Review of economic impact assessment supporting the Glendell Continued Operations Project

Peer review

Prepared for
NSW DPIE

30 November 2021

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Economic benefits of the Project

- There are a range of potential benefits associated with the Project. These typically relate to royalty payments to Government and, to a lesser extent, income tax. There are also a range of other benefit categories allowed for under the Guidelines (e.g. benefits to workers and suppliers) but these items have been estimated to be immaterial in the majority of economic evaluations submitted to the Department over the past few years.

Royalties and company income tax benefits

- A key driver of the benefits of royalties and company income tax payments of the Project is the coal price.
  - Coal price forecasts are inherently volatile, in part reflecting the uncertainty in energy markets which is amplified as the world shifts towards renewable energy supply.
  - The operations of the mine are expected to continue until 2024, therefore, a long-term outlook on coal prices is required. The KPMG estimates relied upon by EY include a long-term forecast of 2024 onwards, with no revisions for incremental periods. The World Bank forecast provides revisions to the long-term forecast in 2030 and 2035, which accounts for the expected decrease in coal demand and alternative energy supply. The KPMG estimates can be used as an upper bound price, with the World Bank forecast showing a mid-lower bound.
  - Coal price forecasts at the lower end of the range would place greater pressure on mine profitability and could result in mines halting production (either temporarily or permanently). The benefits estimate below do not account for this, although additional analysis is presented in the main body of the report to provide some guidance to decision makers.
- Using the price forecasts, the royalty range is $202.2m to $273.3m (in present value terms). The higher royalty reflects the KPMG price forecasts as at January 2021, as reported by EY.
- For the benefits of company tax, a range from 0 per cent to 30 per cent should be presented, reflecting the historical data. This reflects the fact that as it is unable to be determined with certainty what income tax will be paid based off an individual entity's earnings. The analysis by EY presents the upper bound estimate of income tax payable, a consideration for zero income tax should be included, given that this is also a realistic outcome

  - Based on the prices, assuming a tax rate of 30 per cent results in income tax ranging from $0m to $38.7m (in present value terms). This compares to EY's estimate of $65m.

- There is also an additional benefit item (net producer surplus) allowed for in the Guidelines. EY has assumed that this to be zero, given that the mine is foreign owned and profits will largely be repatriated off-shore. We believe that this is a reasonable assumption.
- EY estimates payroll tax benefits of $37m. This assumes that workforce would is drawn from workers at the average wage across all jobs. No evidence is presented to support the assumption. Consistent with the Guidelines, we assume that there will be no net impact on the NSW economy as a result of the payroll tax payable by Glencore. This is due to offsetting reductions in payroll tax as workers transfer between employers.

Benefits to workers and suppliers

- EY estimates benefits to workers of $468m in present value terms.
- EY's approach in measuring worker benefits is inconsistent with the NSW Government guidelines, in particular, assuming a 'reservation wage' to be equal with the average wage across all workers in the NSW economy, and not the average wage across *mining* workers.
  - The average wage for *the Project* is significantly higher than the existing average *mining* wage and the wage paid at Glencore's Liddell site. As noted in the Guidelines, it is unlikely that any new mine would pay workers significantly more than other existing mines in the region. We believe it is appropriate to assume no wage premium, consistent with the Guidelines.
  - The average *mining* wage is more than double the NSW average wage. Observed data suggests that this is most likely due to factors such as, the skills/education and experience of the mining workforce, as well as, the disutility from working conditions in the mining industry. This supports the Guidelines which recommend the use of the average mining wage (not the average wage of all workers in the economy) as the 'reservation wage' of potential new workers in the Project.
- EY's estimates 'benefits to suppliers' of $286m. This is inconsistent with the findings from the economic analysis of the majority of projects submitted to DPIE over the past decade which suggests that the supplier benefits to be immaterial. CIE estimates also indicates that the supplier benefits is likely to be immaterial. It appears that EY may not have accounted for the cost to other sectors, if the price charged by suppliers increases. This should not form part of the benefits attributable to the Project.

Economic costs of the Project

Greenhouse gas emissions

- The largest economic cost of the Project is associated with greenhouse gas emissions.
  - EY's attribution of only 0.11% of greenhouse gas emissions is inconsistent with the Guidelines and CBA practice by NSW Government agencies. The full cost of scope 1 and 2 greenhouse gas emissions should be attributed to NSW.
  - There is significant uncertainty regarding the price of carbon emissions. WE have utilised the price trajectory scenarios recommended in the draft Guidelines spreadsheets, including updating these for more current data.
  - Using the carbon prices in the Guidelines, the cost of greenhouse gas emissions (Scope 1 and 2) is estimated to be between $64.8 million and $294.0 million (in present value terms). This compares to EY's estimate of $0.1m.

Other externalities

- There are a range of other externalities items such as:
  - Transport impacts. EY estimates these costs to be $1.6m (in present value terms)
  - Loss of surplus to other industries which EY estimates to be $0.7, (in present value terms).
- Biodiversity impacts have been internalised and EY indicates that offset purchases of $16.6m (in present value terms) have been made. We assume that this fully mitigates any biodiversity impacts.

Conclusions

Table 1 summarises EY's estimates and the CIE's review of these estimates.

- There is some uncertainty regarding the quantum of net benefits (benefits less costs) associated with the Project. This reflects the uncertainty regarding future global commodity prices (i.e. forecast range of coal price), as well as, the carbon price trajectory associated with greenhouse gas emissions.
- The benefits range between $202m-$312m, depending on the assumed coal and carbon prices described throughout the report).
  - Assuming the cost of GHG emissions of $64.8m (based on the EU carbon price, as reflected in the Guidelines), the Project would deliver *net benefits* to the community of between $135m-$245m (depending on the coal price applied within the calculation).
  - However, assuming the cost of GHG emissions (based on the Australian Treasury Clean Energy Future Policy Scenario at $37.28 to $124.42/tCO2e),

this results in GHG emissions cost of around $294m. Under this scenario the Project would result in *net costs* of $94m if coal prices were in line with World Bank forecasts. However, the Project would deliver *net benefits* of $16m if the KPMG coal price forecasts were adopted.

- While there is uncertainty regarding a range of parameters, it is reasonable to expect that the Project will deliver a net benefit of around $151m (as a 'central case' estimate).
  - This assumes the World Bank coal price forecasts, as it factors in price revisions in the long term (2030 and 2035). This results in a royalties benefit of $202m and estimated tax benefit of $15.9m (based on tax of 12.3% of profit which is the average tax payable from the tax grouping from 2018-2020). For the GHG emissions, the EU carbon price estimate, as reflected in the Guidelines, is adopted which results in a cost of $64.8m. However, given the significant uncertainty regarding the carbon price, further consideration of this issue would be required from a whole of NSW Government perspective to ensure consistency across all projects.

1 Impact of mine plan options on NSW benefits and costs

	EY, PMP	CIE, PMP
	$m, 2019	$m, 2019
Royalties	282.4 [b]	202.0 - 273.3
Tax attributable to NSW	49.9	0 - 38.7
Payroll tax	37.1	0.0
Total benefit to NSW	**369.4**	**202.0 - 312.0**
Net economic benefit to NSW workers	468	0.0
Net economic benefit to NSW suppliers	286.3	0.0
Total indirect benefit to NSW	**754.3**	**0.0**
GHG emissions	0.1	64.8 - 294.06
Other environmental costs [a]	2.3	2.3
Total cost to NSW	**2.4**	**67.1 – 296.4**
Estimated Net benefit	**1,121.3**	**150.8**

[a] Includes Transport impacts and loss of surplus to other industries, [b] Based on the December/January 2020-1 KPMG coal price forecast

Note: 2019 dollars, GHG emissions calculated using the forecast EU carbon price from the draft Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals

Source: The CIE based on values from EY

2 Overview of the Project

Project description

Glendell Tenements Pty Limited (Glendell), a subsidiary of Glencore Coal Pty Limited (Glencore) is seeking approval to extend operations at the Glendell Mine, which is part of the Mount Owen Complex (MOC). The open cut operations at the Glendell Mine are currently undertaken in accordance with the Glendell Mine consent (DA 80/952) (Approved operations). Under current Approved operations, planned operations at Glendell, will extract up to 4.5 Mtpa of ROM coal over the period to 2044.

Glendell is seeking approval for the Glendell Continued Operations Project (the Project) to extract an additional approximately 135 Mt of ROM coal over a period of 24 years. The original assessment assumed that the Project would commence in 2021 with mining finishing in 2044.

Glendell Continued Operations will use existing mining facilities, including the Mount Owen coal handling and preparation plant and transport infrastructure for the life of the operations. The assessment has assumed that the operation of the Mount Owen CHPP and rail loading facilities continues to 2044.

The role of Cost Benefit Analysis

A CBA framework is a widely used tool for deciding *ex-ante* between alternative options (policies or projects). It allows decision makers to consider trade-offs arising from different options with the aim of understanding whether the community as a whole is better (or worse) off by adopting an option.

A CBA framework is focused on the aggregate welfare of the community, rather than the welfare of individual groups. It should take account of the full range of potential benefits and costs of the options, including environmental, health and other social impacts as well as the economic impacts. Where benefits exceed costs, the options are deemed to deliver a net benefit to the community as a whole. Where costs exceed the benefits, then the options should be rejected as society is worse-off if the options were implemented. Where there are a number of options, all of which deliver net benefits (i.e. benefits exceed costs), then the option that generates the highest net benefit is preferred.

Impacts are often not known with certainty. In these circumstances the CBA should at least present a range of potential outcomes so as to understand the extent to which alternative assumptions changes the conclusions . In some circumstances, not all impacts can be readily quantified and valued in a robust manner. Decision makers will need to draw on other information to complement the result of the CBA and to assist in deciding on whether society is better off from adopting an option.

Ernst and Young (EY) has undertaken a CBA of the project as part of the Economic Impact Assessment (EIA). A summary of the results are shown in table 2.1. The Project yields a net benefit of $1,149.9 million over the years to 2044.

2.1 Central case estimated CBA

Benefits	NPV	Costs	NPV
	$m, 2019 dollars		$m, 2019 dollars
Total direct benefits	**369.4**	**Total direct costs**	**-**
Net producer surplus attributed to NSW	-		
Royalties	282.4		
Payroll tax	37.1		
Council rates	-		
Company income tax apportioned to NSW	49.9		
Total indirect benefits	**754.3**	**Total indirect costs**	**19.1**
Net economic benefit to landholders	-	Air quality	-
Net economic benefit to NSW workers	468.0	Greenhouse gas emissions	0.1
Net economic benefit to NSW suppliers	286.3	Noise impact	-
		Transport impact	1.6
		Net public infrastructure cost	-
		Surface water impact	-
		Groundwater	-
		Biodiversity impact	16.6
		Loss of surplus to other industries	0.7
		Visual amenity	-
		Aboriginal cultural heritage	-
		Historical heritage	-
		Other	-
Total Project economic benefit	**1 123.7**	**Total incremental cost of project**	**2.4**
		NPV of project	**1 121.3**

Note: Based on the December/January 2020-1 KPMG coal price forecast

Source: EY

Peer review

The CIE has been engaged by NSW Department of Planning, Industry and Environment to review the economic analysis that forms part of the EIA for the continued and extended operation of the Glendell coal mine.

In conducting this peer review, we have relied on the Government's *NSW Guidelines for the economic assessment of mining and coal seam gas proposals* (December 2015). Technical notes also support the guidelines and outline methodologies, parameters and assumptions for the economic assessment.

3 Economic benefits

The benefits of the Project arise from the quantity of saleable product and the price of this product. As noted above, the NSW Government has established Guidelines for undertaking Cost Benefit Analysis. The Guidelines describe benefits attributable to NSW in the form of royalty payments, company income tax, net producer surplus, economic benefits to existing landholders, economic benefits to workers and economic benefits to suppliers.[1]

This chapter discusses the estimates presented by EY and the CIE's review of the individual elements.

Production profile

A number of benefit categories (e.g. the royalties estimate) depend on the quantify of resources extracted and sold to market. This section discusses the production profile while the next section discusses the price of the resource sold.

Glencore has investigated multiple production options for the mine as there are various geographic and structural factors which would impact the feasibility of the mine. Key factors for consideration were the impacts to the Ravensworth homestead, existing mining infrastructure, impacts to Hebden Road impacts to the Bowmans, York and Swamp creeks. A Preferred Mining Plan (PMP) was identified with a corresponding production profile, which is used for the basis of all estimates.

NSW DPIE requested Minecraft to review the options for the PMP and noted that

> Minecraft believes that Glencore has identified all the feasible alternatives for the continuation of mining at Glendell given the site's complex geology and the numerous surface constraints. Minecraft also concludes that Glencore's reasons for deciding on the final PMP footprint are sufficiently justified…[2]

Furthermore, the submission of Regional NSW notes that

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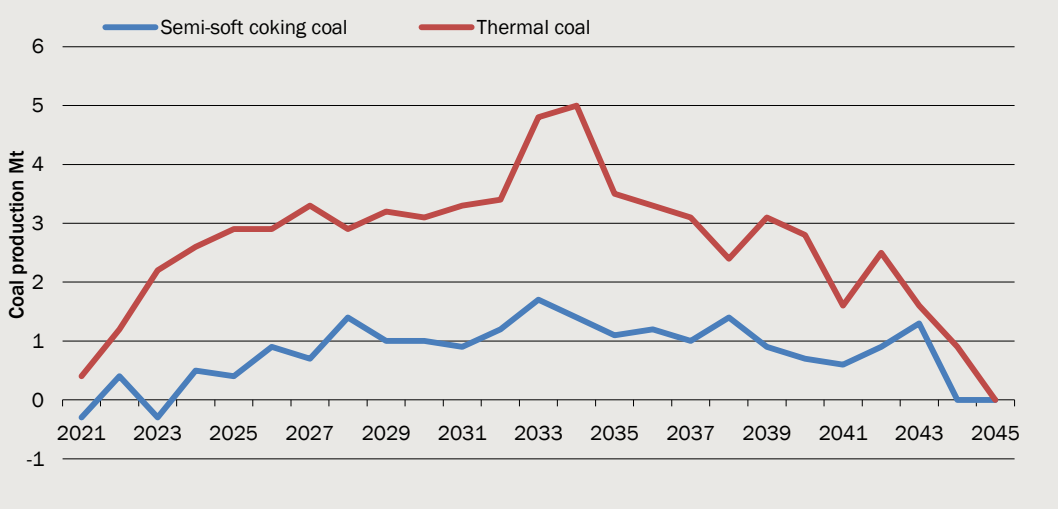
1 NSW Government (2015), Guidelines for the economic assessment of mining and coal seam gas proposals, December. https://www.planning.nsw.gov.au/~/media/Files/DPE/Guidelines/guidelines-for-the-economic-assessment-of-mining-and-coal-seam-gas-proposals-2015-12.ashx

2 NSW Government Department of Planning, Industry & Environment (2020), Review of Glendell continued operations project mine plan and mine plan options, Executive Summary

MEG has reviewed the information supplied in relation to the abovementioned Project and is satisfied with the information provided by the Proponent.[3]

Chart 3.1 shows the production profile of the mine from 2019 to 2044. Thermal coal production is largest activity, with 66 Mt projected to be produced compared with 20 Mt of semi-soft coking coal.

3.1 Production profile 2019-2044



Data source: EY EIA pp. 14

The production profiles of the options ranged from 10 Mt for the underground extraction option to greater than 150 Mt for the maximum resource recovery option.[4]

We have relied on the production schedule provided by EY for our calculations in the following sections related to royalties, company tax and GHG emissions. We note that there are discrepancies in the headline financial metrics, which are likely due to calculation differences in the EY and CIE financial models. As only limited information was provided by EY, we will require further detail on the EY model to resolve these discrepancies, although this does not materially change our analysis.

Coal price

For the coal price forecast, EY rely on the *KMPG Coal Price and FX Market forecasts*[5], which provide forecasts based on consensus estimates from various research databases and broker reports.

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3 NSW Government Regional NSW - Mining, Exploration & Geoscience Advice Response to the Glendell Continued Operations Project

4 Glencore, Appendix 1: Mine Planning Options Report, pp.4

5 KPMG (2019), KMPG Coal Price and FX Market forecasts, https://home.kpmg/content/dam/kpmg/au/pdf/2019/coal-price-fx-consensus-forecast-june-july-2019.pdf , https://home.kpmg/content/dam/kpmg/au/pdf/2021/coal-price-fx-market-forecast-december-2020-january-2021.pdf

- For the semi-soft coking coal forecast, 17 contributors reported forecasts for the consensus estimate, ranging from 80.0-105.0 USD/t for the long-term forecast.
- For the thermal coal forecast, 21 contributors reported forecasts for the consensus estimate, ranging from 57.5-90.0 USD/t for the long-term forecast.

There is a considerable degree of uncertainty in the long-term coal price forecast, as illustrated by the variance in estimations, 31 per cent for semi-soft coking coal and 57 per cent for thermal coal. Furthermore, the long-term forecast period for the consensus estimates are based on 2024 onwards, and do not provide estimates for the expected reduction in coal production towards 2050. As the operations of the mine extend to 2044, relying on a 2024 onwards estimate would appear to result in a higher than expected range.

Table 3.2 shows the KPMG forecasts compared with the World Bank and Office of the Chief Economist forecasts. The World Bank and Office of the Chief Economist do not provide forecasts for semi-soft coking coal.

3.2 Coal price forecasts

Series	2019	2020	2021	2022	2023	Long term
All prices real 2019 AUD/t						
Semi-soft coking coal						
Original June/July 2019	169.9	155.2	141.4	126.7	118.3	119.7
Revised December/January 2021			112.7	113.6	111.7	120.5
Thermal coal						
Original June/July 2019	121.9	108.3	100.0	94.0	87.2	95.9
Revised December/January 2021			86.1	84.7	83.5	87.9
World bank April 2021	111.3	83.6	101.8	94.3	89.7	62.6-48.8 [a]
Office of the Chief Economist September 2021 [b]		79.8	117.8	110.3	90.1	-

[a] Long-term forecast to 2030 and 2035 [b] Converted from Japanese financial year to calendar year

Note: EY provided revised forecast as part of the submission Addendum to the EIA (June 2021)

Source: KPMG, World Bank, Office of the Chief Economist.

There is considerable variation in the short term coal price forecasts from the different sources, however, they tend to converge by the 2023. This reflects the impact of current world events, such as the 2021 EU energy crisis reflected in the September 2021 Office of the Chief Economist forecasts. These impacts do little to influence the economic projections of the mine, which will have operations lasting until 2044. Therefore, the long-term forecast provides the most impactful guidance.

The World Bank forecast shows a significant reduction in thermal coal prices from 2030 to 2035 and beyond. Compared with the average KMPG thermal coal price, there is a 17 per cent decrease in 2030 and a 33 per cent decrease in 2035. A fall in coal prices as forecasted by the World Bank could reflect a reduction in market demand as global energy supply shifts from fossil fuels to renewable energy, as expected in the net zero emissions by 2050 strategies.

- **Coal price forecasts are inherently volatile, reflecting the uncertainty in energy markets which is amplified as the world shifts towards renewable energy supply. The operations of the mine are expected to continue until 2044, therefore, a long-term outlook on coal prices is required. The KPMG estimates relied upon by EY include a long-term forecast of 2024 onwards, with no revisions for incremental periods. The World Bank forecast provides revisions to the long-term forecast in 2030 and 2035, which accounts for the expected decrease in coal demand and alternative energy supply. The KPMG estimates (updated in December 2020-January 2021) can be used as an upper price bound, with the World Bank forecast showing a mid-lower bound.**

Exchange rate

The value of coal revenue is dependent on the AUD:USD exchange rate. In the EIS, consistent with the coal price forecasts, EY rely on the exchange rate consensus forecasts published in the *KMPG Coal Price and FX Market forecasts.* Table 3.3 shows the forecasts for AUD/USD in 2019 and 2021. The is little variance between the 2019 and 2021 forecasts, which ranges between 0.01-0.02 US cents.

3.3 AUD/USD forecasts

	2019	2020	2021	2022	2023	2024	2025	Long term
USD								
Original June/July 2019	0.70	0.71	0.73	0.75	0.75			0.76
Revised December/January 2021			0.75	0.76	0.76	0.76	0.76	0.75

Note: Revised estimate provided in Addendum to EIA (June 2021)

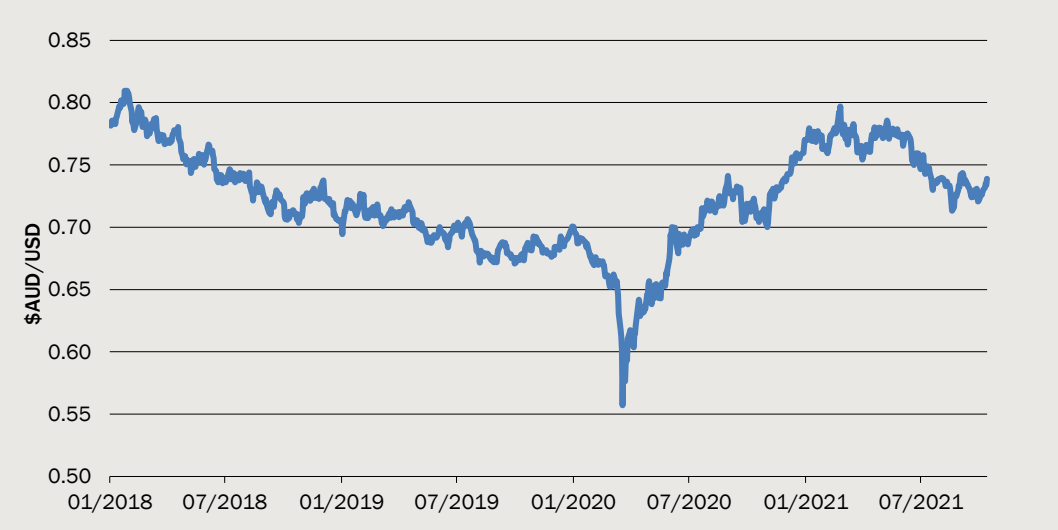
Source: KMPG Coal Price and FX Market forecasts

In the EIA, EY (p. 15) notes that

> From 2024 and onward, we assume the coal prices and exchange rate remain at the published long-term rates

Coal prices are subject to further variation caused by the movements in the AUD/USD exchange rate. Over the past three and a half years, the Australian dollar traded at a low of 0.56 US cents on 19 March 2020 and a peak of 0.81 US cents on 29 January 2018, as shown in figure 3.4. Movements in the exchange rate are difficult to predict with any degree of accuracy due to the multitude of influencing internal and external factors.

3.4 AUS/USD Exchange rate



Data source: Reserve Bank of Australia, Exchange Rate Historical Data (2021)

- **The KPMG forecast exchange rate (of between 0.75 and 0.76) is within the range of the current exchange rate and provides a reasonable assumption for the CBA**

Royalty estimates

The primary benefit of the Project is the value of the resources, estimated to be over $3.9 billion in present value terms (using EY's production and price assumptions discussed above). The value of production is sensitive to production, coal price and foreign exchange assumptions, which inherently carry some level of uncertainty.

The royalties received by the NSW Government in the future depends on the value of the resources from the mine. A proportion of this future value is received by the state as a royalty payment. The royalty payment is based on the standard NSW Government rate of 8.2 per cent ad valorem for open cut mines. A discount of $3.50 per tonne is applied for washing.

The future production profile from the mine is largely determined by a range of physical factors (e.g. the location of the resource) as well as other factors such as the demand and expectations of future coal prices.

Royalty payments to the state

The results of the economic analysis significantly depend on the value of coal (in AUD terms). While there is inherent uncertainty regarding future coal prices, the results presented in the EY analysis can be considered reasonable as they use a consistent consensus approach for forecasting coal prices and the AUD/USD exchange rate.

Sensitivity testing using the World Bank forecast results in a negative gross margin in 2031, 2032 and 2035 onwards. Should these prices eventuate, we may expect production to temporarily cease at Glendell in 2030. Table 3.5 shows the impact of using the World Bank price forecasts and for ceasing production in 2030. A no price forecast for semi-soft

coking coal was provided by the World Bank, we assume the same difference in prices of the long-term thermal forecasts. The World Bank forecast prices result in a large decrease in royalties, with a 29 per cent drop in the 2044 timeframe and a 15 per cent drop in the 2030 timeframe.

3.5 Royalty payments under different price forecasts and production timeframes

Price forecast	Royalty NPV
	$m
Production until 2044	
KPMG (June/July 2019)	286.8
KPMG (Dec/Jan 2021)	273.3
World Bank	202.2
Production until 2030	
KPMG (June/July 2019)	128.2
KPMG (Dec/Jan 2021)	120.4
World Bank	111.7

Note: 2019 AUD
Source: The CIE

- **Coal prices are quite volatile with particular uncertainty in the long-term timeframe. As the Project is expected to operate until 2044, we tested the impact of a range of long-term price forecasts. While using the World Bank forecast resulted in a large decrease in royalties, it is still a significant benefit category overall.**

Income tax

The amount of income tax payable is dependent on the estimated taxable income to which the statutory tax rate is applied. Company tax payments are commonly based on an estimate of the net profits from the production, including a straight-line depreciation, and assumed a tax rate of 30 per cent. The income tax to the Australian Government is assumed to be partly distributed to NSW - typically 32 per cent is attributable to NSW based on its population share of Australia.

Estimating the income tax payable is challenging given the complexities of the tax system, particularly with global mining (and other) companies operating in Australia. It is in all companies' self-interest to minimise any tax payments within the 'rules' of the tax system. Mining companies are no different and operate with the interest of their shareholders in mind.

The Project is operated by Glendell Tenements Pty Limited, who are a subsidiary of Glencore Coal Pty Limited. There is no public information describing the corporate structure of Glencore Coal Pty Limited, which means we are unable to determine its relationships with other Glencore controlled entities. Therefore, in order to understand the tax practices of Glencore, we have analysed the reporting of one of the major Australian Glencore entities, Glencore Investment Pty Limited (Glencore Investment).

Glencore's Australian mining operations are conducted via numerous wholly and partially owned subsidiaries. These subsidiaries consolidate under the company Glencore Investment Pty Limited (Glencore Investment). As of the 31 December 2020, Glencore Investment reported a consolidated revenue of $10.26 billion with 17 688 employees.

Within Glencore Investment is a tax grouping (Tax Group), whereby all agreed entities consolidate accounting to lodge a singular financial report[6]. The tax grouping enables revenue gains and losses to be 'netted out' between the entities when consolidated, which means that a revenue gain from one coal mine could be offset by a loss elsewhere.

This Tax Group comprises of wholly owned subsidiaries in the following activities:

- Copper production
- Copper/Zinc/Lead production
- Nickel production
- Zinc production
- Bauxite exploration
- Coal investment holding
- Coal production
- Holding
- Finance
- Operating
- Coal marketing

All coal production entities are shown in table 3.6.

3.6 Coal production entities

Entity	Interest
	%
HV Coking Coal Pty Limited [a]	100
Mangoola Coal Operations Pty Limited [a]	100
Mt Owen Pty Limited [a]	100
NC Coal Company Pty Limited [a]	100
Oaky Creek Holdings Pty Limited [a]	100
Ravensworth Operations Pty Limited [a]	100
Rolleston Coal Holdings Pty Limited	100
Abelshore Pty Limited [a]	100

[a] Member of the closed group

Source: Glencore Investment Pty Limited Financial Statements 2020 pp. 69-70

6 Pursuant to ASIC Corporations (Wholly-owned Companies) Instrument 2016/785, relief has been granted to the companies identified in the tax group from the Corporations Act 2001(Cth) requirements for the preparation, audit and lodgement of their financial reports

Table 3.7 shows the summary profit and loss statement between 2018-2020 for the Tax Group.

3.7 Profit and loss of tax grouping 2018-2020

Item	2018	2019	2020
	$USm	$USm	$USm
Revenue	11 515	11 891	9 305
Cost of goods sold	(8 517)	(9 326)	(8 669)
Loss/profit before income taxes	1 537	985	(1 009)
Income tax benefit/expense	(492)	(52)	279
Tax paid as a % of profit	**32%**	**5%**	**-**
Loss/profit for the year	1 045	933	(730)

Source: Glencore Investment Pty Limited Financial Statements 2018-2020

Over the past 3 years, the Tax Group has paid zero tax, 5 per cent of profit and 32 per cent of profit. This shows that while some entities may be profitable, it is dependent on the profitability of the Tax Group as whole as to whether income taxes will be paid.

- **A range from 0 per cent to 30 per cent should be presented, as it is unable to be determined with certainty what income tax will be paid based off an individual entity's earnings. The analysis by EY presents the upper bound estimate of income tax payable, a consideration for zero income tax should be included. At the lower end, the income tax payment would be zero but could increase to $38.7m, based on KPMG (December 2020-January 2021) coal price forecasts and a tax rate of 30 per cent.**

Payroll tax

In the EIS, EY attribute $37.2 million in payroll tax to the NSW Government. Payroll tax is a tax payable to the NSW Government for business with wages that exceed the payroll tax threshold, which was $900 000 for July 2019 to June 2020. The payroll tax rate for this period was 5.45 per cent.

The Guidelines are explicit in how to account for payroll tax, see page 10 of the Guidelines:

> Note that a new mine will also pay other taxes, such as payroll tax and personal income tax. The majority of these taxes will have been generated without the project, as people would have been employed elsewhere. Hence these should be included in costs. To the extent that a proponent can demonstrate that other taxes are genuinely additional and will not be offset by lower tax payments elsewhere in the economy, they may be recognised, provided that the impact of these taxes on the overall NPV of the project is reported.

Workers for the Project will be drawn from either the mining sector or other industry sectors. Workers transferring from the mining sector are expected to receive a wage similar to their current wage, as stated in the Guidelines (p.13):

> …it is not generally the case that one mine will pay significantly more than other mines for workers doing a similar job in similar conditions.

EY has not presented evidence to suggest that the workforce of the Project will be drawn from workers currently being paid a substantially lower wage compared to the mining wage. Further data would be required to understand where the workers for the Project will be drawn from and the wage in their current employment.

- **Consistent with the Guidelines, no additional payroll tax benefit will be generated from the Project. No evidence was provided to indicate that the workforce for the Project would be drawn from workers that are currently paid substantially less than under the Project.**

Net producer surplus

The mine is wholly owned by Glencore, who are a 100 per cent foreign owned entity. While shareholders of Glencore may be Australian residents, it is difficult to determine this share. Accordingly, the net producer surplus is estimated at zero in line with EY.

4 Worker and supplier benefits

EY assessment of worker benefits

EY interpret the benefit to workers as the:

- Wages earnt in the mine
- Minus the opportunity cost of labour for working in the mining sector, i.e. compared to working in the non-mining sectors (or being unemployed)
- Minus the wage difference due to skills and the disutility of work in the mining industry

EY use an assumption of a wage for the Project of $176,299 per FTE, which is higher than the average mining wage of $139,797 in 2019.[7] To measure the opportunity cost of labour EY use the average NSW wage of $67,193, based on 2016 Census data updated to 2019 dollars. EY assume no disutility of working in mining and assume that there are no additional skills required to work in the mine compared to a job receiving the average wage.

During the construction phase, Glencore estimate that the workforce will be made of 85-90 per cent contractors and the remainder Glencore personnel. In the operational phase, the number of contractors is expected to reduce to 10 per cent. According to the EIS, in 2021 the number of full time equivalent (FTE) employees will be 75.6, ramping up to 429 by 2026 and 687 by 2033.

A summary of EY's estimate of worker benefits is provided in table 4.1.

4.1 Summary of worker benefits

Variable	NPV project
	$m
Total average wage	288.2
Total mining wage	756.2
Disutility of working in mining	-
Estimated worker benefit	468.0

Source: EY EIA pp.19

EY also present an addendum which seeks to further justify its approach. These issues are dealt separately in Appendix A.

7 ABS, 6302.0 Average Weekly Earnings, Australia

NSW Government guidelines

The opportunities for employment in the region depend on the availability of unmet labour demand (i.e. whether there are enough unemployed people looking for work), the skills required for these jobs, and the level of remuneration (which may cause a labour shift from one industry to another).

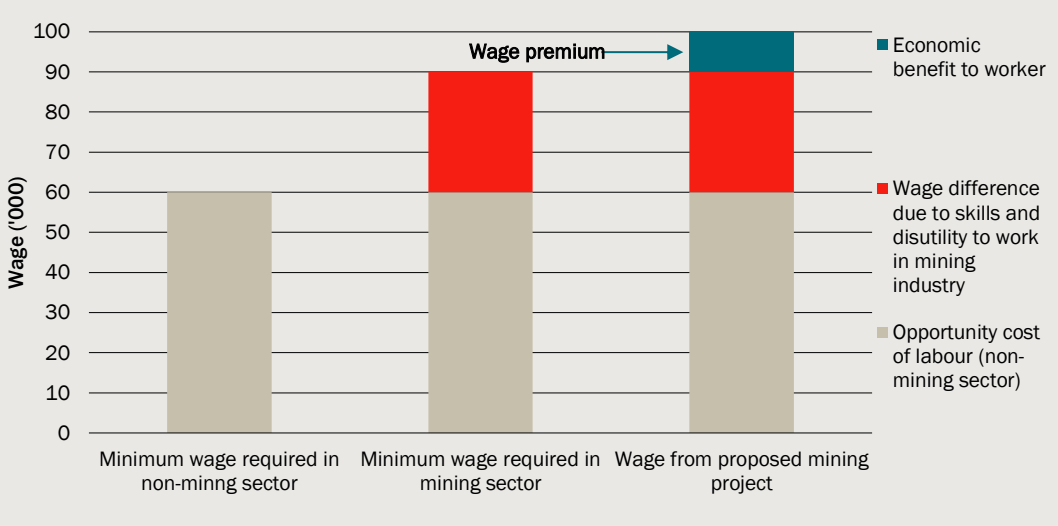
When a new mine opens in a region, it increases the demand for mining labour. In the absence of an excess supply of suitably qualified labour, the increase in demand will push-up wages in the region which benefits the workers in the mine. The Government would also benefit from receiving additional income tax on the higher wage.

The NSW Guidelines allow for an additional benefit category defined as 'benefits to workers' associated with a wage premium paid to workers as a result of the Project. The benefit to workers is the difference between the wage paid in the mining project and the minimum (reservation)[8] wage that the workers would accept for working elsewhere in the mining sector. The minimum wage reflects the employment opportunity costs (of alternative employment), skill level required and the relative disutility of an employment position. In chart 4.2

- the grey shaded bar, can (broadly speaking) be interpreted as the wage that an 'average' worker in the region *currently* receives;
- the red shaded area represents the additional amount that the 'average' worker could *currently* receive in the mining sector if they had the right skills as well as the additional amount needed to compensate a worker for other factors such as greater hardship for working in a mine compared to their existing job; and
- The teal shaded area is the impact on the mining wage due to the increased demand for labour, if the Project were approved. That is, a Project may increase the mining wage from, for example, $90,000 to $100,000 per year. This is described as the 'wage premium' for inclusion as a benefit in a CBA.

8 The reservation wage is the minimum wage a worker has to be paid to work in a particular industry. In view of the hours of work and working conditions, there is a reasonable possibility that workers' reservation wages in mining are higher than in other industries and take into account hours of work and working conditions.

4.2 Identifying the economic benefit to workers



Box 4.3 presents an extract from the NSW Government's Guidelines which explains how the wage premium considered to be an economic benefit to workers should be interpreted.

4.3 Description of NSW Guidelines approach to measuring benefit to workers

In practice, minimum (reservation) wages are not readily observable. The NSW Guidelines note that an appropriate starting assumption should be that workers do not receive a wage premium, even if they will earn more working in the mining sector.[9]

- If workers are already working in the mining sector, it is not generally the case that one mine will pay significantly more than other mines for workers doing a similar job in similar conditions.
- If a mine will employ workers that are currently working locally, but not in the mining sector, a mine may need to offer higher wages to compensate for more physically demanding work, tougher conditions etc. In this case, the benefit to the worker from higher pay will be offset by the costs associated with, for example, greater hardship (referred to as 'disutility').
- If a mine needs to attract workers from other parts of NSW, it may need to pay them more than they are earning in their existing or previous jobs so that they will relocate. For example, a mine that employs truck drivers in a remote area may need to offer a higher wage than is paid to drivers of similar trucks in the city or large towns. If so, the difference between the minimum wage necessary to get a truck driver to relocate and the standard wage in the city or town only reflects the disutility of having to work in a remote area.

The Guidelines note that an appropriate starting assumption should be that workers do *not* receive a wage premium, even if they will earn more working in the mining sector (given the disutility of working in mines and due to differences in skills). The Guidelines, however, also state that

> Although a zero wage premium is a useful starting assumption, the appropriateness of this assumption must be assessed on a case by case basis. This is because benefits to workers can be one of the major economic benefits from a project. If a proponent considers that a project will generate positive benefits for workers, the economic assessment should clearly explain the reasons for this conclusion and present evidence in support of the valuation that has been adopted.

Further, in theory, a CBA for NSW should include the economic benefit to workers already residing in NSW prior to the project (the base case). The economic benefit to workers migrating to NSW should not be included in the CBA for NSW. The estimate should be based on the proportion of NSW resident and non-NSW resident workers to be employed by the project for the purposes of attribution.

9 NSW Government (2015), *Guidelines for the economic assessment of mining and coal seam gas proposals*, December, page 13.

Based on the Guidelines, the welfare measure (covering individual and Government welfare) that should be reflected in the wage premium is:

- where a mine worker is previously employed elsewhere — the pre-tax wage in the mine less pre-tax wage employed in the current occupation *less any change in the disutility/skill of work;* and
- where a mine worker is otherwise unemployed — the pre-tax wage in the mine *less disutility/skill of working in the mine.*

Further, there is also uncertainty regarding EY's wage assumptions for the Project. The projected average wage of the Project is $36,502 greater than the average mining wage in NSW. A report by the McKell Institute on wage cutting in the mining industry showed that the average wage of a Glencore (Liddell) employee in 2018 was $135,222 (2019 dollars) according to figures provided by the Construction, Forestry, Maritime, Mining and Energy Union (CFMMEU).[10]

Furthermore, the average wage of a contractor at the Liddell site (from the contract company OneKey) is $91,223 (2019 dollars). Glencore estimate that 85-90 per cent of the construction workforce will be contractors, reducing to 10 per cent for the operation phase of the mine.

There does not appear to be a clear reason why Glencore would pay substantially higher wages to workers at the Glendell site compared to its other nearby mine sites or mines owned by other companies. As stated in the Guidelines (p.13):

> …it is not generally the case that one mine will pay significantly more than other mines for workers doing a similar job in similar conditions.

- **EY's approach is inconsistent with the NSW Government guidelines, in particular assuming a reservation wage to be equal with the NSW average wage, and not the mining average wage.**

Supplier benefits

There are a range of suppliers of services to the mining sector. This could include, for example, construction services, engineering services, environmental management services, explosives and electricity supplies. These relate to 'intermediate inputs' and do not include a range of other costs such as tax payments, royalty payments.

The Guidelines (p.14) allow for the inclusion of economic benefits to suppliers noting that:

> Similar to the economic benefit gained by existing landholders and workers, local suppliers may also receive an economic benefit by achieving higher surpluses through supplying the mining/coal seam gas project. This economic benefit reflects producer surplus created for suppliers. This should be net of any producer surplus loss because of a reduction in an existing industry.

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10 McKell Institute (2020) Wage-cutting Strategies in the Mining Industry The cost to workers and communities, https://mckellinstitute.org.au/wp-content/uploads/McKell-Wage-Cutting-in-the-Mining-Industry.pdf

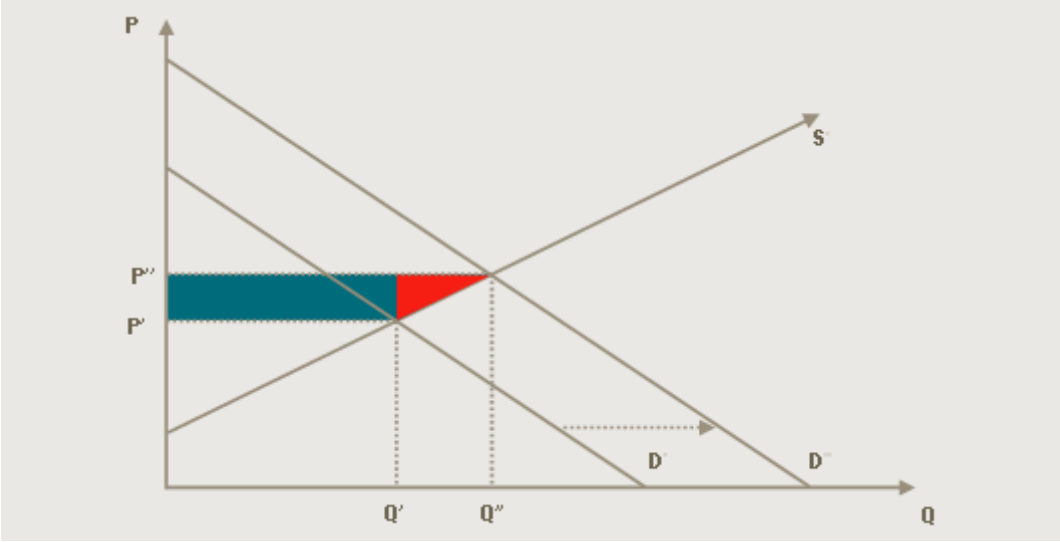
Conceptual framework

Suppliers to a new mine may receive additional 'producer surplus' by being able to charge a higher price for their services due to the increased demand caused by the Project. In a competitive market where price equals marginal cost and there is highly elastic supply, this impact would be zero. That is, in the long term new firms can enter the market and it is difficult for existing suppliers to charge higher prices. In reality, this impact is likely to be greater than zero, particularly in the short term, as firms taking time to respond to the increased demand for their services.

This economic benefit reflects producer surplus created for suppliers. This should be net of any producer surplus loss because of a reduction in an existing industry. The value of economic benefit to suppliers attributed to NSW should reflect expected input-shares for NSW and non-NSW suppliers for the Project.

An increase in mining production in NSW from a new mine can increase producer surplus to all industries that supply to the mining industry (the red and teal shaded area of chart 4.4). The estimation of values for the economic benefit to local suppliers from a new mine needs to distinguish between producer surplus to all suppliers to the mining industry (teal shaded area) and producer surplus to suppliers to the new mine (red shaded area). For the purposes of estimating values of the economic benefit to local supplies, only the producer surplus to industries supplying to the *new mine* is relevant (red shaded area).[11]

4.4 Estimating change in producer surplus to local suppliers



Data source: TheCIE

11 This assumes other mines in the region are locally owned and hence the additional producer surplus to industries supplying the broader mining industry (excluding the new mine) is not relevant as this represents a transfer from seller to buyer. This assumption means the estimate of economic benefit to local suppliers will be an underestimate if other mines in the region are foreign owned (foreign ownership is unknown).

CIE estimate

The lower bound estimate of supplier premiums to NSW and local suppliers arising from a new mine is $0 based on competitive markets where suppliers can readily respond to changes in demand for their services. The upper bound estimate of supplier premiums is estimated using a computer general equilibrium model of the Australian economy, CIE-REGIONS. An increase in mining production of $100 million in NSW by a new mine (not mine specific) results in expenditure of $35 million on intermediate inputs:

- $23.5 million sourced from NSW local suppliers
- $6.5 million sourced from interstate
- $5 million imported from overseas.

Key industries supplying the mining industry are business services, rail freight transport, other mining sector (e.g. construction materials and services to mining), finance services, electricity supply and construction.

The producer surplus to local suppliers of the new mine (the red triangle in chart 4.4) was estimated based on the direct impact and short-run supply elasticities. That is, suppliers gain by being able to charge a higher price to service the additional mining activity due to the Project. Based on the modelling undertaken by my team using the CIE-REGIONS model, the producer surplus (economic benefit) to NSW suppliers created by additional mining activity is:

- approximately 0.01 per cent of expenditure on locally sourced intermediate inputs
- approximately 0.007 per cent of total expenditure on intermediate inputs sourced locally, interstate and overseas.

For example, if a new mine spends $100 million on intermediate inputs, this implies the economic benefit to NSW suppliers supplying to the new mine is $7 000.[12] Adopting the expenditure on intermediate inputs supplied from NSW of $1,419m (in present value terms) presented in table 10 in EY's report, this equates to supplier benefits of $0.1m (in present value terms) based on the estimate that 0.007 per cent of expenditure on intermediate inputs is a benefit to suppliers.

These estimates should be interpreted as an indicative estimate that provides an 'order of magnitude' estimate of supplier benefits. Nevertheless, it is significantly different to EY's estimate of $286m (in present value terms). It would appear that EY's estimate also includes the teal rectangle (in chart 4.4) which reflects the increased supplier costs to other firms. These higher costs should not be treated as a benefit of the Project.

This small estimate of supplier benefits is consistent with other projects, such as the Bowden's silver mine near Mudgee (Gillespie Economics, 2021) and the Rocky Hill and United Wambo coal mines (Deloitte Access Economics 2016).

- **EY's estimate of supplier benefits is inconsistent with the vast majority of mining CBA's conducted by other consultants that estimate supplier benefits of close to zero. CIE's estimate also indicates supplier benefits are likely to be immaterial (close to zero).**

12 Estimated based on short-term elasticities built into the CIE-REGIONS model.

5 Environmental and social impacts

The CIE has not verified the assessments undertaken by specialists as related to the below topics.

Greenhouse gas emissions

The NSW Government's April 2018 *Technical notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* outline that analysis include:

- a central estimate of GHG emission output and the expected emissions profile of this central estimate for Scope 1 and Scope 2 emissions
- an estimate of the economic impact of GHG emission output to NSW only
- sensitivity analysis on anticipated project GHG emissions outputs (Scope 1 and 2) at carbon prices below and above the central estimate price.[13]

The Technical notes (page 49) specify:

> The value of the externality is limited to the impact on NSW, consistent with the Guidelines and how other costs/benefits are measured within the CBA. As noted in the Guidelines, the focus is on the costs and benefits of the project as they relate to the community of NSW.

EY has estimated greenhouse gas (GHG) emissions attributable to the Project through accounting for the following emissions types:

- Scope 1 emissions, representing the direct GHG emissions from project operations, such as the use of diesel in plant and equipment and fugitive emissions; and
- Scope 2 emissions, representing the indirect emissions from purchases of inputs, generally associated with the purchase of electricity.

Scope 3 emissions are excluded from the calculations, consistent with the Guidelines and associated April 2018 Technical Notes.

EY assume a fixed carbon price of $14.17 (in 2019 dollars) per tonne of CO2e abated over the life of the Project, based on the June 2019 auction undertaken by the Clean Energy Regulator (CER) under the Emissions Reduction Fund (ERF). This results in an economic cost of $62.3m in present value terms over the life of the Project. However, EY only attributes 0.11 per cent of these costs to NSW based on its interpretation of the Guidelines. This attribution factor and the carbon price assumptions are discussed below.

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13 NSW Government's April 2018 *Technical notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals*

Attribution to NSW

EY's approach of only valuing 0.11 per cent of greenhouse gas emissions (Scope 1 and 2) is based on his interpretation of the phrase in the Guidelines related to "estimating the economic impact of GHG emission output to NSW only".

In our view, this is a misinterpretation of the Guidelines. We recognise that the final Guidelines do not provide explicit step by step 'rule' on how to estimate the impact to NSW, although the *draft* Guidelines and accompanying technical notes previously provided this guidance in the form of an Excel spreadsheet. EY's approach would be inconsistent with the 2015 draft guidelines, which include a step-by-step guide and require the attribution of the full cost.

Further, if the *final* Guidelines intended to radically diverge from the approach in the draft guidelines, there would have been a detailed/explicit discussion on the reason for this and the different approaches (e.g. by population share) of apportioning impacts to NSW. The fact that the final Guidelines are silent on the apportionment issue strongly suggests that it assumed the attribution of the full cost to NSW.

The need to attribute the full cost to NSW is also clearly stated in NSW DPIE's response to submissions on the draft Guidelines. In 24 November 2015, Gillespie Economics provided a submission to the NSW Government on the draft Guidelines. Gillespie noted that

> the draft guideline attributes all the social damage costs of GHG emissions to NSW despite most of the social damage costs of carbon occurring overseas. This was raised by a reviewer of the draft guideline and dismissed by NSW DP&E….:

As noted by Gillespie Economics, NSW DPIE responded by stating

> The draft guidelines focus on calculating the relative cost or benefit to NSW. For the most part this requires proponents to calculate the environmental and social costs that will be attributable to NSW. The fact that GHG impacts will not be localised to NSW is noted, however it is considered appropriate to value these based on the amount of emissions that are produced in NSW.

NSW DPIE, therefore, provides a clear interpretation of the intent of the Guidelines. The IPC has also supported NSW DPIE's position. For example, in relation to the April 2021 decision on Mangoola Coal Continued Operations Project, the IPC Determination (p.43) stated

> The Commission notes that the EIA multiplies the cost of climate impacts by the ratio of NSW population to global population. The Commission does not accept the methodology for calculating GHG impacts and costs referenced above. The Commission noted that this approach, in particular for addressing the costs of Scope 1 and 2 emissions, is not consistent with international rules, as these emissions are entirely accounted for where they are generated and emitted (i.e. in NSW) and by the emitting entity. The Commission has therefore disregarded the EIA's estimate of the indirect cost of fugitive emissions and is of the view that

> all Scope 1 and Scope 2 emissions should be fully costed in the economic analysis because they are emitted in NSW, and therefore attributable to NSW and the Project.[14]

Assigning 100 per cent of emissions from the Project is also consistent with *NSW Government Guide to Cost-Benefit Analysis (TPP17-03)* which discuss the approach to including externalities in the CBAs. Box 5.1 presents an extract from Section 7.4 on page 59 of the Guidelines. Given the materiality of the issue, if Treasury believed that only 0.35 per cent of emissions from a Project should be accounted for the CBA Guidelines would make this explicit.

5.1 Valuation of Externalities (NSW Treasury CBA Guidelines)

Externalities can be estimated drawing on market data, where it is available. For example, the valuation of externalities like greenhouse gas emissions is normally examined as part of an Environmental Impact Assessment which follows broadly similar steps:

1 Determine the scope of the impact (e.g. categories of externality and/or geographic coverage).

2 Measure the physical change (i.e. the volume of greenhouse gas emissions relative to the base case).

3 Derive from market data or reasonable proxies a market price or cost in dollars per unit of volume/impact (e.g. market prices of emissions trading certificates).

4 Undertake sensitivity analysis of key parameters.

The approach of assigning 100 per cent of the emissions from the Project is also consistent with CBA guidelines in other sectors such as AustRoads guidelines for road projects.[15]

- **EY's attribution of only 0.11% of greenhouse gas emissions is inconsistent with the Guidelines and CBA practice by NSW Government agencies. The full cost of scope 1 and 2 greenhouse gas emissions should be attributed to NSW.**

Carbon price

A key driver of the impact of GHG is the carbon price. The Technical Notes (p.44) supporting *The Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* state:

> While there is some uncertainty regarding future domestic carbon prices, it is important that NSW industries and new projects take proper account of the impact of their emissions on GHG abatement efforts and the environment.

14 https://www.ipcn.nsw.gov.au/resources/pac/media/files/pac/projects/2020/12/mangoola-coal-continued-operations-project-ssd-8642/determination/210426-mangoola-coal-continued-operations-project-ssd-8642--statement-of-reasons.pdf

15 https://austroads.com.au/publications/economics-and-financing/agpe04-08

The Technical Notes (p.48) further states

> Even though there is uncertainty around the future mix of price and regulatory approaches to GHG abatement, price expectations from the EU ETS currently provides one of the clearest indications of a market based carbon price linked to longer term emission targets.
>
> As a central estimate of a carbon price, the EU ETS carbon price potentially provides a benchmark to proponents for examining the implications of domestic carbon pricing or other abatement measures on the emissions output of mining and CSG operations. However, a proponent may in their economic assessment, justify the use of a different central estimate carbon price.

The Review of the NSW Energy Savings Scheme suggested that an appropriate reference price for the cost of carbon is the forecast price of emission allowances (EUAs) with the European Union Emissions Trading System (EU ETS) based on futures derivatives published by the European Energy Exchange.[16]

> Even though there is uncertainty around the future mix of price and regulatory approaches to GHG abatement, price expectations from the EU ETS currently provides one of the clearest indications of a market based carbon price linked to longer term emission targets.

The guidelines for *Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* proposes three alternative carbon prices:

- Forecast European Union Emission Allowance Units price - $10.72 to $24.01/tCO2e
- Australian Treasury Clean Energy Future Policy Scenario - $37.28 to $124.42/tCO2e
- US EPA Social Cost of Carbon - $20.22 to $38.03/tCO2e.[17]

Using the carbon prices starting in 2021 (but still in 2019 dollars) would result in a cost of greenhouse gas emissions (Scope 1 and 2) of between $64.78 million and $294.06 million.

While the assumptions in the Guidelines provide a starting point there have been significant changes since the Guidelines which are considered below.

- **NSW and Australia have not defined a carbon price to use in cost benefit analyses. Regulatory bodies generally have a preference to present a range of carbon prices via sensitivity testing for CBAs. In the past 12 months, these carbon prices have increased significantly as carbon markets transform. Further guidance may be required from the NSW Government for the appropriate carbon prices to consider for CBA parameters across all sectors.**

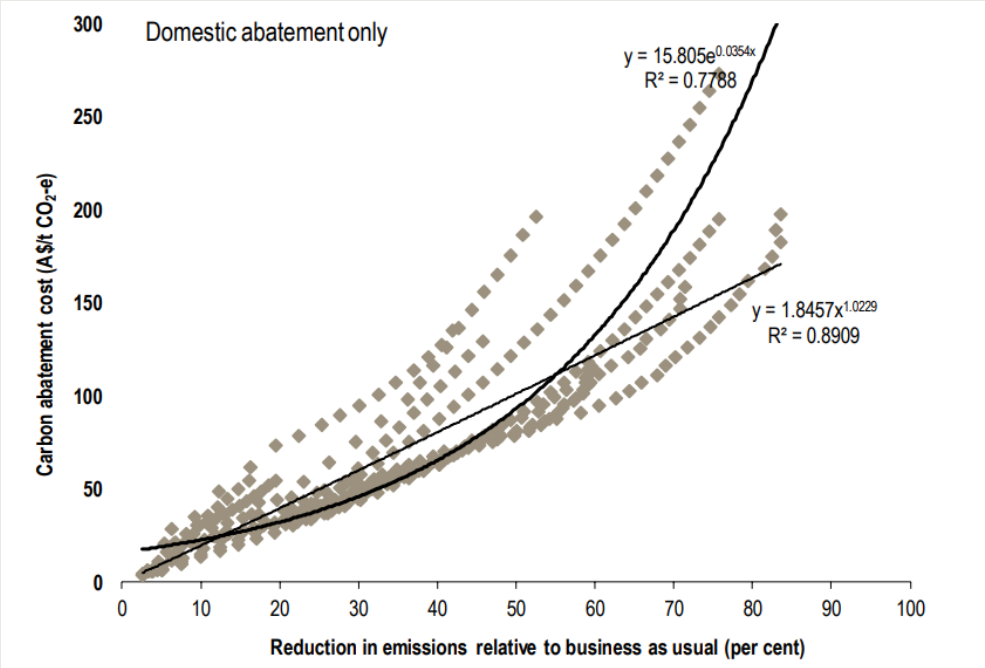
16 https://www.planning.nsw.gov.au/-/media/Files/DPE/Other/technical-notes-supporting-the-guidelines-for-the-economic-assessment-of-mining-and-coal-seam-gas-proposals-2018-04-27.pdf?la=en

17 The price projections were based on the spreadsheets presented in the draft guidelines updated for inflation.

Carbon price escalation

Inherent in the carbon prices is an escalation of the carbon price, reflecting the increasing cost of abatement as emissions are reduced. Chart 5.2 shows the implicit marginal cost of abatement for Australia as estimated from multiple models and policy settings[18].

5.2 Carbon price and abatement outcomes for Australia Real $2010



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Note: Curves represent different model specifications and scenarios for costing carbon abatement

Data source: Modified and updated from Pearce, D 2012 'Empirical uncertainties in climate policy implementation' The Australian Economic Review, Vo. 45, No.1. Updated data from Commonwealth of Australia 2013, Climate Change Mitigation Scenarios and from Jiang et al 2013 Modelling the trade implications of climate mitigation policy RIRDC Publication No. 12/104, July.

The *Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* provide escalating carbon prices from 2015-2064, with price escalations ranging from 2-5 per cent per annum.

EY assume a fixed carbon price of $14.17 over the life of the project. This is at odds with the guidelines and carbon pricing models. Australia, among other countries, has committed to reducing emissions, thus inherently increasing the cost of abatement. Assuming a constant carbon price will decrease the NPV cost of GHG emissions.

- **Consistent with existing carbon price modelling, price escalation should be incorporated.**

18 See What existing economic studies say about Australia's cost of abatement, https://www.industry.gov.au/sites/default/files/2020-05/what-existing-economic-studies-say-about-australias-cost-of-abatement.pdf

EU carbon price

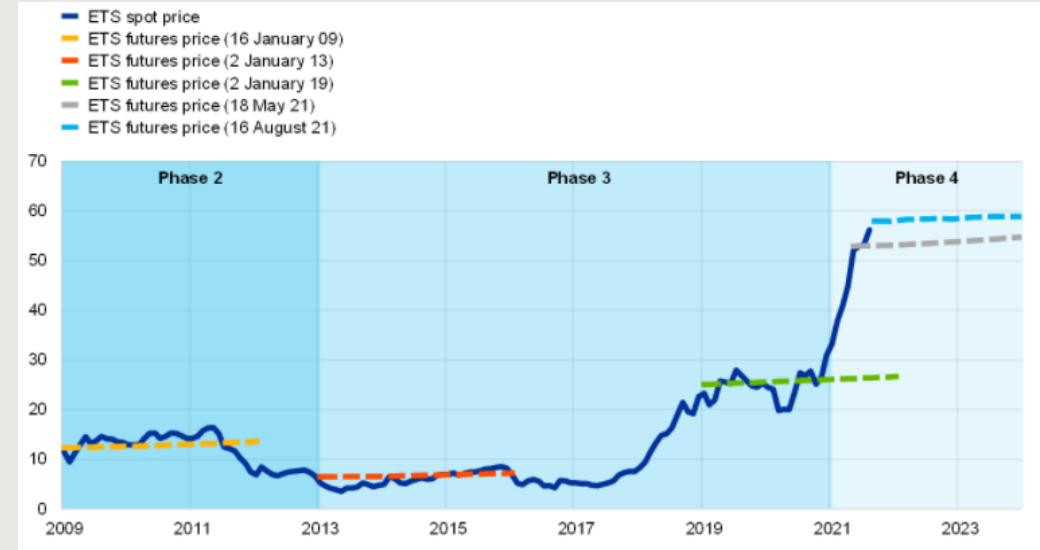
As noted above, the Technical Notes to the Guidelines recommend using the EU ETS carbon price as a central estimate for examining the implications of domestic carbon pricing.

The EUA carbon price traded at EUR 54.55 on 19 October 2021. One EUA gives the holder the right to emit one tonne of carbon dioxide, or the equivalent amount of two more powerful greenhouse gases, nitrous oxide and perfluorocarbons.

Chart 5.3 shows the EU spot and futures EUA unit prices from 2009 to 2023. The price of emissions allowances traded on the EU ETS has increased from EUR 8 per tonne of CO2 equivalent at the beginning of 2018 to around EUR 60 more recently. Driving these price increases is the transition from Phase 3 to Phase 4 of the trading scheme.

Since the EU ETS began operating in 2005, it has been implemented in different *Phases*, gradually reducing the cap while increasing the scope of the system, geographically, by sector and by type of GHG emissions covered. While the first two phases were characterised by a large number of free allocations, the two more recent phases were accompanied by an increase in the share of auctioned rather than allocated allowances, a harmonisation of rules, a reduction in the annual emissions cap, and market reforms to adjust for oversupply through a backloading of excess allowances.[19]

5.3 EU emissions allowances – ETS spot and futures prices



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Note: Vertical axis EUR per metric tonne, Yearly EU ETS futures prices are calculated as averages of the quarterly futures prices for any given year. Latest observation: August 2021 for EU ETS spot prices (monthly data) and December 2023 for EU ETS futures prices (quarterly data).

Data source: European Central Bank https://www.ecb.europa.eu/pub/economic-bulletin/focus/2021/html/ecb.ebbox202106_05~ef8ce0bc70.en.html

19 https://www.ecb.europa.eu/pub/economic-bulletin/focus/2021/html/ecb.ebbox202106_05~ef8ce0bc70.en.html

Drivers of the price in the medium term were the:

- Introduction of the Market Stability Reserve[20]
- Faster reduction in the number of EU emissions allowances
- Revision of the EU ETS Directive which set the framework of the 4th trading period from 2021-2030, which appears to have given the scheme more credibility.

More recently, prices have been impacted by the shift to more stringent climate policies globally, the European Green New Deal[21] and the likelihood of an earlier end to the free allocation of emissions allowances, as outlined in the *fit for 55* package.[22] Outside of the market design changes, the price surge could be explained by weather patterns, re-opening of the economy after COVID as well as speculation by some market actors.

The price movements reflect a structural change to the market and provide an indication of the price level for a fully operating trading scheme. The carbon price level may not reflect the expectations for Australia, due to the market characteristics and domestic cost of abatement. However, it can provide an indication of the price increases expected when the market opens more participants and transactions, against an increasing emissions reduction target. Should future international policy directions allow for a global carbon trading scheme, we would expect a convergence in carbon prices.

ACCU spot price

An alternative carbon price to the auction price is the ACCU spot price. The private market for ACCUs is currently conducted through mainly over-the-counter transactions and activity by brokers and other intermediaries is increasing. ACCU spot prices on the secondary market are now published on private websites, at $32.50 as of 20 October 2021[23].

While the Emissions Reduction Fund average weighted auction prices provide an indication of market prices, prices for short term purchases through traders or agents are materially different depending on ACCU availability at the time and can command a premium for immediate delivery.

Spot ACCU prices are somewhat above long term average Emissions Reduction Fund auction prices illustrating the opportunity to supply more ACCUs into the secondary market. Potential sellers could contract part of their supply to the Commonwealth and the remaining could be contracted to others or sold into the growing secondary and spot markets. Chart 5.4 shows the historical spot price, which has surged approximately 70 per cent since June 2021.

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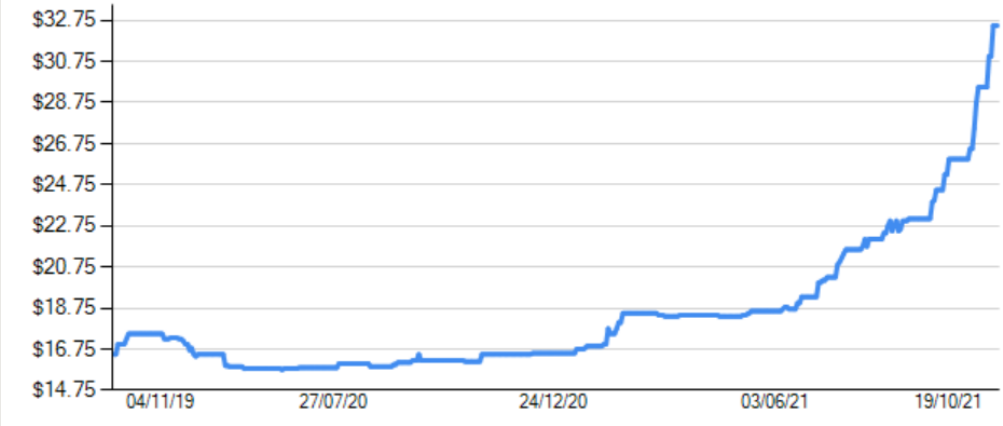
20 The MSR addresses the current surplus of allowances and improves the system's resilience to major shocks by adjusting the supply of allowances to be auctioned

21 See A European Green Deal, European Commission. https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

22 The Fit for 55 package aims – together with other policy measures – to cut 55 per cent of all GHG emissions by 2030 compared with 1990 levels

23 https://accus.com.au/ (accessed 20/10/2021)

5.4 ACCU spot price



Data source: JARDENS (accessed 20/10/2021)

Australian Transport Assessment and Planning Guidelines

The position on carbon pricing by the Australian Transport Assessment and Planning (ATAP) in its Guidelines is that practitioners should **not** use a single carbon price value, but rather should present a range of values for the $ per tonne of CO2-e via sensitivity testing.

In the Guidelines, ATAP use a central value of $60 per tonne (2019 dollars), which is the average estimated price of carbon from the two most recent Australian studies by Austroads (2012[24] and 2014[25]). These values are derived from the guidance of the CE Delft Handbook on the external costs of transport[26]. CE Delft revised these estimates in the 2019 edition, which are shown in table 5.5.

5.5 Delft 2019 estimate of Climate change avoidance costs in $/tCO2 equivalent

Timeframe	Low	Central	High
	$/tCO2	$/tCO2	$/tCO2
Short-and-medium-run (up to 2030)	92.2	153.7	290.5
Long run (from 2040 to 2060)	239.8	413.5	765.5

Note: AUD 2019, Highlighted cell is the estimate used in the CE Delft Handbook parameters

Source: CE Delft

CE Delft use the central estimate for the short-and-medium-run in the Handbook's estimates, which is based on the average of the avoidance cost of climate change up to

24 Austroads 2012, Guide to project evaluation part 4: project evaluation data, AGPE04-12, Austroads, Sydney, NSW

25 Austroads 2014, Updating environmental externalities unit values, AP-T285-14, Austroads, Sydney, NSW

26 CE Delft 2019, Handbook on the external costs of transport, European Commission, Delft, The Netherlands.

2030 found in the literature. ATAP do not update their estimates using this value, but rather aim to maintain consistency between Australian parameters and use the $60 estimate and scaling down CE Delfts estimates accordingly[27].

Table 5.6 shows the expected present value cost of carbon emissions for the project for each carbon price methodology. The combined CE Delft short-and-medium-run and long run price uses the short-and-medium-run price until 2030, where it then follows a linear escalation to the long run price by 2050.

5.6 ATAP and CE Delft carbon price estimates on the Project

Methodology	Carbon price	PV project
	$/tCO2	$m
ATAP guidelines	60.0	276.0
CE Delft short-and-medium-run	153.7	706.9
Combined CE Delft short-and-medium-run and long run	153.7-413.5	868.2

Note: 2019 dollars

Source: ATAP, CE Delft, CIE estimates

Social cost of carbon

While the CER auction price and the EU carbon price reflect the implicit regulatory price of carbon, they do not accurately reflect the welfare impacts of climate change. The full welfare reflective price is known as the social cost of carbon (SCC).

There are a variety of estimates of the SCC available in the literature and that have been used in practice. In recent years, for example, SCC estimates by the United States (US) Government's Interagency Working Group (IWG) on Social Cost of Greenhouse Gases are widely used. Recently, this group revised its estimates for the SCC for use in Regulatory Impact Analysis.[28]

Since this recent revision, Nordhaus[29] has provided an updated set of estimates of the SCC, with his updates based on recent developments in science, and expanded set of cost estimates and expanded coverage of the measurement of economic effects.

Chart 5.7 presents values of the SCC for three different discount rates. Varying the discount rate by 0.5 per cent, as seen by the 2.5-3 per cent discount rates, can yield a significantly different price in 2020 - $145.94m versus $235.18m.

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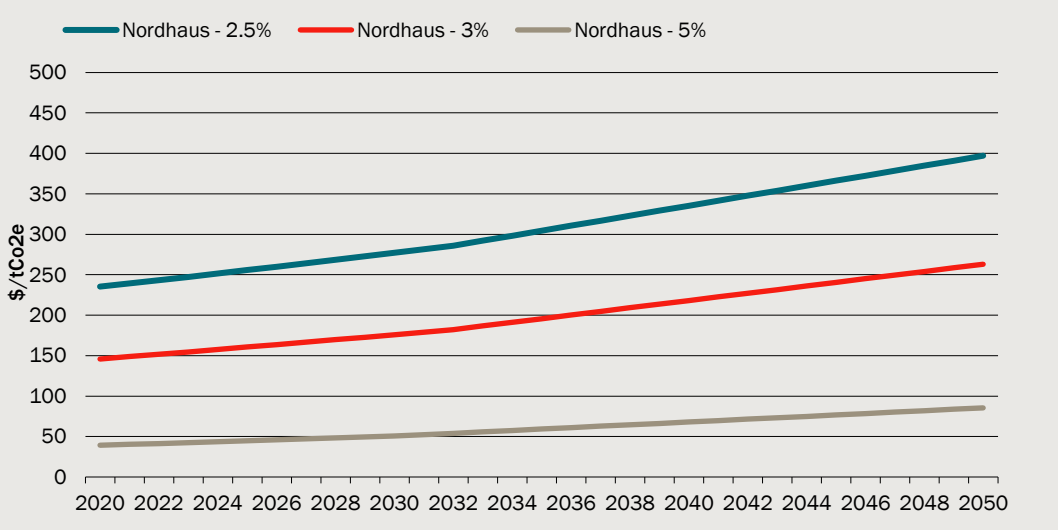
27 CE Delft 'climate change' and 'Well-To-Tank' figures are scaled the by the ratio 60/160 = 0.375

28 US EPA 2016, The Social Cost of Carbon: Estimating the Benefit of Reducing Greenhouse Gas Emissions, https://19january2017snapshot.epa.gov/climatechange/social-cost-carbon_.html

29 Nordhaus, W.D., 2017. Revisiting the social cost of carbon. Proceedings of the National Academy of Sciences, 114(7), pp.1518-1523

5.7 Values of SCC used to estimate benefit, by year



Data source: CIE estimates based on Nordhaus 2017

Australian Government Long-Term Emissions Reduction Plan

On 26 October 2021 the Federal Government released *Australia's Long-Term Emissions Reduction Plan.*[30] The document states

> In a scenario where we succeed in driving down technology costs and accelerating their deployment at scale across all sectors, Australia can get within range of net zero by 2050 with a voluntary incentive of less than $25 per tonne CO_2-e in 2050.

This statement would align more closely to the EU Emission Allowance Units price trajectory as at 2015, although (as discussed later this trajectory has substantially increased). However, the document also states that

> if we fail to unlock new technologies then net zero by 2050 is only achievable for Australia at much higher marginal costs (about $100 to $170 per tonne CO_2-e) and with heavy reliance on carbon offsets from Australia's productive agricultural land or from overseas.

This would be closer to the price trajectory of the Australian Treasury Clean Energy Future Policy scenario.

Conclusion

- **There is considerable uncertainty regarding the appropriate future carbon price to adopt when estimating greenhouse gas emissions. Using the carbon prices presented in the Guidelines would result in a cost of greenhouse gas emissions (Scope 1 and 2) of between $64.78 million and $294.06 million. However, further consideration is required by the NSW Government to ensure that the Guidelines reflect the significant upward shift in global carbon prices during 2021.**

30 https://www.industry.gov.au/data-and-publications/australias-long-term-emissions-reduction-plan

Air quality

The EIS states that air quality impacts in larger residential areas (Singleton, Singleton Heights and Muswellbrook) will be negligible and due to the low population density in other areas around the Project area, the predicted incremental impacts will be low.

Ambient noise impact

Noise levels are not expected to increase in most instances due to a netting out effect from winding down production at the Liddell and Mount Owen projects. This applies to the Hebden area and the rail infrastructure for the Mount Owen Complex CHPP. Due to the predicted low incremental increases in ambient noise, no quantification was included by EY in the EIS.

Surface water

The Project requires the realignment of the lower portion of Yorks Creek and will mine through remnants of Swamp creek. The Project is not expected to impact Bowmans creek.

No discharge of mine affected water is proposed by the Project, with excess water to be managed through the Greater Ravensworth Area Water and Tailings Scheme, which allows for excess mine water management at the neighbouring Ravensworth and Liddell Operations. This reduces the need for licensed water discharges under the Hunter River Salinity Trading Scheme.

The Project includes management measures to minimise the interception of clean water, including building a network of clean water drains and the realignment of Yorks Creek to direct clean water away from areas disturbed by the mine. Costs associated with this are included in the operating and capital costs for the Project.

Groundwater impact

The only potentially highly productive aquifer in the Project Area is the Bowmans Creek alluvium. The long history of underground and open cut mining in close proximity of the Project has resulted

in the groundwater levels within the coal measures being extensively depressurised indicating evidence of cumulative impacts within this hydrogeological environment. Impacts on the alluvium are predicted to peak in 2046, shortly after the planned cessation of mining at the Project.

Impacts of the Project on the aquifers are small (approximately 7ML/year additional take). Predicted take from the Project is expected to be licensed through readily available licence allocations or existing licences held by Glencore and are included in the operational costs.

Transport/traffic impacts

The Project is expected to impact traffic through 2 activities:

1 Realignment of Hebden Road and

2 Delaying traffic flow as a result of blasting

The realignment of Hebden Road is expected to result in $0.09m per annum in additional travel time cost. Delaying traffic as a result of blasting is expected to cost $0.07m in travel costs per year. These estimates are based on travel time assumptions from Transport for NSW Economic Parameters Values. This is an appropriate input source for these estimations.

Biodiversity and ecological impacts

The Biodiversity Development Assessment concludes that biodiversity impacts are unavoidable and will require credits to mitigate against the cost of loss of ecology values. In total the development of the Project will require 9,281 credits, which is largely made up of, the 4898 credits required to offset the Project's assessed impacts to the Narrow-leaved Ironbark, Bull Oak and Grey Box Shrub Plant Community Types (PCTs) communities.

The costs of the biodiversity mitigation strategy and the cost to generate the biodiversity credits are included in the operating costs of the Project. Umwelt advises that the biodiversity offset credits have been calculated based on the cost to pay into the Biodiversity Conservation Fund for the entirety of the estimated impact credits.

Based on our review of the agency submissions to the EIS documentation, there do not appear to be any concerns. We assume that the offset purchases full mitigate any biodiversity impacts and there are no additional unmitigated impacts that need to be incorporated into the CBA.

Aboriginal cultural heritage

The Aboriginal Archaeological Impact Assessment identified 91 sites (55 artefact scatters and 36 isolated finds) which will be impacted by the Project, if approved. In response, Glencore has collaboratively developed management and mitigations measures with the registered Aboriginal parties involved in the Aboriginal Cultural Heritage Assessment. The costs of management measures are included in the capital costs of the Project.

Historical heritage

The Project Area contains the Ravensworth Homestead, which is a collection of buildings constructed in the early 19th century and is considered to have significant heritage values. Glencore proposes to relocate the homestead to a new site for its re-use as a mitigation measure. Two relocation options are proposed:

1 An in-tact move to the newly created 'Ravensworth Farm' site, which is on Glencore land within the Project Area.

2 Relocating to the Broke township. This method of relocation involves dismantling the buildings 'stone-by-stone' and then rebuilding in the new location.

The costs of these options are included in the capital costs of the Project.

Visual amenity

The Project will result in minor changes to visual amenity to the surrounding region. The area surrounding Glendell is generally comprised of active and non-active mining operations, coal related infrastructure, power generation infrastructure including the Liddell and Baywater power stations and other built infrastructure.

Some impacts are expected and will be mitigated through similar measures as applied at the Mount Owen Complex. These costs are included in the operating and capital costs of the Project.

Loss of surplus to other industries

The Project is expected to impact the agricultural sector by displacing vealer and weaner cattle. During the operations from 2021 to 2048 (the life of the Project plus an additional 4 years), both the disturbance area and the adjacent parcel could be lost to agricultural production.

During the operations stage (2021-2048), 279 production units are expected to be lost from a combination of vealer and weaners. During the post-mining stage (2049 onwards), 57 units are expected to be lost.

The loss of units is valued using average weights from DPI and MLA sales data for Singleton. Vealer sales are expected to reduce by $0.15m per annum and weaner production by $0.05m per annum.

EY estimate a gross operating surplus (GOS) loss of $0.06m and $0.011 to the NSW economy for the operations and post-mining stages, based on the EY regional Input-Output Model GOS loss value of 0.31 per dollar of output. Over the life of the Project and the post mining period the loss of agricultural GOS amounts to $0.7m in NPV terms.

Net public infrastructure costs

The Project is not expected to generate public infrastructure costs beyond the infrastructure relocation costs included in the capital costs of the project. As a result, the Project is expected to generate nil externalities in relation to net public infrastructure costs as the relocation costs are all internalised.

A Worker Benefits – Addendum

On 5 August 2021, EY submitted additional information to support its arguments in relation to worker benefits and supplier benefits. This was in light of feedback from various stakeholders for other recent coal mine project assessments on the appropriateness of the inclusion of employee and supplier benefits. In particular, the approach to quantifying these benefits was rejected by the IPC in its assessments of the Mangoola Coal Continued Operations Project and Tahmoor South Project.

This Appendix considers the additional information submitted.

Summary of EY's arguments

EY's key argument is that coal mining production and employment demand sector is on a declining trajectory and alternative jobs within the mining sector would not be readily available.

The key issues include:

- if the Project does not progress, whether workers would gain employment elsewhere in the mining industry
- the extent to which the mining Projects employ workers locally versus through drive-in-drive out and fly-in-fly-out arrangements from broader areas and interstate
- the extent of disutility in the mining industry compared to other sectors
- the extent of skills/experience differences between the mining industry compared to other sectors.

EY's argument is that, if the Project is not approved, the existing mining workers would instead work in a job receiving the average wage. This assumes that there is no disutility of working in the mining industry compared to other industries and there are no additional skills required to work in the mining sector compared to the 'average' job.

Worker locations and jobs

Mining jobs

EY argue that workers will not be able to transition to other jobs in the mining industry due to the industry facing decline over the medium to long term. EY infer that projections of mining employment operate as a proxy for coal production, which according to the NSW intergenerational report is forecast to decrease over the medium to long term.

Globally, Australis's top three thermal coal export countries (Japan, South Korea, China) are committing to achieving net zero emissions by the middle of the century. In the 2021 IGR, the NSW Treasury explain that declining global demand for coal will impact employment in coal mining.

Furthermore, EY state in the EIS that:

> …the progressive increase in employment over the life of the Project coincides with reductions in employment at the Mount Owen Mine in the Mt Owen Complex. In this regard, the Project may also partially maintain the workforce levels from the Mount Owen Complex throughout much of the life of the Project.

This would allow the Project to partially maintain the workforce levels from Mount Owen Complex throughout part of the life of the Project and would give these workers more opportunity to have access to long-term employment in mining.

EY assume that other mines would be:

> … attempting to maximise their production though the minimisation of vacancies, which would result in minimal lateral transitions between operations.

EY conclude by stating that should the Project not proceed, the existing workforce would find it difficult to find alternative employment in the coal mining industry in NSW. This would:

> … result in a net loss of benefits to NSW relative to the Project Case (and assumed base case).

CIE comment

According to the National Skills Commission, coal mining employment is forecast to increase 7.5 per cent by 2025[31]. There are currently many vacancies for mining jobs. A search for coal mining jobs in the Hunter, Newcastle and Maitland region on Seek[32] shows 150 job vacancies. Chart A.1 shows the number of vacancies recorded in the NSW mining sector by the National Skills Commission[33]. During 2016-17, which was the period of lowest mining employment, vacancies remained over 50, showing that a base level of vacancies is likely to exist. This baseline is sustained through natural attrition and the retirement of existing workers.

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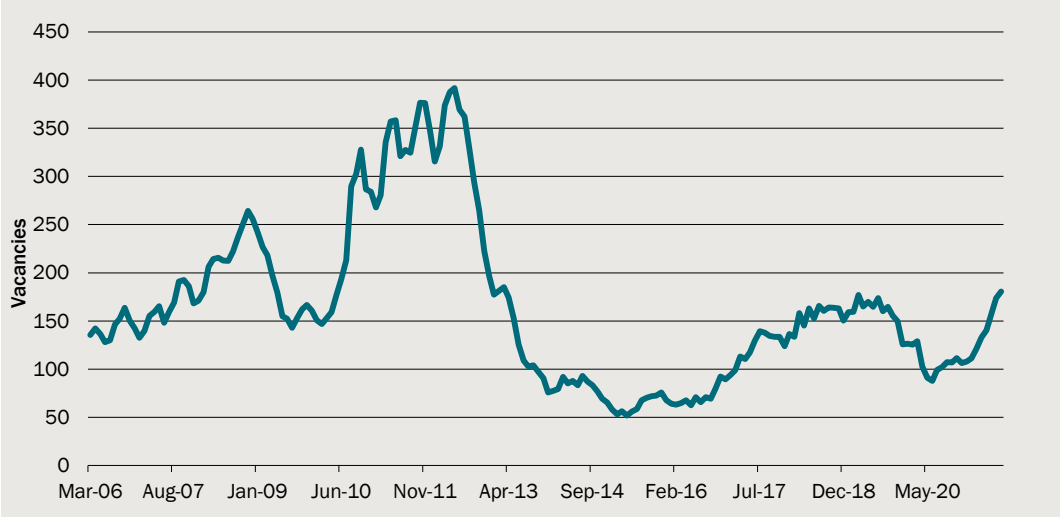
31 National Skills Commission, Labour Market Information Portal, https://lmip.gov.au/default.aspx?LMIP/GainInsights/EmploymentProjections

32 Seek, Search criteria: Coal Mining in Region Newcastle, Maitland and Hunter, Accessed 2 October 2021, https://www.seek.com.au/coal-mining-jobs/in-Newcastle,-Maitland-&-Hunter-NSW

33 Source

A.1 NSW mining vacancies, 2006-2021



Data source: National Skills Commission

In the short term mining employment may increase or remain stable as estimated by multiple sources. In the medium-long term, mining employment is forecast to decrease. However, due to natural attrition and retiring workers, vacancies will open in the market to allow some workers to laterally transition.

Worker locations

EY refute the argument that many workers for the Project would not be sourced locally, and that they would be resourced from Fly-In-Fly-Out programs. They explain that as this is an:

> …extension of a currently operating mine, it is expected that many of the workers currently employed will remain working at Glendell and the increase in worker numbers as productions rates increase would be met primarily through workers no longer required at the Mount Owen Mine as production rates at that mine reduce.

Furthermore, the social impact assessment published by Umwelt states:

> …nearly 95 per cent of the workforce resides within broader Hunter Region, therefore it is reasonable to expect that the vast majority of wage benefits that accrue to employees in the project case would be attributable to NSW.

CIE comment

We agree that it appears reasonable to assume that workers will be sourced locally for the Project. This is a combination of the existing and closing mines at the Mt Owen complex. This is confirmed by Census data, where table A.1 shows the regions where Upper Hunter coal mine workers reside.

A.1 Top 5 SA2 regions where Upper Hunter coal mine workers reside

SA2 region	Employees
Muswellbrook	788
Singleton	415
Scone Region	282
Scone	253
Muswellbrook Region	232

Source: ABS Census 2016

Skills argument

Interindustry movement

EY propose that one of the major arguments levied on the estimation worker benefits are that jobs in the mining sector require

> …a very specialised and niche set of skills. Such an implication would mean that there would be a significantly lower level of transitions from other industries into the mining sector, whether individuals work in the same occupation (for example, technicians) or not.

EY propose that longitudinal Census analysis can represent:

> …a reasonable proxy on estimating the level of difficulty, or levels of qualifications required, to enter certain industries, as these can be compared on a like-for-like basis across a range of sectors in the Australian economy.

They find that from 2011 to 2016:

> …roughly half of the employees in the mining sector had transferred from alternative industries, placing it roughly between the construction and professional, scientific and technical services sectors in terms of ease of entry. In this respect, there doesn't appear to be any significant differences in the level of accessibility for employees of this industry relative to the rest of Australia.

EY argue that this implies

> …there doesn't appear to be any significant differences in the level of qualification, or education needed to secure entry into the mining, with that of the general employment landscape in Australia.

CIE comment

Measuring the amount of lateral transitions between industries does not provide a suitable proxy for the level of skills required in an industry. It is more appropriate to calculate the wage differentials by skill difference as described in the following section.

Average age of the workforce and skills

EY propose proxies to measure the unique skillsets of a workforce between industries, such as:

> …examining demographics such as the average age of occupations as a proxy for experience, as well as the total years of reported schooling, to measure education and skill levels.

They find that

> …there are no significant differences in the age of workers at the occupational level between mining and the three comparable industries.

And as a result:

> …there may be no significant differences in the level of experience between those employed in the mining sector, and those that are employed in comparable industries.

In addition, EY propose that

> A suitable proxy for examining the skill and qualification levels of employees in occupations is to look at the amount of time each employee has spent in schooling.

Where they find that:

> Overall, education levels in each occupation is similar across mining and other sectors. This implies that there are no significant differences in the amount of schooling that employees undertake in the mining sector relative to some of the comparable industries.

CIE comment

Considering average age as a proxy for experience across industries is not substantiated by EY. Each industry has different levels of training to enter the industry as well as degree of labour intensity, all of which would impact the median age of the workforce.

With regard to schooling, the Census data provided by EY shows that miners do have more schooling. Take for instance machinery operators and drivers, who have 12 years of schooling compared with 11 for construction. Technicians and trades workers have 13 years compared with 12 for manufacturing and construction. Labourers have 12 years compared with 11 in manufacturing and construction. Regardless, years of schooling is an unsubstantiated measure for skills in mining.

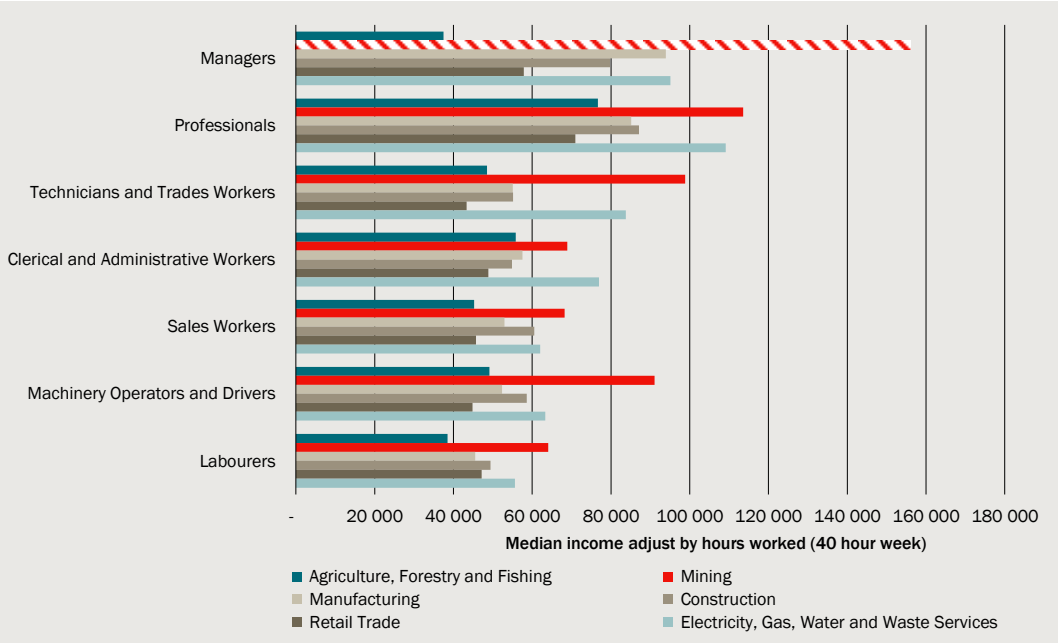
CIE comment on wage differentials reflecting skill differences

To assess the wage differentials by skill differences we draw on ABS 2016 Census - Employment, Income and Education data. We have compiled a dataset that comprises personal income by industry (1 digit level), occupation (1 digit level), and level of highest educational attainment, as well as the same dataset for hours worked. While the personal income includes more than just employee income, it is still a very close approximation of wages and salaries paid. In 2017-18, the total median personal income differed approximately by ~2 per cent from the median employee income stated.

From the personal income dataset we drew the median income by industry, occupation and education, and standardised the results to a 40-hour week by using the median hours worked. Table A.1 presents the standardised median income by industry and occupation; please note that median income within each occupation vary considerably by highest education attained and have, therefore, been weighted by the number of people accordingly:

- The industries represent the main source of employment for the mining industry.
- Median incomes by occupation in mining are considerably higher compared to other industries
- The table shows that the average mining wage is mainly driven by over proportionally well-paid managers (the median income for that occupation lies within the highest income bracket, i.e. $156 000 or more per year), and professionals.
- Differences between the other occupations are less pronounced than the average mining wage would suggest.

A.1 Standardised and weighted median personal income, by industry and occupation



Note: The selected industries are based on a Survey conducted by GE Economics about where labour for mining comes from. Median income for Managers in Mining is in the highest income bracket and therefore higher than shown.

Data source: ABS Census, The CIE

Median income varies within industries, occupations and level of education considerably and can make comparisons inappropriate. Therefore, we have constructed an occupation-education pattern for the mining industry based on the number of employees (table A.2). Comparison of the highest level of education in mining compared to all industries and to NSW shows that mining employees have attained higher levels of education throughout the occupations. Most notable are Managers and Machinery Operators and Drivers who have a significantly higher levels of education (table A.2).

Those two occupations are also the ones with the highest wage differential compared to other industries. This means that the mining industries employs on average a higher educated workforce which drives wage differences.

A.2 Highest level of education by occupation in mining

Mining Occupation by Education	Mining Median highest level of education	Selected Industries Median highest level of education	All industries Median highest level of education
Managers	**Bachelor Degree**	Certificate III & IV	Certificate III & IV
Professionals	Bachelor Degree	Bachelor Degree	Bachelor Degree
Technicians and Trades Workers	Certificate III & IV	Certificate III & IV	Certificate III & IV
Community and Personal Service Workers	NA	Secondary Education - Years 10 and above	Certificate III & IV
Clerical and Administrative Workers	Certificate III & IV	Certificate III & IV	Certificate III & IV
Sales Workers	Secondary Education - Years 10 and above	Secondary Education - Years 10 and above	Secondary Education - Years 10 and above
Machinery Operators and Drivers	**Certificate III & IV**	Secondary Education - Years 10 and above	Secondary Education - Years 10 and above
Labourers	Secondary Education - Years 10 and above	Secondary Education - Years 10 and above	Secondary Education - Years 10 and above

Source: ABS Census

Disutility argument

Hardship allowance and health and safety statistics

EY state that disutility of work is hard to ascertain in absolute or relative terms. They propose to use mining awards as a measure of hardship. They find that the Black Coal Mining Industry Award 2010 does provide for the payment of an Underground allowance (Electrical/ Mechanical) of 0.23 per cent per day or shift (above the standard rate/ reimbursement) to an adult employee who works underground on any shift. In addition, there is a Confined space allowance of 0.08 per cent and a Dirty work allowance of 0.23 per cent, that may apply to underground workers. They compare this to the First Aid Officer Allowance of 0.76 per cent per day, which is significantly higher.

EY then argue that another way to measure disutility is by comparing work health and safety statistics across industries. They present data which shows that mining has reduced its work health and safety claims from 2000-2019 and has relatively lower in claims per million hours than comparable industries.

In conclusion, they find that:

> Given the relative safety of the mining industry, the minor allowances for working in a coal mine and the measurement difficulties associated with measuring these disutility's generally, we have assumed the disutility for workers under the project cases is zero. This implies, effectively, that those workers employed by the Project experience no additional disutility from working in the mine compared with any alternative employment they would have secured in the absence of the Project.

CIE comment

Both metrics are not appropriate measures for the disutility experienced by mining workers. The hardship allowance is a government award that is set by a regulatory body

and does not reveal personal preferences for working in certain conditions. An example of how these awards are detached from personal preferences is in construction where workers are paid an award rate depending on what floor they work on, even when the building is enclosed[34].

Furthermore, the disutility arises from working at a mine as opposed to the specific tasks within the site. By working at the site the worker knows they will be exposed to tough conditions and the high wage compensates them for this.

Comparing work health and safety statistics across industries is unsubstantiated as a measure for disutility. Notwithstanding, if worker safety was of importance to a worker they would assess the safety record of a company as opposed to the industry as a whole. Their would be a high level of variation between small-medium size construction firms with industry leaders.

Compensating factors of open cut mining operations

Working at an open cut coal mine requires a tolerance to tough working conditions not found in most jobs. An example of these conditions are, but not limited to, the 7 day/night rostering, high concentration long shift length and exposure to noise and pollutants. Combined these conditions form a 'disutility' of working in open cut mining, whereby workers are compensated for enduring these conditions.

These conditions are a well known factor of mining. Hume Coal in its *Guide to Jobs within the Mining Industry* publication states on page 2,

> It is typically hard work and not for everyone… Some individuals and families find it difficult to adjust to a role that requires an employee to work fixed and/or rotating rosters. Working rotational rosters of up over the 7 days of the week means that you may miss anniversaries, birthdays and other special occasions. You also need to consider family and friends that rely on you for support.[35]

The challenges of mining work are discussed in more detail below.

Working week

Miners typically work in excess of the 38 hours of the normal Australian working week[36]. To understand the preferences of mining workers, we can refer to the AWALI survey which provides data on mining workers preferences for working hours and rostering.

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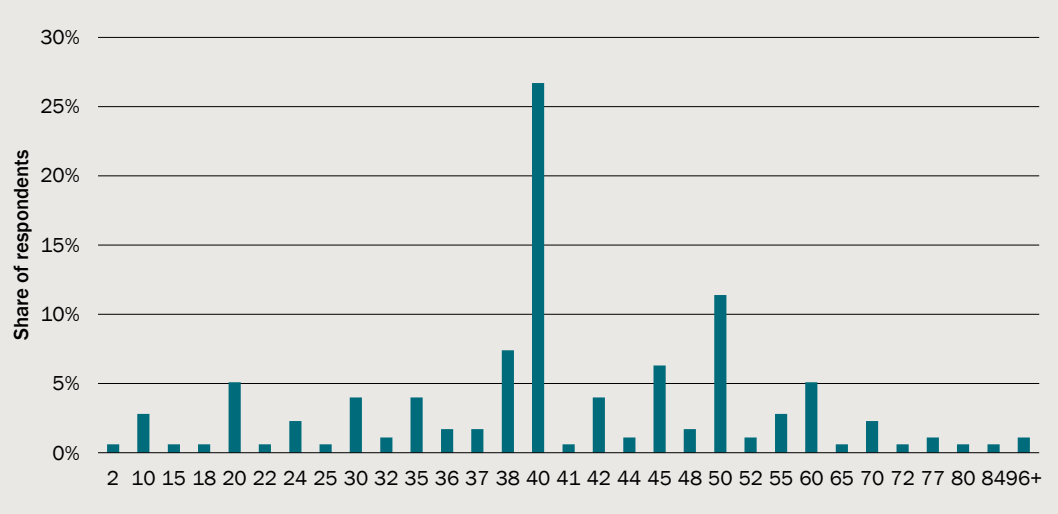
34 Building and Construction General On-site Award 2020, Section 23.3 (d) states: In respect of any building or structure (including a tower) which does not have regular storey levels and which exceed 15 metres in height,an allowance of $0.76 per hour will be paid for all work above 15 metres,with an additional $0.76 per hour for work above each additional 15 metres.

35 Hume Coal (2016), A Guide to Jobs within the Mining Industry, pp. 2, https://www.humecoal.com.au/wp-content/uploads/2016/06/A-Guide-to-Jobs-Within-the-Mining-Industry.pdf

36 National Employment Standards, https://www.fairwork.gov.au/tools-and-resources/fact-sheets/minimum-workplace-entitlements/maximum-weekly-hours

In the survey, respondents were asked 'If you could choose the number of hours you work each week, and taking into account how that would affect your income, how many hours would you choose to work?' This distribution of responses is shown in chart A.1. The majority of responses show a preference for working less than 41 hours per week. In total, 64 per cent of mining employees prefer to work less than 44 hours per week and only 36 per cent prefer to work 44 hours or more per week. The most common preference was to work a 40 hour week.

A.1 Preferred hours per week of mining employees



Note: AWALI survey 2007-2009
Data source: AWALI survey 2007-2009

The data for the mining industry as a whole includes long distance commuting (LDC) mineworkers, who travel from their home, often on the coast or in capital cities, to the mine site and live on-site for the duration of their 'on' period. We would expect that LDC workers would have longer hours preferences than other mining industry workers because of the longer blocks worked and the need to factor in blocks of time for travel. Accordingly, hours preferences of workers in residential community sites are likely, on average, to be shorter than those described here. These workers would be typical of the mines in the hunter valley region, where it is a job requirement to live within a certain radius of the mine.

The roster arrangements of the Glendell mine are shown in table A.2. All employees work in excess of the maximum weekly hours as directed by Fairwork Australia, which are limited to 38 hours per week[37]. General staff slightly exceed the maximum weekly hours by 2 hours per week, however their roster follows the general working week of daytime hours from Monday to Friday.

37 National Employment Standards, https://www.fairwork.gov.au/tools-and-resources/fact-sheets/minimum-workplace-entitlements/maximum-weekly-hours

A.2 Expected roster for the Glendell mine operational phase

Worker	Shifts per week	Working week	Hours per shift	Total hours per week
			Hours	Hours
Staff/Admin/Engineering support/Technical services	5	Mon-Fri	8	40
Mine operators	3.5 [a]	All days	12.33	43.16
Maintenance crews/fitters	3.5 [a]	All days	12.33	43.16

[a] 7 day rotating day/night roster which results in 7 shifts per 14 days

Source: Glendell

Mine operators and Maintenance crews/fitters have a significantly different working week, where they work 4 hours longer than the typical shift which results in over 5 hours more per week worked. Shifts are also not limited to daylight hours, where workers are required to work night shifts as well as weekends and public holidays. An expected working week of 43.16 hours is at the higher end of the responses from the AWALI survey, considering the majority of workers are local and not living on-site.

12 hour shifts

According to a study by Cottle and Keys, [38] about open-cut mining operations in the Upper Hunter, it was found that there are significant social ramifications related to the long hours of shift work required of its employees.

There are considerable differences between the shift work pattern of underground coalmines and that of the Hunter Valley's open-cut coalmines. In the underground coalmines, work was performed by rotating three crews over 24 hours. Employees of the Hunter region's open-cut mines no longer work an eight-hour day. Instead they work rotating twelve-hour shifts each day, seven days a week. If both the change of shift and the journey to and from work were calculated as part of their working day, it may be 13-14 hours rather than 12, as most drive to the mine site from the Central Coast or the Lower Hunter. Over a sustained period, this work pattern may induce chronic fatigue and prove uneconomic[39].

The potential social pathologies of alcohol abuse, drug use or domestic violence associated with the 'work-life balance' of mining workers residing in Singleton was noted in a recent local government report. Studies on both the drive-in drive-out and fly-in-fly-out work-life cycle of mining workers confirm the generation of these problems.[40]

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38 Cottle D. and Keys A. (2014), Open-cut coal mining in Australia's Hunter Valley: Sustainability and the industry's economic, ecological and social implications, International Journal of Rural Law and Policy, https://www.researchgate.net/publication/284025097_Open-cut_coal_mining_in_Australia's_Hunter_Valley_Sustainability_and_the_industry's_economic_ecological_and_social_implications

39 Cleary, P (2012), Mine-Field: The Dark Side of Australia's Resources Rush (Black Inc, Collingwood), 148-152; Stuart Rosewarne and Linda Connor

40 Carrington, K. et al. (2011), 'Inquiry into the Use of "Fly-In, Fly-Out" (FIFO)/Drive-In, Drive-Out (DIDO) Workforce Practices in Regional Australia', (Submission to the APH

Noise and pollutant impacts on health and wellbeing

According to the Cottle study, although noise levels are monitored and regulated, the operations of industrial open-cut mining create and perpetuate continuous noise. A fundamental operation in open cut coal mining is the blasting, with explosives, of the coal seam from other rock strata. The blasting is a high-impulse noise, exposure to which may permanently damage the hearing, breathing and the digestive system of workers at the site. Continuous high impulse noise levels are also created by the drilling, digging, loading, hauling and dumping of the diesel-powered machinery used at the mine site or in the transportation of the coal. Although mining employees wear safety equipment, the industrial noise levels at the mine site are not considered an unavoidable health risk[41].

A 2012 study by University of Sydney researchers on the health and social impact of particle dust caused by coal mining and coal burning on communities in the Hunter Valley registered high rates of cancer, heart, lung, liver and kidney disease as well as birth defects throughout the region.[42] An earlier study from 2008 had revealed that 113 tonnes of the toxic metals, 13 200 tonnes of sulphur dioxide and 62 000 tonnes of nitrogen oxides generated by coal mining and coal-powered electricity contaminated the air in the Hunter Valley via particle dust.[43]

EY justification for the wage differential - Capital intensive industry

EY argue that the wage premium is driven primarily by:

> …the highly capital-intensive nature of the mining sector which results in a higher average labour productivity for workers in the sector. The high capital requirements of the sector imply high operating leverage (i.e. a higher proportion of fixed to total costs). Such businesses have a strong incentive to maximise the utilisation of those assets, failing which, their margins fall disproportionately. This means that such firms, including mining firms, would be willing to pay a large premium to ensure that vacancies are minimised, turnover is kept low, employees are trained sufficiently, and that the safety of employees are considered as top priority.

CIE comment

The mining industry minimises vacancies primarily through the use of contractors from labour high companies. The use of contractors has been growing in the mining sector, see box A.1. As highlighted in this example, a reason for the wage difference between the direct employees and contractors is the impact of collective bargaining from workers unions.

House of Representatives Inquiry, Number 95, Canberra: Standing Committee on Regional Affairs), <http://www.aph.gov.au>; Carrington, K. et al. (2011), 'The Resource Boom's Underbelly: Criminological Impacts of Mining Development', 44(3) Australian and New Zealand Journal of Criminology, 335.

41 Cottle, D. (2013), 'Land, Life and Labour in the Sacrifice Zone: The Socio-Economic Dynamics of Open-Cut Coal Mining in the Upper Hunter Valley, New South Wales', 22 Rural Society 208.

42 Pearse, G. et al. (2013), Big Coal: Australia's Dirtiest Habit (New South Publishing) 12, 26.

43 O'Malley, N. (2010), 'Black Marks on the Health Chart', The Sydney Morning Herald, 12.

A.1 BHP outsources to itself[44]

BHP's 2019 sustainability report showing 56 per cent of jobs in its Australian operations were contractors and not directly employed.

In response to wage cutting at coal mines through contract workers, BHP created its own outsourcing company, Operations Services Pty Ltd. In 2018, BHP created two $1 shelf companies to act as employing entities, including Operations Services (OS). These entities submitted two proposed non-union enterprise agreements to the Fair Work Commission, with pay rates of $30,000 to $50,000 a year less than current site agreements, and no pay rise over their four year term among a host of inferior conditions.

Meanwhile, BHP is deploying hundreds of OS workers in Queensland and New South Wales coal mines on common law contracts and is recruiting heavily. At Mount Arthur, Operations Services workers are being paid $106,000, compared to the rate in the union agreement of $159,200. This pay discrepancy is similar at other mines where OS has been deployed. Operations Services marketing has focused on the jobs being permanent, not casual like most contract labour hire, and therefore attracting annual leave.

Nevertheless, the jobs attract substantially worse conditions in a number of other areas including no accident pay, incentive bonuses that are prohibitively difficult to attain and no payment for transport including FIFO flights (which are a huge cost).

BHP Chief Executive Andrew Mackenzie told an investor briefing in August 2019 that Operations Services was BHP's own 'contracting organisation' designed to cut costs while addressing high turnover among casuals. "There are labour cost pressures … we have addressed this via our Operations Services model, where we are actually steadily converting a lot of our more permanently contracted workforce and some not so permanent to our own contracting organisation for the whole of Australia."

Regarding turnover rates, the mining industry has significantly high turnover rates as compared with other industries. Typically higher wages are associated with lower labour turnover[45], which lead us to expect that labour turnover to be low in the mining industry as it has the highest weekly earnings. Albeit, some labour turnover is necessary to enable workers to move to jobs that better match their preferences, to move to areas that accommodate their family needs and to follow the fluctuating needs of commodity markets. Employee turnover in the resource industry is amongst the highest in the

44 McKell Institute (2020) Wage-cutting Strategies in the Mining Industry The cost to workers and communities, https://mckellinstitute.org.au/wp-content/uploads/McKell-Wage-Cutting-in-the-Mining-Industry.pdf

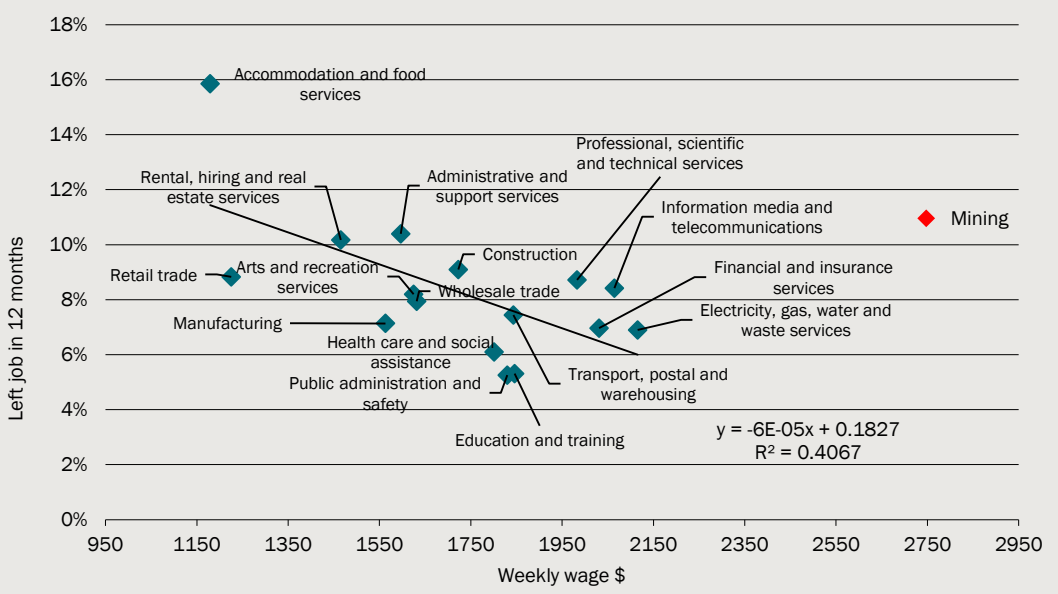
45 Freeman, R. and Medoff, J. (1984), What Do Unions Do?, and Ehrenberg, R. and Smith, R. (1988), Modern Labor Economics: Theory and Public Policy

Australian economy for reasons including the difficulty of the work, the remoteness of project locations and the competition for skilled workers[46].

However, as outlined in an analysis of Mining labour markets by Griffith University[47], relatively low or high labour turnover could be symptomatic of satisfaction or dissatisfaction with working conditions.

An analysis of labour data from the ABS shows that there is substantially high labour turnover in mining. Chart A.2 shows a strong relationship between industry-level turnover and ABS weekly hourly earnings estimates. Mining has a much higher turnover estimate than what would be predicted by its weekly earnings. A simple regression on 16 industries using the 2019 weekly earnings[48] estimate and the 5-year average turnover rate[49] indicates that a $100 increase in weekly earnings corresponds to an average decrease in turnover of 0.6 percentage points. The actual mining turnover rate is 11 per cent, which is 6.13 times greater than the turnover rate predicted by the industry trend.

A.2 Labour turnover and weekly earnings by industry



Data source: ABS

The observed wage differential between the average mining wage, which is more than double the average wage across the economy, is most likely due to factors such as:

- The skills and education of the mining workforce
- The disutility from working conditions in the mining industry.

46 Atkinson, G. and Hargreaves, J. (2014), An exploration of labour mobility in mining and construction: who moves and why, National Centre for Vocational Education Research

47 Peetz, D. and Murray, G. (2011), 'You get really old, really quick': Involuntary long hours in the mining industry, https://research-repository.griffith.edu.au/handle/10072/40174

48 ABS 2019, 6302.0 Average Weekly Earnings, Australia

49 ABS 2021, 6226.0 Participation, Job Search and Mobility, Australia

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