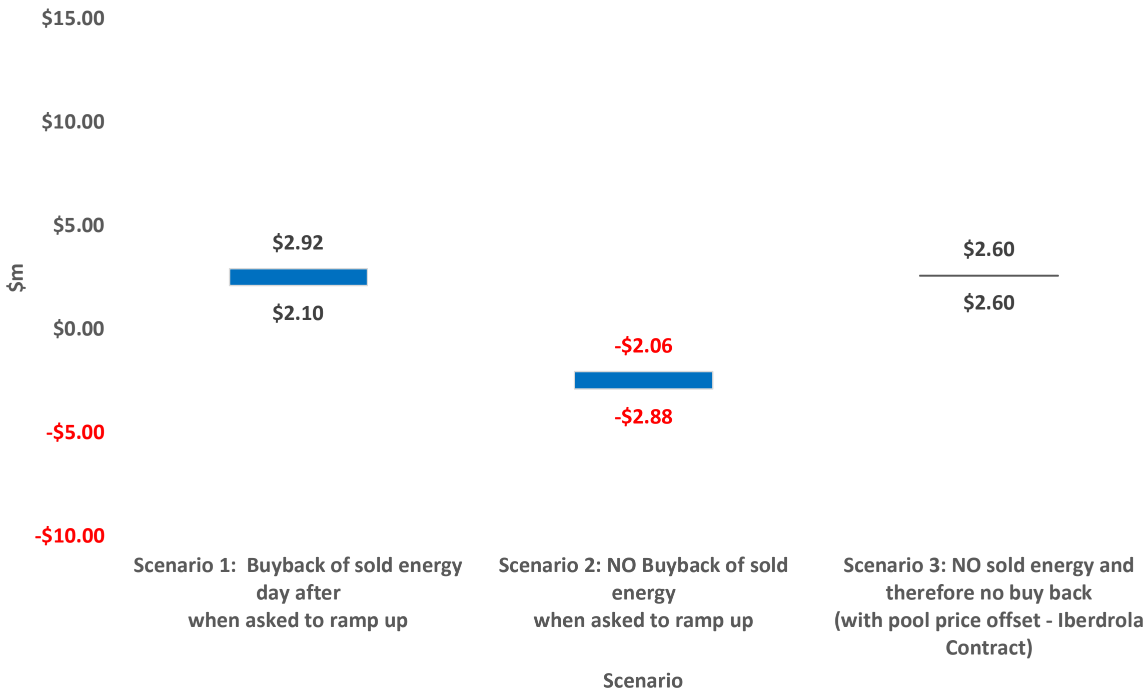


Table 5.4: Emergency response notice request, Q1 2022

- SDP was at 20% production.
- On 3 March 2022 SDP was requested to ramp up to >50% production by the next day.
- Between 11 March and 16 March 2022 SDP received various notices to change production.
- On 16 March 2022 SDP was requested to reduce production to 20% by the next day until further notice.

Figure 5.6: Costs and benefits of hypothetical sales by scenario, Q1 2022

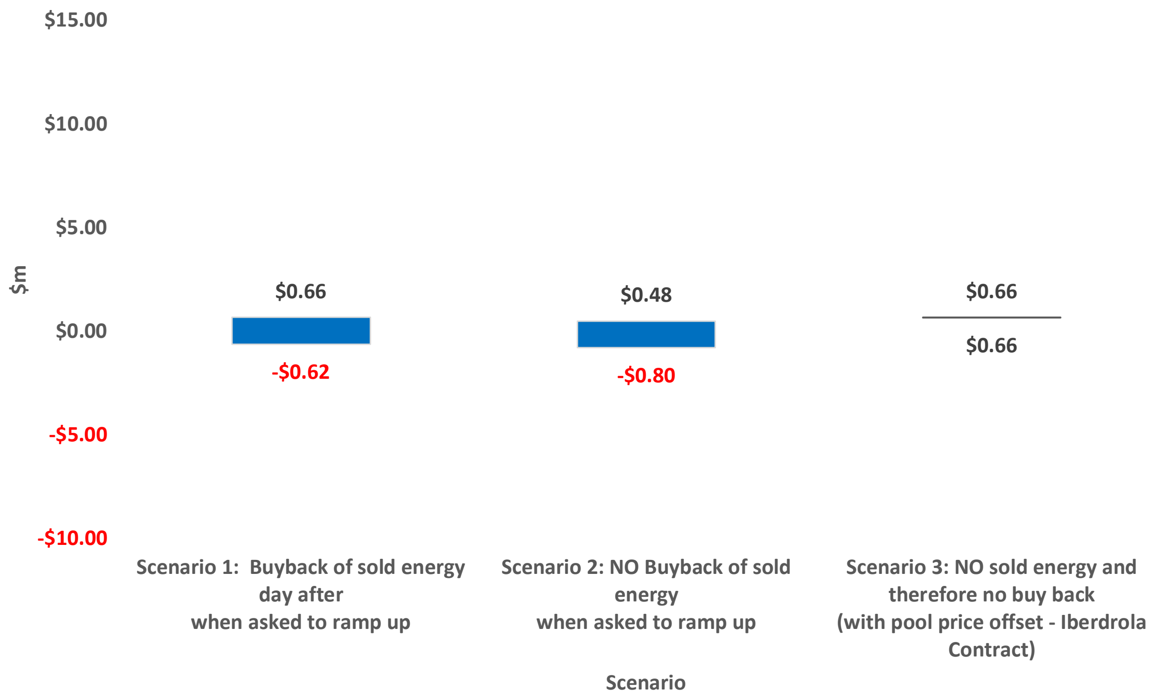
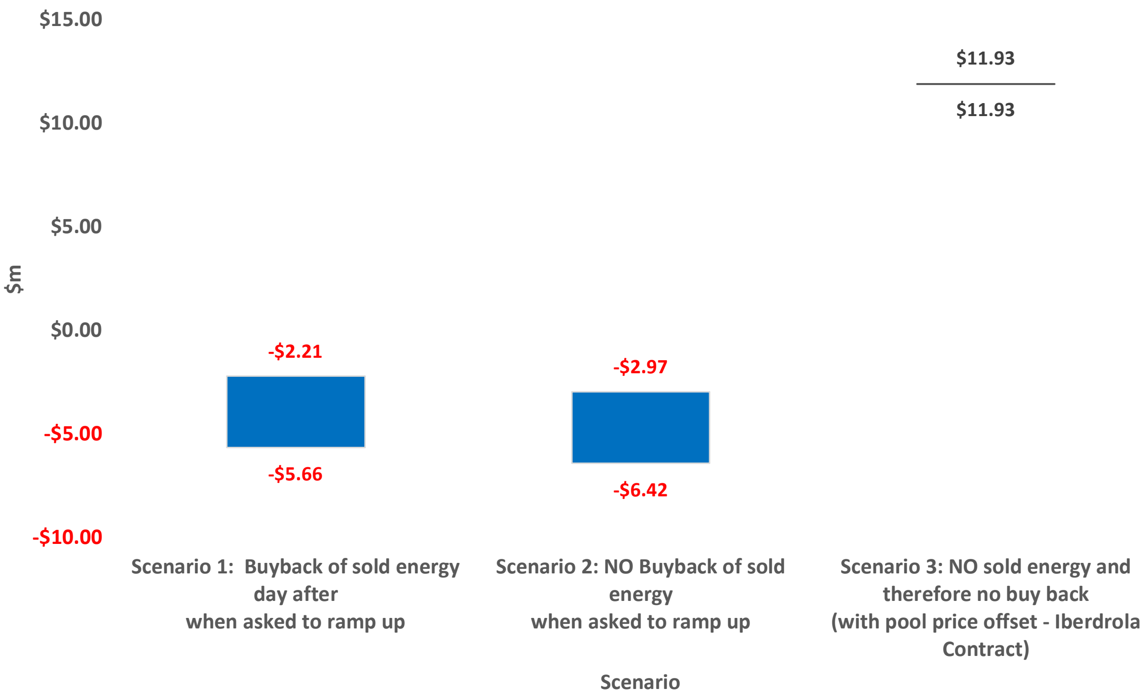


Table 5.5: Emergency response notice request, Q2 2022

• SDP was at 20% production. • On 30 May 2022 SDP was requested to increase to 50% production by the next day until further notice.

Figure 5.7: Costs and benefits of hypothetical sales by scenario, Q2 2022



6 Conclusions

Our analysis has highlighted the following:

- SDP has a highly uncertain volume of electricity consumption and has limited to no visibility of when it will be called upon to meet Sydney Water's requests for further water production. This impacts SDP's ability to understand its surplus electricity and therefore its ability to forecast how much surplus electricity it may have to sell in the forward market (i.e. it has timing and volume uncertainty in forward electricity sales)
- forward premiums are unstable, unpredictable and highly volatile. They can be significantly positive in one quarter and significantly negative in a subsequent quarter. To forecast spot and forward prices requires sophisticated expertise in the electricity markets, which is not a core competency of SDP, even businesses who possess such expertise are challenged to accurately forecast spot and forward prices.
- this means that SDP has no ability to predict if the forward premium for any given quarter will be positive or negative, i.e. will SDP be better off or worse off selling forward electricity. **This means that any forward trading activity would be highly speculative given the uncertainty in the forward premium outcome.**
- it is also not possible for SDP to determine if it would be better off or worse off forward selling one month ahead or one quarter ahead or two quarters ahead. All timeframes analysed display similar unpredictability and volatility.
- had SDP implemented a forward sales strategy in four recent quarters there was significant variability in the hypothetical outcomes. In all bar one quarter SDP would have been better off not selling forward electricity.

Therefore, under the most recent operating conditions and the new network operator's licence, it will be impossible for SDP to predict when and how much electricity would likely be surplus to its requirements. At the same time, electricity markets remain highly volatile, making speculation about market prices risky where SDP can theoretically make a gain from forward selling electricity but equally can make a large loss.

This activity is therefore highly speculative in nature and not prudent nor efficient for SDP to undertake. Given the uncertainties in forward premiums and the speculative nature of this activity it is not reasonable for SDP to expect to achieve improved outcomes from forward selling electricity. However it is reasonable to expect SDP to have increased risk from forward sales versus spot sales due to the additional uncertainties in forward sales discussed above and earlier in this report.

It is therefore prudent and efficient for SDP to sell any surplus electricity to the spot market.

A. Overview of Seed Advisory

Formed in 2008, Seed Advisory is an independent commercial advisory firm specialising in the energy sector covering electricity, gas, renewable technologies and carbon and spans the entire value chain. Key services include the provision of commercial, policy, strategic and risk management advice to energy companies, energy users, infrastructure businesses, regulators, governments, financial institutions, entrepreneurs and investors.

Seed Advisory has worked with several water utilities including the Intelligent Water Network (IWN), Melbourne Water, GWM Water, South East Water, City West Water and Wannon Water. Our work with water utilities includes the recently completed feasibility study on industry scale renewable energy, preparing a business case to develop a renewable energy strategy and business case for the Board of Directors of one water utility. Our work has also included identifying options to reduce energy costs and developing a comprehensive energy strategy. For another water utility we spent over 9 months with their energy team and management developing an energy strategy to reduce costs.

We have also advised: the Victorian Government; ARENA; the Clean Energy Finance Corporation; Low Carbon Australia; the Carbon Markets Institute (with ClimateWorks Australia); the Australian Energy Markets Commission; the Australian Energy Market Operator; the Independent Market Operator, Western Australia; the Western Australian government; the Commonwealth Government, a range of market participants in Australian electricity and gas markets and their peak organisations, including the Australian Energy Council, the National Generators Forum, the Private Generators Group and the Energy Retailers Association of Australia.

Leading this project was Peter Eben, a Director and co-founder of Seed. Peter has over 23 years' practical and advisory experience across the energy value chain covering consumers, retailers, networks, wholesale participants, regulators, governments and investors.

His expertise covers the gas, electricity, carbon and renewable energy markets. Peter has worked in senior management position at Energy Australia, AGL, Pulse Energy, United Energy and IKON Energy as well as at KPMG.

Peter is also a member of ARENA's advisory panel and a qualified actuary with strong analytical and risk management skills.