COMMERCIAL IN CONFIDENCE

REPORT

Bowdens Silver Mine Economic Analysis

Peer Review

Prepared for
NSW DPIE

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Summary

The Bowdens Silver Project (the Project) involves the recovery of silver, zinc and lead minerals from defined ore reserves within a proposed open cut pit. The Project's activities are largely focused on extracting silver and, to a lesser extent, zinc and lead for export to global customers. The Proponent has submitted EIS documentation which includes economic analysis conducted by Gillespie Economics (GE) in support of the new mine.

The CIE was engaged by NSW DPIE to review the economic analysis prepared by GE with the CIE's findings documented in a report dated February 2021. The Proponent has provided GE's response (dated 9 March 2021) to the CIE's review, as well as, providing an additional peer review conducted by EY (dated 31 May 2021).

NSW DPIE has reengaged the CIE to consider the Proponent's response and to collate evidence and conduct additional analysis to understand the potential benefits/costs of the Project. This will provide further evidence to assist NSW DPIE and the Independent Planning Commission (IPC) in their deliberations.

This report presents the CIE's findings based on more current information available and additional analysis conducted.

Economic benefits

Direct production benefits

There are a range of benefit categories directly associated with the production and sale of resources from the Project including royalties, company tax and residual producer surplus. These benefits depend on the quantity of resource extracted from the mine, as well as, the price received for the product (in Australian dollars terms).

Price forecast range

There is uncertainty regarding the future commodity prices. Given this, the CIE believes that forecasts should be presented as a range, rather than a single-line forecast. In the CIE's February 2021 review, we recommended the use of the World Bank commodity price forecasts as an alternative estimate.

In GE's 9 March response, he argues against the use of the World Bank forecasts, stating that the WB/IMF forecasts are inherently conservative and that the forecasts are "highly spurious and unsuitable for use". Limited evidence, however, is presented to support these assertions.

GE continues to support the use of a price forecast based on the average forecast of a selection of financial institutions. However, some of these financial institutions presented price forecasts in line with the World Bank forecasts which again supports the use of the World Bank forecasts as an alternative.

Based on the current available forecasts from the financial institutions and the World Bank, we propose the following price range:

- at the high end, the *maximum* of the silver price forecasts from the financial institutions presented by GE in March 2021 are around 20 per cent *above* GE's original forecasts in May 2020 economic analysis.[1]
- the mid-range forecasts are based on the World Bank silver price forecast (as at 21 October 2021), which are 10% *above* GE's original forecast. The World Bank lead and zinc price forecasts are 6% and 8% *below* GE's original forecast.
- at the lower end, the *minimum* of the silver price forecasts from the financial institutions presented by GE in March 2021 are around 8 per cent *below* GE's original forecasts.

In regards to the exchange rate, GE assumes a AUD:USD of $0.75. This assumption remains appropriate based on observed historical rates, recognising that exchange rates are volatile.

Company tax payments

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 an assumed tax rate of 30 per cent. GE supports the adoption of this approach.

CIE has previously used the observed tax data from the ATO as a means to test GE's estimates. GE argues that the sample of companies in the ATO's data may not be representative of the Project, given that many mining companies are larger and often foreign owned.

CIE has reconsidered the issue and reviewed the ATO's database. In our view, the ATO's database remains a strong evidence base on which to test the validity of GE's estimates. The evidence shows that, on average, across all years and the 140 mining companies, 'taxable income' comprises around 7.40% of 'total income'.[2] Note that the ATO does not report cases where taxable income is negative, therefore, the figure of 7.4% is an overestimate. Nevertheless, it provides some guide as to the average profitability of mining companies. As a comparison, in present value terms, GE estimates total income of $1,033m and taxable income of $160m equates to a ratio of 15% (total income/taxable income). This would imply that the Project is around 2 times as

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1 GE's 9 March response, only focuses on the silver price where updated information was available.

2 There are 3,135 separate companies in the database. Across all companies in the sample and all years, 'taxable income' comprises around 7.3% of 'total income', similar to that of mining companies.

profitable as the average mining operations in Australia, suggesting that GE's estimates are a high-side estimate.

Further, while the statutory tax rate of 30% is a starting point, companies do not necessarily pay this rate. Other factors such as R&D tax offsets and consolidation into a single tax entity can result in tax payable which is substantially lower than the statutory rate, applying to smaller mining companies as well, irrespective of whether they are Australian or foreign owned.

The average effective tax rate across the mining companies in the sample and across all years was 22%, compared to 30% assumed by GE. This provides further guidance on the expected tax over the life of the Project. Although it is important to recognise that the tax paid could be substantially less.

Revised net production benefits

Royalties

GE's original report forecast royalties of $21m (in present value terms over the life of the project). Using the different price scenarios discussed above presents a range:

- **At the high-end, we estimate royalties of $23.6m based on the highest of the silver price forecasts of the financial institutions and GE's original price forecasts for zinc and lead.**
- **At the mid-range, we estimate royalties of $21.8m based on the World Bank forecasts (as at October 2021) for silver, lead and zinc.**
- **At the low-end, we estimate royalties of $19.7m based on the lowest of the silver price forecasts of the financial institutions and GE's original price forecasts for zinc and lead.**

Company tax payments

Using the revised price forecast range above and assuming an average effective tax rate of 22% (rather than 30%) results in revised tax payments of between $10.4m-$12.4m (based on the price range above). However, as noted earlier, observed tax payments from the ATO's data suggests that the tax payments could be considerably lower.

Third party royalties and net producer surplus

GE also includes benefit categories 'royalty payments to third parties' and 'residual producer surplus'. These are linked to income tax payments. For example, higher income tax payments would lead to lower residual producer surplus (and vice-versa). Similarly, an increase in wages (as discussed below) would also lower third party royalties and net producer surplus. We have not adjusted these items, except 'scaled' GE's original estimates of third party royalties and net producer surplus in accordance with updated price information and adjustments for company tax.

Based on revised prices, we estimate between $8m to $10m in third party royalties and net producer surplus.

Wage premium and supplier benefits

The Guidelines recognise that a new mine would increase the demand for labour to work at the mine. Miners may be required to pay higher wages to attract workers to the mine. In this circumstance, a share of the production benefits from extracting the resource could be *redistributed* to mining workers (in the form of higher wages), although if this occurred it would reduce other benefit categories (e.g. lower company tax due to lower profits as a result of the higher wage bill).

The NSW Guidelines categorise this 'benefit to workers' as a wage premium paid to workers as a result of the Project. That is, 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 Guidelines specify that, the benefit to workers is the difference between the wage paid in the mining project and the minimum (reservation)[3] wage that the workers would accept for working elsewhere in the mining sector. GE acknowledge that there is limited scope for increases in wages. Therefore, given GE's conclusion of a limited wage impact, using the measurement approach described in the Guidelines, there is *zero benefit to workers.*

The Guidelines are recognise that 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.

Consistent with the Guidelines the CIE estimates:

- **the wage premium to be around $2.2m in present value terms based on available information. This is consistent with the indication in the Guidelines that an assumption of zero wage premium is a useful starting point. It is also consistent with GE's view that the Project would have limited impact on wages.**
- **supplier benefits of around $92,000 (in present value terms) based on available data. In this context, GE's conservative assumption that there are no supplier benefits is reasonable.**[4]

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3 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 In a letter to NSW DPIE dated (24 November 2015), GE has also previously argued against the inclusion of supplier benefits, stating that it "…considers that secondary benefits to

Indirect economic benefits

GE includes a category of indirect benefits which, based on his estimates, are more than double the direct benefits from the mine.

Benefit to workers

GE presents other benefits which are not associated with any wage increases as a result of the Project. GE defines the benefit to workers as an *indirect benefit*. These are defined as:

- Direct recruitment of unemployed workers. GE estimates this to generate benefits to workers of $3.5m in present value terms.
- Job-shifting impact on those persons already employed. GE argues that the Project would attract workers from their existing employment, resulting in vacant jobs for others to 'upgrade their employment". This has a 'chain effect' filtering down to other jobs, creating further vacancies/opportunities for 'occupational upgrading'. GE estimates the job-shifting impact to generate benefits of $21.3m in present value terms.

CIE has undertaken a review of the additional arguments submitted by GE in his March 2021 response and reached the following conclusions:

- The assumptions are not based on evidence. GE relies on a range of implicit/explicit arbitrary assumptions which are not supported by evidence. As such, GE's analysis is only relevant if those assumptions are consistent with reality. Some of the key assumptions (discussed below) include:
  - 10% of the Project's future workforce is drawn from the currently unemployed workforce
  - 90% proportion of future workforce is drawn from workers that are currently employed across the whole spectrum of the labour force. The average wage across the whole workforce is assumed (in aggregate) to represent the wages of the workforce in their existing employment.
  - a 10% wage premium is applied to the average wage to compensate workers for additional disutility of working in a mine compared to their existing job.
  - no cost to the employer of employing new workers (e.g. a farmer may have to recruits and retrain a new worker, if the previous worker left to be employed at the mine).
- It is unclear what attributes GE is seeking to measure. The other argument is that job-shifting allows for 'occupational upgrading', expanding the skill base of the worker. However, GE's measurement approach does not appear to be measuring this attribute.
  - Any 'occupational upgrading' that occurs would impact on the *future* employment opportunities of the workers. As the Guidelines note, "workers are also more likely to realise net economic benefits if they will develop new skills by working on a project, such that they become more employable in the long term, especially if the skills are relevant to jobs in other industries or locations".

suppliers should be removed from the guidelines as a relevant consideration for CBA undertaken at the National and State level."

– GE does not seek to measure the changes in the future employment opportunities of the workers and, instead, just focuses on the difference in the current mining wage compared to the average wage across all sectors. It is not clear what attribute GE's approach is seeking to measure.

The CIE's report presents additional information which highlights the limitations in GE's approach.

GE's approach to estimate the 'wage benefits of employment' was inconsistent with the approach recommended in the Guidelines. GE's proposed approach is not robust and is based on a range of assumptions where limited evidence was presented to justify these assumptions.

Non-market wage benefits

This particular item relates to the impacts on the unemployed individuals themselves. GE's rationale for inclusion of this item is that there are social benefits from reducing unemployment because, for example, "….of the workers being unemployed and increased crime and community dislocation". As a result, the community would be willing to make payments for each person that the Project draws from the currently unemployed labour force. This payment would be in addition to households' annual income tax and other payments such as donations to charities to support households in need.

When developing the Guidelines, the NSW Government did not support the inclusion of this item in the Guidelines (as previously requested by GE). The inclusion of this item is, therefore, inconsistent with the Guidelines.

We have also identified limitations in the underlying survey which forms the basis of GE's benefit estimates. It does not provide a robust basis on which to understand:

1 what are relevant outcomes that are important to the community (e.g reduction in violent crime, reduction in drug abuse, reduction in petty crime).
2 the value that the community places in changing each of these specific outcomes, noting that the community may place different values on the different outcomes.
3 how the Project would impact on each of these outcomes, assuming that the Projects draws some of its future workforce from the currently unemployed pool of workers.

Consistent with the Guidelines, non-wage benefit of unemployment should not form part of the net benefit from the Project.

Economic costs of greenhouse gas emissions

The largest economic cost of the Project is associated with greenhouse gas emissions.

Apportionment of emissions to NSW

GE's only values 0.35 per cent of greenhouse gas emissions (Scope 1 and 2), based on his interpretation of the phrase in the Guidelines. GE's use of the apportionment factor is a key issue of contention. In response to a reviewer's comments on the draft Guidelines, NSW DPIE previously advised that

> 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.[5]

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 (paragraph 250, 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.[6]

In our view, the NSW Government Guidelines should be interpreted as requiring 100 per cent of the greenhouse gas emissions from the Project's to be included in the CBA (not 0.31% applied by GE). The NSW Government is considering this issue further and will provide clarification on the interpretation of the Guidelines.

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.

Consistent with the guidelines GE presents the results using 3 alternative prices (Forecast European Union Emission Allowance Units price, Australian Treasury Clean Energy Future Policy Scenario, US EPA Social Cost of Carbon).

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5 Quoted in letter dated (24 November 2015) from GE notes to NSW DPIE.

6 IPC (2021), Mangoola Coal Continued Operations Project (Mangoola Coal Continued Operations Project), Statement of Reason for Decision, 26 April

Based on these prices, GE estimates the present value of the cost of greenhouse gas emissions (Scope 1 and 2) ranges between $9 million and $36 million.

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 (but starting in 2021, instead of 2019) would result in a cost of greenhouse gas emissions (Scope 1 and 2) of between $10 million and $41 million. However, further consideration of the appropriate carbon price is required by the NSW Government to ensure that the Guidelines reflect updated information.

Conclusions

Based on the information available and the additional analysis conducted by the CIE we conclude that:

- the Project is expected to generate 'net benefits' for the community (i.e. benefits that outweigh the costs).
- the quantum of net benefits is estimated to be between $32.4-$38.3m (assuming a central carbon price estimate using the EU ETS carbon price). This reflects:
  - benefits of between $42.4m-$48.3m (in present value terms over the life of the mine) for the community, reflecting the *direct benefits* from mine production. The benefits:
    - largely relate to royalty ($19.7m- $23.6m) and company income tax payments ($10.4m-$12.4m) associated with the extraction/sale of the resource.
    - also include some third party royalty payments and residual producer surplus of around $10m,
    - from extraction/sale of the resource will also be distributed to suppliers and workers. Benefit to suppliers is estimated to be around $0.1m (in present value terms) and benefits to workers around $2.2m.
- Cost of greenhouse gas emissions (Scope 1 and 2) of between $10 million and $41 million, based on the carbon prices presented in the Guidelines (but starting in 2021, instead of 2019). However, there is some uncertainty regarding the appropriate carbon price, in the context of recent changes. The appropriate carbon price should be considered from a whole of Government perspective to ensure consistency across all NSW Government CBAs.

The estimate of benefits is marginally higher than that estimated in the CIE's February 2021 review report, reflecting the latest commodity price forecasts and adjustments to the income tax. Adjustment was also made for estimates of the 'benefit to workers' and 'benefit to suppliers'.

GE had also proposed benefit categories that are classified as *indirect benefits*, which are in addition to the *direct* benefits estimated above. These include 'wage benefits to workers' and 'non-market benefits of employment'. Under Gillespie's approach results in these benefits are over twice the size of the direct benefits to NSW from the Project. In relation to these items our review finds that:

- GE's estimates are inconsistent with the Guidelines.

  - The Guidelines do not allow for 'non-market benefits of employment'. GE had previously argued for the inclusion of this item in his submission to the development of the Guidelines. The NSW Government did not accept the GE's arguments and did not include it as a benefit category in the Guidelines.
  - GE's approach to measuring the 'wage benefits to workers' is inconsistent with the Guidelines. The Guidelines do allow for an alternative approach to measuring this item, however, GE does not provide a robust case to support the proposed approach. It is worth noting that a similar approach to that adopted by GE has also previously not been supported by the IPC in relation to the Mangoola Coal Continued Operations Project[7] and the Tahmoor South Project.[8]
- Limited evidence is provided to support the estimates. Instead, GE relies on 'assumptions' which are not supported by observed data. For example, GE assumes that 10% of the mine's future workforce come from workers that are currently unemployed. No evidence is provided to support this assumption. Changing these assumptions would materially impact on the quantum of benefits estimated.

Table 1 summarises the CIE's conclusion of the quantum of benefits/costs from the project

1 Benefits and costs to NSW — Gillespie Economics and CIE estimates

Benefit/cost categories	Gillespie Economics	CIE estimate
	$m, PV	$m, PV
Production benefits		
Government royalties	21	19.7 to 23.6
Australian third party royalties	4	5
Company tax	15	10.4 to 12.4
Residual producer surplus	4	5
Supplier benefit	0	0.1
Wage premium benefits	-	2.2
Total production benefits	**44**	**42.4 to 48.3**
Public impacts		
Wage benefits of employment	25	0
Non-market benefits of employment	78	0
Greenhouse gas emissions	0	-(10 to 41)
Total public impacts	**103**	**-(10 to 41)**
Net benefit (EU ETS carbon price)		**32.4 to $38.3**

Source: Gillespie Economics, 2020, *Bowdens Silver: Part 15 Economic Assessment.*

7 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

8 https://www.ipcn.nsw.gov.au/resources/pac/media/files/pac/projects/2020/10/tahmoor-south-coal-project-ssd-8445/determination/tahmoor-south-coal-project-statement-of-reasons.pdf

1 Introduction

About the project

The Bowdens Silver Project (the Project) involves the recovery of silver, zinc and lead minerals from defined ore reserves within a proposed open cut pit. The mine site is located approximately 2 to 3 kilometres northeast of Lue and 26 kilometres each of Mudgee within the Mid-Western Regional Local Government Area.

Gillespie Economics' results (May 2020)

GE was commissioned by the Proponent to undertake an economic analysis of the costs and benefits of the Project, as well as, to conduct a Local Effects Analysis.

GE's economic assessment estimates global net production benefit of $89 million initially to Australia and then subsequently apportions it to NSW. The net production benefit of the Project to Australia is estimated to be $89 million after accounting for benefits which accrue to foreign owners.[9] Of this $89 million net production benefit to Australia, $44 million is attributed to NSW based on the attribution factors outlined in table 1.1.

1.1 Benefits and costs to Australia and NSW — Gillespie Economics

Benefit/cost categories	Australia	Proportion attributed to NSW	NSW
	$m, PV	Per cent	$m, PV
Production benefits			
Government royalties	21	100	21
Australian third party royalties	11	32	4
Company tax	48	32	15
Residual producer surplus	9	45	4
Total production benefits	**89**		**44**
Public impacts			
Wage benefits of employment			25
Non-market benefits of employment			78
Greenhouse gas emissions			0
Total public impacts			**103**

Source: Gillespie Economics, 2020, *Bowdens Silver: Part 15 Economic Assessment.*

9 It is stated that Bowdens Silver is 7 per cent foreign owned.

There are also a number of indirect benefits described as 'wage benefits of employment' and 'non-market benefits of employment'. Based on Gillespie's analysis these items generate the largest benefits (totalling $103m in PV terms), over double the direct benefits from mining.

CIE's February 2021 review

In February 2021 the CIE prepared a report that reviewed the economic analysis commissioned by the Proponent and undertaken by Gillespie Economics (GE). The CIE concluded that……..

> Overall, the Project is estimated to deliver net benefits to NSW. At the upper end of the range, the benefits (associated with royalties, tax and residual producer surplus) is estimated at $50m in present value terms. This would be partially offset by greenhouse gas emissions valued at between $9m-$36m. Commodity prices would need to fall by over 20% (compared to that assumed by Gillespie Economics) for the Project to result in net costs to NSW. This is unlikely based on current prices and available market forecasts over the next few years.

The CIE also noted that the approach adopted to estimate 'wage benefits of employment' was inconsistent with the approach recommended in the December 2015 NSW *Guidelines for the economic assessment of mining and coal seam gas proposals* (the Guidelines). GE's calculations also relied on a number of key assumptions where limited evidence was presented to justify these assumptions. The CIE also previously noted that the inclusion of 'non-market benefits of employment' was inconsistent with the Guidelines.

Proponent's response

The Proponent has re-engaged GE and Stephen Brown from EY to prepare a response to the CIE's February 2021 review. In the response (dated 9 March 2021) GE:

- has misinterpreted/misrepresented the CIE's review. For example, GE states that the CIE "ignores potential wage benefits, which the NSW Government (2015) Guideline recognises can be one of the major economic benefits from a project" (p.1). However, later in his response GE recognises that "The CIE spends a considerable component of its review dismissing the potential employment benefits of the Project" (p.8). Rather than "ignoring" the potential wage benefits the CIE's February 2021 report highlighted that GE's proposed approach was inconsistent with the Guidelines and not a robust basis to estimate the benefit to workers.
- provides limited new evidence to support assumptions/calculations. For example, GE assumes that 10% of the future workforce of the mine will be drawn from the pool of currently unemployed workers. No evidence is provided to support this claim and GE states that the "assumption of 10% of future employment coming from unemployment pool is simply that, an assumption, to demonstrate the potential magnitude of benefits wage benefits" (p.10). A robust evidence base is required to provide confidence that the economic analysis provides a helpful basis to guide decision making.

This report

The purpose of this report is to reconsider GE's original economic analysis in light of the Proponent's response to the CIE's February 2021 review. This report also presents additional data which has been collected and analysed, as requested by NSW DPIE, in order to provide more robust information to assist the NSW Government in making recommendations regarding the Project.

The key focus of this report includes:

- reassessing the estimate of benefits associated with royalties and company tax in light of GE's 9 March 2021 response and current market data.
- estimating the potential worker and supplier benefits, taking account of GE's response.

We also provide additional comment on the estimate of the cost of greenhouse gas emissions, noting that the NSW Government agencies are separately considering this issue to ensure consistency of treatment.

2 Royalties, tax benefits and residual producer surplus

A key issue raised by Gillespie Economics was the commodity price forecasts which impacts on a number of benefit categories (royalties, company tax and residual producer surplus). NSW DPIE has requested that the CIE review the additional data provided, including consideration of GE's comments in relation to company tax benefits.

Commodity price forecasts

The net production benefits from the mining activity are dependent on the price received for the product (in Australian dollar terms). The Project's activities are largely focused on extracting silver and, to a lesser extent, zinc and lead for export to global customers. As such, the Project depends on the price received in the global market for the products, as well as, changes in the Australian dollar.

GE states that

> The Economic Assessment of the Project was based on consensus forecasts in the Marketing and Product Handling chapter of the Project Feasibility Study (GRES, 2018). This consensus pricing was based on average price forecasts of multiple financial institutions.[10]

In 9 March 2021 response to the CIE review, GE asserts that financial institutions more accurately forecast commodity prices and that the World Bank/IMF are inherently pessimistic and consistently underestimate the global prices for the 3 base metals relevant for the Project. GE asserts that the financial institutions are a more appropriate source for commodity price forecasts compared to forecasts by the World Bank and IMF. GE states that,

> The CIE again draws on the questionable World Bank reference to provide a lower bound estimate of these other net production benefits. As discussed above, this forecast is considered highly spurious and unsuitable for use in The CIE's review. The prices used in the Economic Assessment are considered more reasonable and already suitably conservative. The fact that the upper bound estimates for production benefits presented by the CIE are higher than that estimated by Gillespie Economics supports the conclusion that the Gillespie Economics estimates are reasonable and not inflated.

GE does not provide evidence to support his statement that the WB/IMF forecasts are inherently conservative or that the forecasts are "highly spurious and unsuitable for use".

GE's main arguments against the use of the WB/IMF forecasts are that:

- the business community rely on the forecasts by the financial institutions
- the WB/IMF forecasts are inherently conservative

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10 Gillespie Economics (2021), Response to CIE Review, 9 March, p.4.

- the World Bank's forecast silver prices are below actual prices (October 2013 forecasts for 2014-2019 being on average 22% below actual prices)
- April 2020 World Bank forecasts were at the early stages of Covid-19 and this uncertainty was reflected in highly pessimistic forecasts.

GE raises a valid point that forecasts developed during the early days of the Covid-19 outbreak may not be as reliable given the economic uncertainty at the time. We present more recent price forecasts in the next section below.

However, GE's assertion that the World Bank and IMF forecasts are inherently conservative lacks substance. The only evidence submitted was that the "October 2013 forecasts for 2014-2019 being on average 22% below actual prices". Simply, picking a single point in time and indicating that market prices rose higher than forecast does not mean that the World Bank's forecasts are 'inherently conservative'. For this statement to be true, GE would need to demonstrate, for example, that:

- the World Bank has consistently underestimated actual prices over a long period of time, not just a single point in time
- the financial institutions relied upon by GE have more accurately predicted (compared to the World Bank) actual prices on a consistent basis over the same period.

As indicated below, the additional information provided by GE in his response to the CIE's February 2021 report further supports the use of the World Bank data as an alternative forecast.

GE's original commodity price forecasts

In GE's original economic assessment, the weighted average real commodity prices are used:

- US$ 20.91 per ounce of silver
- US$ 2,756 per tonne of zinc,
- US$ 2,205 per tonne of lead.

These commodity prices are based on consensus forecasts from major financial institutions, as outlined in the Marketing and Product Handling chapter of the Project Feasibility Study.[11] The weighted average real commodity price is based on the forecast price over the three years of 2019, 2020 and 2021 (table 2.1).

2.1 Commodity prices

Commodity	Unit	2018	2019	2020	2021	2022
Consensus reported in economic assessment (nominal dollars)						
Silver	USD/oz	19.75	21.42	21.5	22.0	22.5
Zinc	USD/lb	1.4	1.31	1.25	1.29	1.17

11 GR Engineering Services (2018), *Bowdens Silver Project Feasibility Study*, prepared for Bowdens Silver Pty Ltd.

Commodity	Unit	2018	2019	2020	2021	2022
Lead	USD/lb	1.08	1.04	1.03	1.03	0.98
World Bank forecast, April 2020 (nominal dollars)						
Silver	USD/oz	15.7	16.2	16.8	17.0	17.1
Zinc	USD/lb	1.33	1.16	0.86	0.91	0.93
Lead	USD/lb	1.02	0.91	0.77	0.82	0.83
Difference between forecasts						
Silver	per cent	-20	-24	-22	-23	-24
Zinc	per cent	-5	-12	-31	-30	-21
Lead	per cent	-6	-13	-25	-21	-15

Note: World Bank's commodity price for silver is based on troy ounces (toz).

Source: Gillespie Economics, 2020, *Bowdens Silver: Part 15 Economic Assessment* and World Bank Commodities Price Forecast released April 23 2020.

The CIE's February 2021 review pointed out that there were other forecasts by the World Bank and IMF available which presented an alternative view that should be considered. The average commodity prices for silver, zinc and lead based on the World Bank's commodity price forecasts (released April 2020) over the three years 2019, 2020, 2021 are lower than the consensus forecasts used in the Economic Assessment, being on average 23 per cent lower for silver, 24 per cent lower for zinc, and 20 per cent lower for lead.

The International Monetary Fund's (IMF) *World Economic Outlook* report published in April 2020 reviewed the impact of the COVID-19 Outbreak on commodity prices. The report noted that prices have decreased sharply since the release of the October 2019 *World Economic Outlook.* With respect to the three base metals relevant for the Project, the IMF estimated prices for silver, lead and zinc declined by between 20 and 25 per cent.[12]

GE revised forecasts (March 2021)

In GE's response additional silver price forecasts from financial institutions are provided (table 2.2). GE uses the average of the financial institutions.

2.2 Recent Consensus Pricing for Silver

Institution	Broker	2021	2022	2023
.	.	US$/oz	US$/oz	US$/oz
Citi	Citi	26.50	26.00	22.00
BAML	Broker 1	31.25	31.00	30.16
Morgan Stanley	Broker 2	26.00	23.00	21.00
Barclays	Broker 3	23.13	21.88	
DB	Broker 4	23.80	22.00	
CIBC	Broker 5	32.00	31.00	30.00
JP Morgan	Broker 6	27.20	27.50	

12 Based on commodity price movements between January 17, 2020 (pre-outbreak) and February 7, 2020.

Institution	Broker	2021	2022	2023
.	.	US$/oz	US$/oz	US$/oz
CS	Broker 7	25.00	18.00	18.26
HSBC	Broker 8	21.50		
UBS	Broker 9	30.00	26.00	19.20
RBC	Broker 10	23.66	22.50	22.50
BMO	Broker 11	27.63	22.50	23.00
Max (financial institutions)		**32.00**	**31.00**	**31.16**
Average (financial institutions)	**.**	**26.47**	**24.67**	**23.27**
Min (financial institutions)		**21.50**	**18.00**	**18.26**
World Bank (April 2021)		**25.0**	**22.0**	**20.0**

Source: Gillespie Economics, 9 March 2021, p.5. World Bank
https://thedocs.worldbank.org/en/doc/c5de1ea3b3276cf54e7a1dff4e95362b-0350012021/related/CMO-April-2021-forecasts.pdf

The data presented above by GE highlights that:

- there are differing views of future prices amongst the financial institutions. Approximately half of the 12 institutions have forecasts below the average (the average being GE's preferred metric).
- some financial institutions are forecasting prices below the World Bank forecasts. In this context the World Bank forecasts are a reasonable alternative to the forecasts from the financial institutions.

Given this, we conclude that:

- **GE's objection to the use of World Bank forecasts lacks substance. The use of the World Bank forecasts remains an alternative guide for the assessment of the benefits from the Project.**

Exchange rate

The value of the product is also dependent on the AUD:USD exchange rate. In regards the exchange rate, Gillespie (p.15-42) notes that

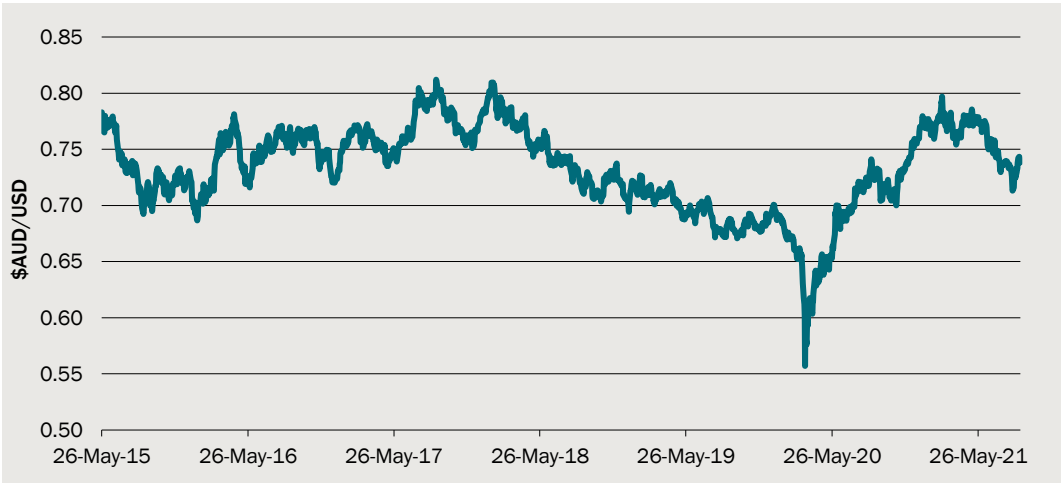
> As with all projects that produce products sold in USD, the exchange rate can have a significant impact on project metrics. Bowdens Silver sought forecast of the AUD:USD exchange rate from a number of major financial institutions, as shown in Table 4.7. An exchange rate of USD0.75 to AUD1.0 was adopted for the study based on this analysis (GRES, 2018).

In the Risk and Sensitivity Analysis section (p.15-70), Gillespie states that "the USD price of silver was assumed at 20.91/oz with an AUD:USD exchange rate of 0.75".

Commodity prices are subject to further variation caused by movements in the AUD/USD exchange rate. Over the two 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 2.2. Movements in the exchange rate are difficult to predict with any degree of accuracy due to the multitude of influencing internal and external factors. As at 8 September 2021, the Australian dollar was trading at $US0.74.

- **GE assumes an AUD:USD exchange rate of 0.75. This assumption remains appropriate.**

2.3 AUD/USD Exchange rate (26 May 2015 to 8 Sep 2021)



Data source: Reserve Bank of Australia, Exchange Rate Historical Data (2020).

Conclusion

It is appropriate to present a range of price forecasts, recognising the uncertainty in the forecasts. The range would be informed by the range of forecasts including by the financial institutions, as well as, other sources such as the World Bank.

Based on the current available forecasts,

- at the high end, the *maximum* of the silver price forecasts from the financial institutions presented by GE in March 2021 are around 20 per cent *above* GE's original forecasts in May 2020 economic analysis.
- the mid-range forecasts are based on the World Bank silver price forecast (as at 21 October 2021), which are 10% *above* GE's original forecast. The World Bank lead and zinc price forecasts are 6% and 8% *below* GE's original forecast.
- at the lower end, the *minimum* of the silver price forecasts from the financial institutions presented by GE in March 2021 are around 8 per cent *below* GE's original forecasts.

Company tax payments

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 an assumed 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. The extent of any debt funding is also important, given that these costs are tax deductible.

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 at the forefront of their decisions.

There are essentially two aspects that require consideration in estimating the likely company tax payments:

- **Taxable income**. The tax paid by a company will vary from year to year depending on, for example, the stage of development and the extent of depreciation allowance and carried forward losses. A detailed review is required to establish, for example, the proposed capital investments, operating costs, depreciation estimated, deductions from borrowing costs and any losses that can be carried forward to future years. This would allow a more accurate estimate of the extent to which these factors would lower the taxable income.
- **The effective tax rate**. Other factors such as R&D tax offsets and consolidation into a single tax entity can result in tax payable which is lower than the 30% statutory rate.[13]

In the absence of a detailed review of the company's accounts, using data from the ATO provides a basis to test aspects of GE's estimates. The ATO has presented information on companies' total income and tax payments for the financial years 2013/14 to 2018/19, as part of its Corporate Tax Transparency initiative.[14] These reports present information for Australian public and foreign-owned corporate tax entities with a total income of $100 million or more; and Australian-owned resident private companies with a total income of $200 million or more.

GE does not support the use of observed tax data from the ATO as a means to test his estimates. GE's argument is that his calculations are based on a detailed profit/loss analysis which takes account of depreciation and carry forward of losses. GE argues that the sample of companies in the ATO's data may not be representative of the Project, given that many mining companies are larger and often foreign owned.

However, as the ATO data above suggests there is scope for smaller companies residing in Australia to also reduce tax payments. We have aggregated the data across all years and company groupings to capture, on average, which should provide a guide to test GE's estimates.

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13 Consolidation involves treating the wholly-owned group as a single tax entity, with the subsidiary members treated as parts of the head company. Intragroup transactions are disregarded for income tax purposes. https://www.ato.gov.au/assets/0/104/1083/1160/206fdab3-c92e-429c-b571-f8bb11063d88.pdf

14 https://data.gov.au/dataset/corporate-transparency. See also https://data.gov.au/dataset/ds-dga-c2524c87-cea4-4636-acac-599a82048a26/details

Taxable income

We have identified around 140 companies in the database that are involved in a range of mining activities. On average, across all years and all mining companies, 'taxable income' comprises around 7.40% of 'total income'.[15] Note that the ATO does not report cases where taxable income is negative, therefore, the figure of 7.4% is an overestimate. Nevertheless, it provides some guide as to the average profitability of mining companies.

GE's analysis assumes that the Project is ungeared (i.e. that no debt is held against the Project).[16] Given the low current cost of debt, it is likely that some proportion of the capital expenditure would be funded through borrowings. The Silver Mines Ltd Annual Report, for example, already indicates a loan of around $1m at an interest rate of 4.06% pa (although the loan was repaid during the year).[17] Presumably, the borrowings would increase as the construction commences. Any borrowing costs would further reduce the taxable income.

- **As a comparison, in present value terms, GE estimates total income of $1,033m and taxable income of $160m which equates to a ratio of 15% (total income/taxable income). This would imply that the Project is around 2 times as profitable as the average mining operations in Australia, suggesting that GE's estimates are a high-side estimate.**

Effective tax rate

While the statutory tax rate of 30% is a starting point, companies do not necessarily pay this rate. As noted earlier, other factors such as R&D tax offsets and consolidation into a single tax entity can result in tax payable which is lower than the statutory rate. Glencore's Voluntary Tax Transport Report 2019, for example, identifies tax offsets which "largely represents utilisation of prior and current year R&D tax offsets and franking tax offsets".[18] Other mining companies may also have the opportunity to utilise such tax offsets.

Likewise, the consolidation of wholly owned entities under a tax grouping results in the projected tax payable position being determined by the aggregation of each of the individual entities. Chart 2.4 illustrates the point where the profitability of entity 1 is offset by the losses of entities 2 and 3.

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15 There are 3,135 separate companies in the database. Across all companies in the sample and all years, 'taxable income' comprises around 7.3% of 'total income', similar to that of mining companies.

16 Gillespie Economics (2020), p. 15-44.

17 Silver Mines Ltd (2021), Annual Report, Note 15, p.43. https://www.silvermines.com.au/wp-content/uploads/2021/09/2270552.pdf

18 See page 8 of the following report https://www.glencore.com.au/dam/jcr:1c66cdfb-a24f-4900-a43e-627fbf1619a0/gln-3152a-voluntary-tax-transparency-report-australia-2019-fa3-sr.pdf

2.4 Tax consolidation illustration

Data source: The CIE.

Uncertainty pertaining to the projected tax payable by the group increases as the number and type of activity the entities are operating in increases.

Some consolidated tax groupings involve a large number of entities. For example, Glencore Investment Pty Limited has a tax grouping which consists of 31 entities.[19] The larger the number of related entities, the greater the uncertainty regarding the tax payable – tax payable by a single entity could range from zero per cent to 30 per cent. For less complex structures, for example, the range of tax payable would be expected to be narrower.

In regards to the Project, there are the following entities consolidated into Silver Investment Holdings Australia Pty Limited:

- Bowdens Silver Pty Limited
- Tuena Resources Pty Ltd
- Bowdens Agriculture Pty Ltd
- Asia Metals Holdings 3 Pty Ltd.

Therefore, consideration needs to be given to the number of entities within the same tax group when assessing the tax payable for a particular project. Given this, consideration of the company's observed historical tax payments or tax payments of its peers provides guidance, as in the majority of cases the individual financial reports of entities will not be publicly available.

Of the 9,128 observations in the sample where taxable income was reported, there were only 4.6% cases where the full 30% statutory tax rate on their taxable income was applied. Around 25% of the sample paid tax equivalent to between 15% and 30% of taxable income.

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19 The activity grouping include: Copper production; Copper/Zinc/Lead production; Nickel production; Zinc production; Bauxite exploration; Coal investment holding; Coal production; Holding; Finance; Operating; and Coal marketing.

According to the ATO's database, some mining companies, such as Alkane Resources Ltd (with annual revenue of around $100m) paid zero tax in 2014/15, 2015/16, 2016-17 and 2017-18 even though there was taxable income reported in 3 of the years.

- **The average effective tax rate across the mining companies in the sample and across all years was 22%, compared to 30% assumed by GE. This provides further guidance on the expected tax over the life of the Project. Although it is important to recognise that the tax paid could be substantially less, similar to Alkane Resources.**

Revised net production benefits

Royalties

GE's original report forecast royalties of $21m (in present value terms over the life of the project). Using the different price scenarios discussed above presents a range:

- **At the high end, we estimate royalties of $23.6m based on the *highest* of the silver price forecasts of the financial institutions and GE's original price forecasts for zinc and lead.**
- **At the mid range, we estimate royalties of $21.8m based on the World Bank forecasts (as at October 2021) for silver, lead and zinc.**
- **At the low end, we estimate royalties of $19.7m based on the *lowest* of the silver price forecasts of the financial institutions and GE's original price forecasts for zinc and lead.**

Company tax payments

GE' estimates total income of around $1,033m (in present value terms). Based on these revenues, GE estimates company tax of around $46m (in present value terms), assuming a statutory tax rate of 30% - this equates to a taxable income of $160m (in present value terms). GE estimates the NSW share of the tax benefits to be $15m (in present value terms), based on apportioning 32% of income tax payments to NSW.

- **Assuming an average effective tax rate of 22% (rather than 30%), implies revised tax payments of between $10.4m-$12.4m. However, as noted earlier, observed tax payments from the ATO's data suggests that the tax payments could be considerably lower, although this would need to be evaluated on a case by case basis. Therefore, this range for income tax payments should be considered to be a high side estimate.**

Other net production benefits

We have aggregated the following benefit categories 'royalty payments to third parties', 'income tax' and 'residual producer surplus' given the linkages between the items. For example, higher income tax payments would lead to lower residual producer surplus.

Similarly, higher wages paid to mining workers in the Project would lower residual producer surplus. We have not adjusted these items, except 'scaled' GE's original estimates of third party royalties and net producer surplus in accordance with updated price information and adjustments for company tax.

- **Based on revised prices, we estimate between $8m to $10m in third party royalties and net producer surplus.**

Adjustments for wage and supplier price increases

As discussed below, the Guidelines consider how some of the net production benefits are distributed between the different parties. Some of the net production benefits could be distributed to workers and suppliers if they can charge higher prices for their services. However, any increase in wages and supplier charges would reduce company profits, resulting in a fall in income tax and residual producer surplus. The figures presented in this chapter have not been adjusted for any potential increase in wages and supplier charges (which are discussed in the next chapter), as it is sufficiently material.

3 Benefits to workers

When a new mine opens in a region, it increases the demand for mining labour. 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).

This section outlines the relevant sections of the Guidelines, reviews GE's proposed approach to estimating the benefits to workers and provides additional information to support a more robust estimate of the benefit to workers.

The Guidelines

The Guidelines recognise that a new mine would increase the demand for labour to work at the mine. Miners may be required to pay higher wages to attract workers to the mine. In this circumstance, a share of the production benefits from extracting the resource could be *redistributed* to mining workers (in the form of higher wages), although if this occurred it would reduce other benefit categories (e.g. lower company tax due to lower profits as a result of the higher wage bill).

The NSW Guidelines categorise this 'benefit to workers' as a wage premium paid to workers as a result of the Project. That is, 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 Guidelines specify that, the benefit to workers is the difference between the wage paid in the mining project and the minimum (reservation)[20] 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 3.1

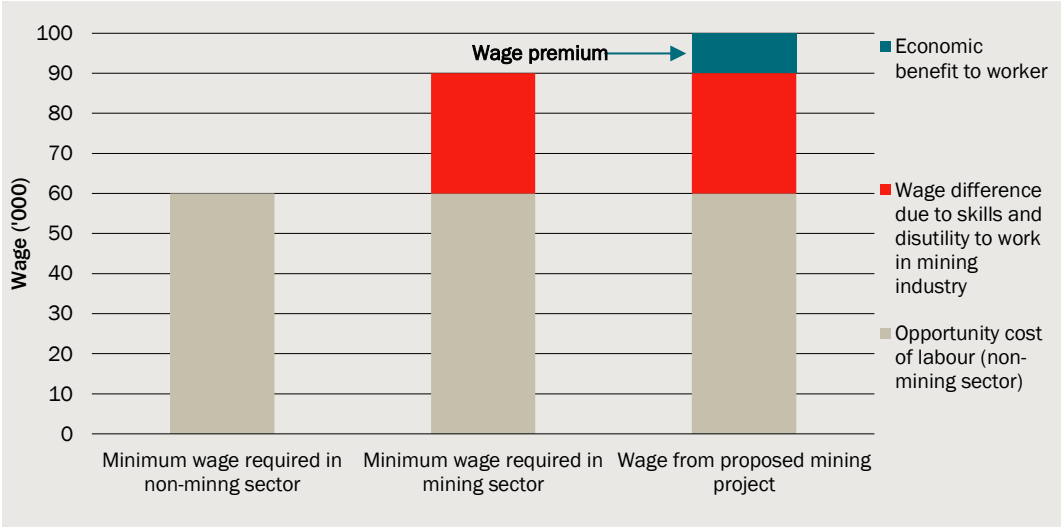
- the grey shaded bar, can (broadly speaking) be interpreted as the wage that an 'average' worker in the region *currently* receives;
- the red shaded area represents the additional amount that the 'average' worker could *currently* receive in the mining sector if they had the right skills as well as the

20 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.

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.

3.1 Identifying the economic benefit to workers



Data source: NSW DPIE (2015), Guidelines for the economic assessment of mining and coal seam gas proposals, December, p.14.

While the Guidelines are specific about how to measure the 'wage premium' to workers they do, however, allow the Proponent to put forward a case for an alternative measurement approach stating

> 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.[21]

Gillespie Economics' estimates of worker benefits

Under GE's approach, the Project does not result in an increase in wages to workers in the mines. GE states that

> In the short-run, increased local area demand for labour as a result of the Project (relative to the "without Project" scenario) could potentially result in some increased pressure on wages in other sectors of the economy. The magnitude and duration of this upward wages pressure would depend on the level of demand for labour, the availability of labour resources in the local area and the availability and mobility of labour from outside the local area…….Wage impacts are therefore not likely to be significant. Where upward pressure on local area wages

21 CBA Guidelines (2015), p.13.

occurs, it represents an economic transfer between employers and owners of skills and would attract skilled labour to the local area leading to downward pressure on wages.[22]

- **Therefore, given GE's conclusion of a limited wage impact, using the measurement approach described in the Guidelines there is *zero benefit to workers.***

GE presents an alternative approach to estimating the benefit to workers, as discussed below.

GE's alternative approach

GE recognises that

> In standard CBA, the wages associated with employment are considered an economic cost of production with this cost included in the calculation of net production benefits (producer surplus).[23]

This is the general approach that is accepted by NSW Treasury, INSW and Infrastructure Australia in evaluating large infrastructure investments.[24] In road investments, benefits such as the reduction in vehicle travel times or reduction in fatalities are the benefits that are being measured. The additional labour used to deliver the project is treated as a cost of delivering the project. Likewise, the additional labour used to build a new water storage or desalination plant is treated as a cost, not as a benefit category.

GE defines the benefit to workers as an *indirect benefit*. These are defined in terms of reduction in unemployment, as well as, job-shifting for those persons already employed. GE estimates the job-shifting effect to have the largest economic impact.

Direct recruitment of unemployed workers

GE states that

> The real benefit to workers relates to those who would otherwise be unemployed, working part-time or in lower paid non-mining sector. The reservation wage for each of these is different and for the unemployed and those working part time or in non-mining sectors the reservation wage has not been addressed in the guideline. For the otherwise unemployed, the reservation wage would normally be equivalent to unemployment benefits plus income tax payable on a mining wage (refer to Streeting and Hamilton 1991). This of course requires assumptions about the percentage of workers that would otherwise be unemployed and how long they would have been unemployed for. The consideration of this potential benefit in the draft guideline is very incomplete.

GE estimates this to generate benefits to workers of $3.5m in present value terms.

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22 Gillespie Economics (2020), p.15-74. Table ES1 p.15-13 also states that there is "no material impact" on wages.

23 Gillespie Economics (2020), p.15.58

24 See also the National Transport Council CBA Guidelines (2006) https://www.atap.gov.au/sites/default/files/National_Guidelines_Volume_5.pdf . Page 38 notes that the extent to which a project reduces unemployment could be incorporated into the CBA.

Job-shifting impact

GE argues that the Project would attract additional workers which would result in vacant jobs for others to 'upgrade their employment". This has a 'chain effect' filtering down to other jobs, creating further vacancies/opportunities for 'occupational upgrading'.

GE states that

> With job chain effects, what is important is not the reservation wage of those immediately hired by the project, but the reservation wage of those at the end of the job chain (Bartik 2012).[25]

This statement implies that the benefit of the Project is the extent to which it reduces the number of persons unemployed.

GE further states that

> Even if all employment came from an alternative mine, there is occupational upgrading – people don't move jobs just to earn the same wages – and job chain effects where occupation upgrading of one person leads to a sequence of occupation upgrading that can reach all the way down to new participants in the labour force or the unemployed.[26]

This is the second component of GE's benefit and is associated with job-shifting and 'occupational upgrading' to higher paid jobs for existing workers.

GE estimates the job-shifting impact to generate benefits of $21.3m in present value terms.

GE's assumptions underpinning calculations

GE measures the two worker benefit components using a range of assumptions as follows:

- A reduction in the number of persons unemployed as a result of the Project. GE assumes that:
  - 10% of the future workforce for the Project (21 out of 210 workers) will come from the unemployed labour force
  - the person is assumed to otherwise be unemployed for 3 years
  - the current reservation wage of the unemployed person is currently $47,526 and they will earn a wage of $120,000 per annum in the mine.
- An increase in the number of persons shifting to higher paid jobs.
  - the remaining 189 workers will receive a benefit of $49,050 per worker (average mining wage of $120,000 less an adjusted reservation wage of $79,050)
    - assumes these "workers, after job chain effects, are evenly located along the labour supply curve, the average wage in NSW ($64,500) gives an indication of a potential average reservation wage".

25 Gillespie Economics(2020), p.15.59

26 Gillespie Economics(2021), p.9

- assumes that the adjusted reservation wage of $79,050 is based on the average wage of $64,500, with an assumed 10% increase to reflect the disutility of working in the mining sector compared to the current employment.

– the wage benefits are assumed to only occur for 3 years.

Limitations of GE's approach

As noted earlier, creating additional jobs or paying workers more is not treated as a 'benefit' in most CBAs – that is, the additional wage bill is just a cost to the employer in the production process. That is, there is no net gain to society from this occurring – the worker benefits from a higher wage but the employer has a higher wage bill.

Under the Guidelines if the increased demand for labour (as a result of the Project) results in higher wages for mining workers (above the existing mining wage), then some of the production benefits would be distributed to the workers. That is, if there is a wage premium from the Project (as described in chart 3.1), then this would also reduce other benefit categories (e.g. company tax payments due to a reduction in profits associated with a higher wage bill).

The Guidelines, however, explicitly recognise that (in some circumstances) creating the additional employment could have additional benefits, stating

> A broad range of factors may be relevant to the question of whether a project will generate net benefits for workers. In general, the net benefit to workers is more likely to exist if workers will be drawn from a population with persistently high unemployment or experiencing other forms of social and economic disadvantage. Workers are also more likely to realise net economic benefits if they will develop new skills by working on a project, such that they become more employable in the long term, especially if the skills are relevant to jobs in other industries or locations.

The Guidelines require any estimates to be economically sound and based on robust evidence. In our view, GE's proposed approach does *not* provide a robust basis of the potential quantum of benefits to workers. The limitations of GE's approach are discussed below.

Unclear what is being measured

As noted earlier, there are two components to GE's estimate:

1 the Project directly employing persons that are currently unemployed.

2 the Project employing persons that are currently employed.

Regarding the second item, it is not clear what benefit GE is seeking to measure:

- one of GE's arguments is that job-shifting allows workers to move to a more productive sector. GE states that "Workers who transfer to the mining sector and earn higher wages are in effect increasing their productivity."
  - If this is the core element to be measured, then GE would seek to have a detailed understanding of which sectors the future potential workforce will be drawn from and the relative productivity of those sectors. Instead, GE makes a general

assumption that the future workforce will be drawn from "anywhere along the labour supply curve" and, in aggregate, the average wage provides a proxy for the wages in their current occupations.

- the other argument is that job-shifting allows for 'occupational upgrading', expanding the skill base of the worker.
  - If this is the case, then GE should be seeking to understand: (1) the extent of occupational upgrading that is occurring, compared to general labour turnover (see chart 3.6); (2) how the occupational upgrading will impact on the *future* employment opportunities of the workers over, say, the next 10 years.

In simple terms, however, GE takes the average wage in all sectors (applying an arbitrary 10% increase for 'disutility') and compares this to the average mining wage. This wage difference is assumed to be the benefit associated with job-shifting.

In its economic analysis of the Glendell Continued Operations Project EY[27], adopts the same approach as GE, but explains it as follows

> To measure the opportunity cost compared to the non-mining sector, the wages earnt by Glendell Mine workers was compared to the average wage paid on average in NSW. This implies that should the Project not go ahead, those who would have been employed by Glendell would find alternative work at the average wage paid in NSW.[28]

- **Adopting this line of reasoning suggests that GE's calculation implies that, if the Project goes ahead, it would be drawing workers who are currently being paid the average wage.**

Assumptions not based on evidence

GE relies on a range of implicit/explicit arbitrary assumptions which are not supported by evidence. As such, GE's analysis is only relevant if those assumptions are consistent with reality. Some of the key assumptions (discussed below) include:

- 10% of the future workforce drawn from the currently unemployed workforce
- 90% proportion of future workforce drawn from workers that are currently employed across the whole spectrum of the labour force. The average wage across the whole workforce is assumed (in aggregate) to be representative of the wages of the workforce in their existing employment.
- a 10% wage premium is applied to the average wage to compensate workers for additional disutility of working in a mine compared to their existing job
- no cost to the employer of employing new workers.

Implicitly, GE also assumes that there are:

- similar hours worked compared to other sectors
- no skill difference between mining and other sectors

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27 EY has acted as a peer review of GE's economic analysis for the Proponent (see report dated 31 May 21).

28 EY (2019), Economic impact assessment of the Glendell Continued Operations Project, p. 18.

Appendix A provides further information to explain wage differentials between the mining and other sectors.

Employment of currently unemployed workers

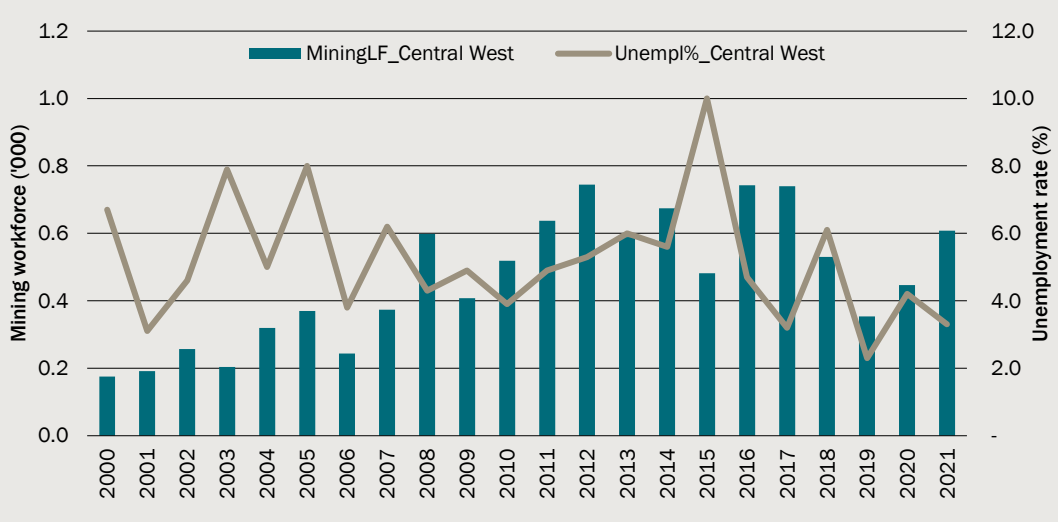
GE assumes that 10% of the future workforce for the Project (21 out of 210 workers) will come from the unemployed labour force. No evidence is provided to support this assumption. In the response to the CIE's February 2021 peer review report, GE states

> The assumption of 10% of future employment coming from unemployment pool is simply that, an assumption, to demonstrate the potential magnitude of benefits wage benefits.[29]

ABS Labour Force data on mining employment and unemployment in the Central West SA4 region indicates a limited correlation between mining sector employment and unemployment rates in the region (see chart 3.2):

- Mining sector employment has increased substantially over the past 2 decades, from around 2,000 workers in the year 2000 to over 7,000 workers in 2017.
- Despite this the unemployment rate has not fallen – the unemployment rate in 2017 being similar to that in 2001.
- The unemployment rate has been volatile over this 20 year period, despite the increase in the mining workforce. In the years, 2009 to 2012, there was a substantial increase in mining employment but the unemployment rate also increased. Similarly, in the 3 years since 2017, there has not been a marked increase in the unemployment rate in the region.

3.2 Mining sector labour force and unemployed, Central West SA4 region

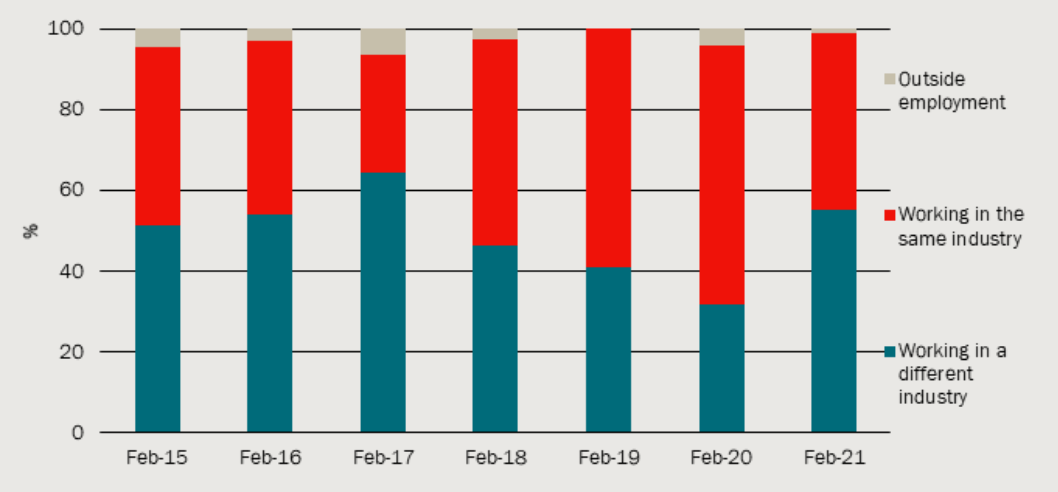


Data source: ABS *6291.0.55.001 - RQ1 - Employed persons by Industry division of main job (ANZSIC), Labour market region (ASGS) and Sex, Annual averages of the preceding four quarters, Year to August 1999 onwards*, released 23 September 2021.

29 Gillespie Economics (2021), Response to The CIE's Peer Review, 9 March, p.10.

This finding is consistent with recent ABS job mobility data from the ABS.[30] The data indicates that by Feb 2021 current employed persons in mining amount to 224 445 in Australia, 12 per cent of which are employed less than 12 months. Among these workers who are relatively 'new' in their current jobs, 55 per cent worked in non-mining sector, 44 per cent moved within the mining sector, and 1 per cent was drawn from unemployed pool. Shares of labour inflow from a different sector and labour movement within the mining sector vary over the past 5 years, while recruitment from unemployment pool remain relatively small (chart 3.3).

3.3 Labour inflows to the mining sector[a]



[a] share of current mining workers working less than 12 months in their main jobs

Data source: ABS Job Mobility, Table 19.

While the share of employees coming from the unemployment pool varies over time, the share averages around 3 per cent in the last seven years. The share of employees coming from the mining industry lies around 47 per cent, while around 50 per cent of employees come from another industry.

- **Based on the data available, the Project would be expected to draw approximately 3% of its new workforce from the currently unemployed persons.**

Employment from currently employed pool of workers

GE assume that 90% of the future workforce is drawn from the currently employed persons. It is assumed that the mine draws from a wide spectrum of workers such that the 'average wage' provides a good guide (in aggregate) of the current wage. In the original (May 2020) economic analysis, GE does not provide any evidence to support the view that the current job mix of potential future workers on the Project would aggregate to the average wage.

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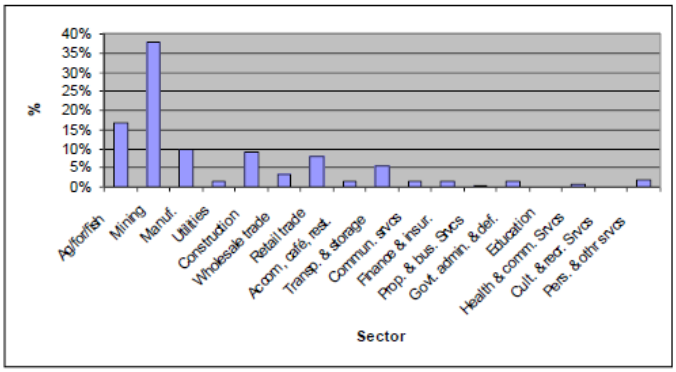
30 ABS Job Mobility, Table 19, https://www.abs.gov.au/statistics/labour/employment-and-unemployment/job-mobility/latest-release#:~:text=Data%20downloads-,Key%20statistics,left%20or%20lost%20a%20job

In GE's March 2021 response, information is presented from a 2006 survey (see chart 3.4) of employment in the Cadia mine, although this is not utilised in GE's analysis. GE's survey identifies the range of sectors that the mine workers previously worked. This highlights that the mine drew its workforce from currently employed workers and suggests that the mine did not employ persons that are currently unemployed.[31]

3.4 Previous employment, Cadia Mines

ES Q24. Industry Sector Employed in Before Working At Cadia Mines n=308

Sector	Percent
Ag/for/fish	16.6%
Mining	38.0%
Manuf.	9.7%
Utilities	1.3%
Construction	9.1%
Wholesale trade	3.2%
Retail trade	8.1%
Accom, café, rest.	1.3%
Transp. & storage	5.5%
Commun. srvcs	1.6%
Finance & insur.	1.3%
Prop. & bus. Srvcs	0.3%
Govt. admin. & def.	1.3%
Education	0.0%
Health & comm. Srvcs	0.6%
Cult. & recr. Srvcs	0.0%
Pers. & othr srvcs	1.9%
Total	100.0%



Data source: Gillespie Economics (2021), Response to CIE's peer review,

As noted previously, recent data from the ABS (across the whole of Australia) suggests that, when a new mine opens, it is likely to draw around 45 per cent of its workforce from other mines.

- **Observed data suggests that around 45 per cent of the workforce of the Project would come from the existing mining workforce. Applying this figure would (at a minimum) would reduce GE's estimated benefits calculation by close to 50 per cent – that is, half the new workforce would currently be receiving the average *mining* wage, not the average wage across all workers.**

Compensation for increased disutility of working in a mine

GE arbitrarily assumes that the average worker needs to be paid 10% more to account for the disutility compared to working in a mine. In doing this GE also states that

> It is questionable whether there is any disutility in a open cut mining job relative to other industry sectors from which labour may be drawn e.g. agriculture, transport, manufacturing, construction etc, as these sectors all have higher worker fatality rates than mining (Safe Work Australia, 2019).[32]

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31 https://www.abs.gov.au/statistics/labour/employment-and-unemployment/labour-force-aaustralia-detailed/latest-release#methodology, see data UQ2b.

32 Gillespie (2020), p.15-59.

Wage differentials reflect a range of factors not just whether there are differences in fatalities rates. Other factors include, for example, skills differences, hours worked, more challenging work conditions and travel time/cost of the commute.

If these factors weren't relevant then economic theory would suggest that market forces would work to remove the wage differential. For example, a worker currently being paid $50,000 per year would be willing to work for, say, $80,000 in a mine. The mine would not need to pay the average mining wage of $120,000 to attract the worker and the average mining wage would be 'bid down'.

The fact that there remains a substantial wage differential would support the view that there are other factors driving this wage differential. That is, factors such as the additional hardship of working in mines compared to the 'average' job and the additional skills needed to work in a mine would explain the wage differences.

Appendix A provides further explanation of the factors driving the wage differentials. In the discussion below, we present further evidence of the disutility associated with mining work.

Hume Coal documentation of disutility

Hume Coal produced a document to inform potential workers about what to expect from working in the mining sector.[33] Box 3.5 presents some excerpts from the document which highlight the relative hardships of working in the mining sector compared to other jobs.

33 https://www.humecoal.com.au/sdm_downloads/guide-jobs-within-mining-industry/

3.5 Hume Coal — information to new workers

The document states that "it is typically hard work and not for everyone". The document outlines some of the challenges of working in the mining sector which include:

- long work hours and shift work, depending on the job requirements (e.g rosters can be anywhere from 5 days on and 2 days off to 7 days on and 4 days off). As a result the mine requires operational employees to

  live within the Southern Highlands region and immediate surrounding areas (within a 45 minute commute of the mine). This will assist in managing fatigue, safety and the wellbeing of employees but will also ensure greater socio-economic benefits flow directly to the local community.

- Requirement for the mine to operate throughout the year. Staff will not automatically be given

  ..time off for public holidays such as Christmas and New Year, you may be able to take annual leave during this period. However, this is not guaranteed due to the 24hr nature of the mine.

Hume Coal also recognised the potential impact on families stating

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.

• Social commitments such as being part of a sporting team may also be affected.

Hume Coal understands that the mental and physical wellbeing of their employees is vital and will not be engaging a 'drive-in-drive-out' and 'fly-in-fly-out' workforce. All operational employees will be required to live within the Southern Highlands region and immediate surrounding areas (within a 45 minute commute of the mine)

Impact of shift work and noise/pollutant impacts

According to a study by Cottle and Keys, [34] 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 coal mines and that of the Hunter Valley's open-cut coal mines. In the underground coal

34 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

mines, 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.[35]

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.[36]

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[37].

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.[38] 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.[39]

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

36 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 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.

37 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.

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

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

Existing high turnover rates in mining

The turnover rates refer to a person who worked in the industry 12 months ago and has changed jobs within 12 months. The job change could either be in the same industry or moving to a different industry.

Higher wages are normally associated with lower labour turnover[40], which lead us to expect that labour turnover to be low in the mining industry as it has the highest weekly earnings. 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. However, as outlined in an analysis of mining labour markets by Griffith University[41], relatively low/high labour turnover could be symptomatic of satisfaction/dissatisfaction with working conditions.

An analysis of labour data from the ABS shows that there is substantially high labour turnover in mining. Chart 3.6 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[42] estimate and the 5-year average turnover rate[43] 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.

The high turnover rates within a short period is likely to reflect some of the challenges of working in the mine.

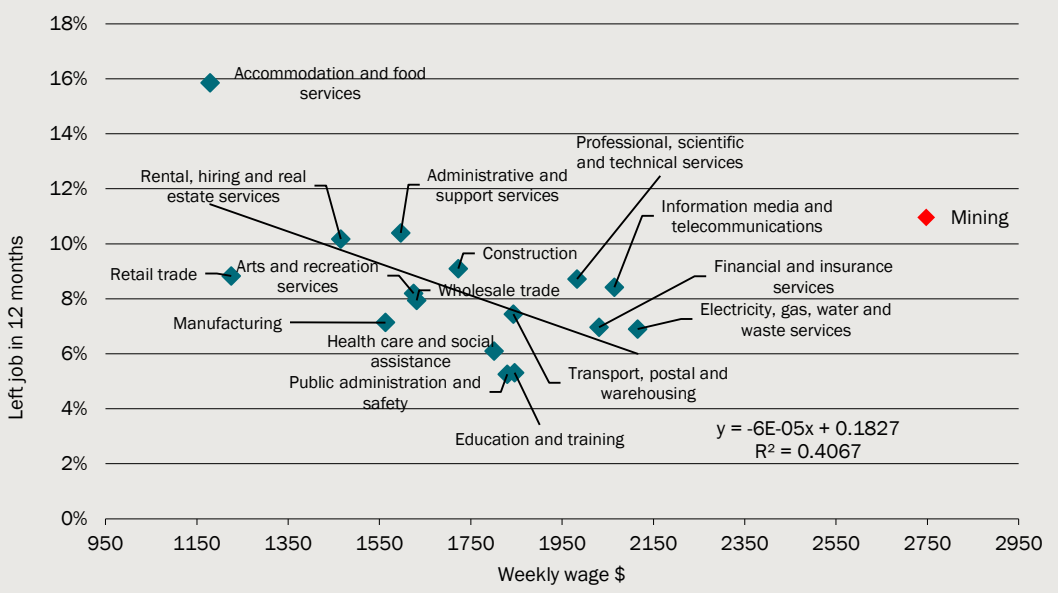
40 Freeman, R. and Medoff, J. (1984), What Do Unions Do?, and Ehrenberg, R. and Smith, R. (1988), Modern Labor Economics: Theory and Public Policy

41 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

42 ABS 2019, 6302.0 Average Weekly Earnings, Australia

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

3.6 Labour turnover and weekly earnings by industry



Data source: ABS.

Conclusion

The data above suggests that the higher mining wage, in part, reflects compensation for disutility of working in the mining sector compared to other jobs.

- **Given this, we support the view in the Guidelines that, for currently employed workers, using the average *mining* wage (not the average wage across all workers) is the appropriate reservation wage to apply.**

Cost to employer of occupational upgrading

GE draws on a study by Bartik (2012). Bartik, however, recognises that there is a potential cost to employers that needs to be incorporated and states

> An efficiency analysis must also consider whether occupational upgrading is offset by losses to employers…… But if unemployment is low, an increase in labor demand will lead to workers being promoted further beyond their previous job experience or job qualifications.[44]

For example, if the Project leads to a farm worker moving to the new mine there would be a cost to the farmer who has to reemploy a new person. Types of costs could include recruitment costs, costs if the vacancy remains unfilled for a period, retraining costs (if new worker has less experience) or loss in productivity (if the new worker takes time to adjust). These costs are not incorporated in GE's analysis.

- **Costs to employers of recruiting/retraining workers needs to be considered any analysis of the impacts of job shifting.**

44 Bartik (2012), p.15.

Alternative estimate

As noted above, the Guidelines recognise that a new mine would increase the demand for labour to work at the mine. Miners may be required to pay higher wages to attract workers to the mine. The Proponent has indicated that it proposes to pay the average mining wage. However, other mines (e.g. the Glendell extension currently being considered by NSW DPIE) have indicated wages that are substantially above other nearby mines.

In a 2016 study for NSW DPIE on the potential wage premium to mining workers, the CIE found that:

- an increase in mining employment increases the mining wage, showing that there are worker benefits.
- the impact of mining employment on the mining wage differs across remoteness areas.
- the positive effect of a change in mining employment on mining income declines as the initial share of mining employment increases.
- the positive effect of a change in mining employment on mining income declines as the initial unemployment rate increases.[45]

'Default values' for benefits to mining workers are determined in terms of a proportional change in the mining wage in response to a 100 per cent change in mining employment (table 3.7). For example, a 100 per cent increase in mining employment in Inner Regional Australia will increase the mining wage by 10.7 per cent.

3.7 Mining income/Mining employment elasticity by remoteness area

Remoteness area	Elasticity
	per cent
Major cities of Australia[a]	0
Inner regional Australia	10.7
Outer regional Australia	5.8
Remote Australia	4.3
Very remote Australia[a]	0

[a] The estimated elasticities for Major Cities of Australia and Very Remote Australia were -1.7 and -6.7 respectively. However, we have assumed the elasticity to be 0 in these two remoteness areas due to limited constraints on labour supply for new mines due to minimal mining activity in Major Cities of Australia and the fly-in fly-out labour market servicing Very Remote Australia.

Note: The wage premium due to changes in mining employment may be underestimated as the modelling is based on ABS income data which specifies the highest income bracket of "$2500 plus". Conversely the estimate is slightly biased upwards because the ABS income estimate includes all income sources, not just income from direct employment.

Source: The CIE based on ABS data.

Using this information the benefits associated with the wage premium can be approximated as follows:

45 CIE (2016), *Economic benefits of mining projects for NSW: Estimating default values for indirect economic benefits*, January.

- The mine is located near Mudgee which we consider to be in Inner Regional Australia. The mining income/mining employment elasticity estimated for Inner Regional Australia is 10.7 per cent for a 100 per cent increase in mining employment.
- Based on ABS Labour Force data, there are around 6,000 persons employed in the mining sector in the Central West SA4 region.[46] Assuming, on average, 210 persons are employed over the life of the Project which is equivalent to a 3.5 per cent increase in employment in the Central West SA4.
- Based on GE, we assume a pre-tax mining wage of $120,000 per annum, the 3.5 per cent increase in employment as a result of the Project would increase the average mining wage to around $120,664 per annum assuming a 10.7 per cent income/employment elasticity. That is, the wage premium per worker for the Project is $664.
- The total economic benefit to workers of the Project:
  - the economic benefit to mining workers is around $62,710 per annum for the 45% of new workers that are drawn from the mining industry and $72,465 per annum for the 52% of new workers that are drawn from other sectors. In present value terms these benefits equate to around $1.2m.
  - the economic benefit to the 3% of the new workforce that are currently unemployed is estimated to be around $111,000 per annum, or $1.0m in present value terms.

- **The estimated benefits to workers is around $2.2m in present value terms based on available information. Once available data from the 2021 Census becomes available, this would also provide additional information to revise the calculations. Further information would also be useful to understand the expected future use of contractors in the workforce. These factors are expected to place downward pressure on wages.**

46 ABS 6291.0.55.001 - RQ1 - Employed persons by Industry division of main job (ANZSIC), Labour market region (ASGS) and Sex, Annual averages of the preceding four quarters, Year to August 1999 onwards, released 23 September 2021

4 Non-market benefits of employment

This particular item relates to the impacts on the unemployed individuals themselves. GE's rationale for inclusion of this item is that there are social benefits from reducing unemployment because, for example, "….if the workers being unemployed and increased crime and community dislocation". As a result, the community would be willing to make payments for each person that the Project draws from the currently unemployed labour force. This payment would be in addition to households' annual income tax and other payments such as donations to charities to support households in need.

Inconsistency with the Guidelines

GE had previously presented a submission to the draft Guidelines which, amongst other things, arguing for inclusion of this benefit category in the Guidelines. In his submission, GE stated that

> Existence values for employment provided by mining projects are valid economic values for inclusion in CBA. Notwithstanding this, it is recognised that because this is a new frontier of economic research, some people may view these values as contentious. Consequently, the draft guidelines should at the very least acknowledge this new frontier of economic research and allow the results of the CBA for mining projects to be reported "with" and "without" the non-use values for employment being included.[47]

- **When developing the Guidelines, the NSW Government did not support the inclusion of this item in the Guidelines (as requested by GE). The inclusion of this item is, therefore, inconsistent with the Guidelines.**

The Proponent's reviewers (EY) also note the contentious nature of this benefit category and have not included this item in their recent economic analysis for the Glendell mine.[48]

Notwithstanding this, further comment is provided in response to additional information presented in GE's 9 March 2021 review.

GE's estimates

As noted earlier, GE assumes that 10 per cent of the new workforce for the Project will be drawn from the currently unemployed pool of workers. GE then utilises a 2009

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47 Gillespie Economics (2015), Submission to draft Guidelines, 24 November, p.10.

48 See, for example, EY (2019) *Economic impact assessment of the Glendell Continued Operations Project*, 29 October.

'choice modelling' study which estimates an average non-market value of approximately $25 000 per employee per year.[49] That is, the community would be willing to make a payment of $25,000 per person that is drawn to the mining project from the unemployed labour force. There are a number of limitations of this study, as noted below.

Importance of outcomes focused analysis

There are typically a number of steps needed for an evaluation of any social policy investments:

1 Understand what are relevant outcomes that are important to the community (e.g reduction in violent crime, reduction in drug abuse).

2 Understand the value that the community places in changing these specific outcomes.

3 Understand what are the factors that impact on these outcomes and how the investments would change these outcomes (taking account of the range of factors).

For a 'willingness to pay' survey to inform the economic analysis of the Project, it needs to gain a robust understanding of specific outcomes that the community values. For example, the survey could seek a detailed understanding of how the community values the reduction in anti-social behaviour (distinguishing between, say, shoplifting, property damage, home invasion, violent crime) - presumably the community would place greater value in reducing violent crime and home invasion compared to ad-hoc theft at local shops.

The next step would be to be understand how the increased employment opportunity at the Project would change each of the specific outcomes that are valued by the community. There are a myriad of possibilities. For example:

- One possibility is that the anti-social behaviour is commonly perpetrated by persons who are not in the labour force. If this is the case then increasing employment opportunities at the Project would have no impacts on these outcomes that the community values.
- Another possibility is that the anti-social behaviour is perpetrated by, say, unemployed youth. Under this scenario the Project would again have no bearing on reducing anti-social behaviour unless the mine employs young persons with limited training.[50]

GE's 2009 choice modelling study relies on respondent 'perceptions' of the outcomes from employment. So one respondent, for example, may perceive that increasing employment opportunities would reduce violent crimes and, as a result, place a high value on new employment opportunities at the Project. Another respondent may perceive that increasing employment opportunities may reduce drug abuse among youth in the community and, therefore, places a high value on employment. None of these perceptions necessarily needs to be factual.

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49 Gillespie Economics, 2009, *Bulli Seam Operations: Choice Modelling Study of Environmental and Social Impacts*, Prepared for Illawarra Coal Holdings Pty Ltd.

50 Having experience (in the mining or other sectors) appears to be an important criteria for employment in the mining sector, based on a review of jobs on Seek.com.au.

Increased mining employment may not achieve any of these outcomes. For example:

- violent crime may be unrelated to employment levels and, instead, be associated with criminal activity
- mines may require workers with some level of experience and, therefore, not impact on youth unemployment.

In responding to the CIE's February 2021 review, GE notes that,

> The CIE in its dismissal of the nonmarket value for employment, focusses on the fact that the study from which the value used in the Economic Assessment is drawn, acknowledges that the actual reasons why people may hold a WTP for other people's employment is unknown. The CIE suggests, without evidence, that people's perceptions of outcomes from jobs may be inaccurate. However, this is the case with ALL nonmarket valuation. These studies do not attempt to discern people's motivations for valuing a specific outcome and indeed these motivations are likely to be highly heterogenous. If the lack of information on people's motivations invalidates WTP for the employment of others, it invalidates all WTP studies, including those for the environment.[51]

Our view is that a robust survey would need to value the wide range of final outcomes of importance to the community. A detailed study would also need to be undertaken to understand how increased mining employment associated with the Project would impact on each of the outcomes.

Limitations of the choice experiment

In regards to GE's choice experiment, we have previously noted our concern that the jobs attribute is *causally prior*. GE's approach to the burden of proof in relation to this issue is inconsistent between his own 2009 study and the CIE Vaucluse Diamond Bay outfalls survey. GE assumes the outfalls attribute is causally prior unless proven otherwise, whereas, he assumes the jobs attribute is not causally prior unless proven otherwise. GE has effectively already conceded that the jobs attribute is causally prior by including statements in the questionnaire about the re-employment prospects of those losing jobs at the mine (see p. 117 of the pdf document). It implies the outcome people care about is not actually the jobs, but the re-employment or otherwise of workers losing jobs (and, as discussed, probably some outcomes resulting from that, such as a reduction in crime). This re-employment outcome is left unspecified and no questions were included to measure respondent perceptions of how many workers would find re-employment.[52]

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51 Gillespie Economics (2021), Response to CIE's peer review, March, p.12.

52 It does appear that the focus groups asked participants on whether jobs were an important part of the decision, but there is no evidence of participants being asked "why" they thought jobs were important.

5 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. This chapter discusses the potential gains to suppliers from the Project.

The Guidelines

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.

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.

Chart 5.1 conceptualises the potential supplier benefits. 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 5.1). 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).[53]

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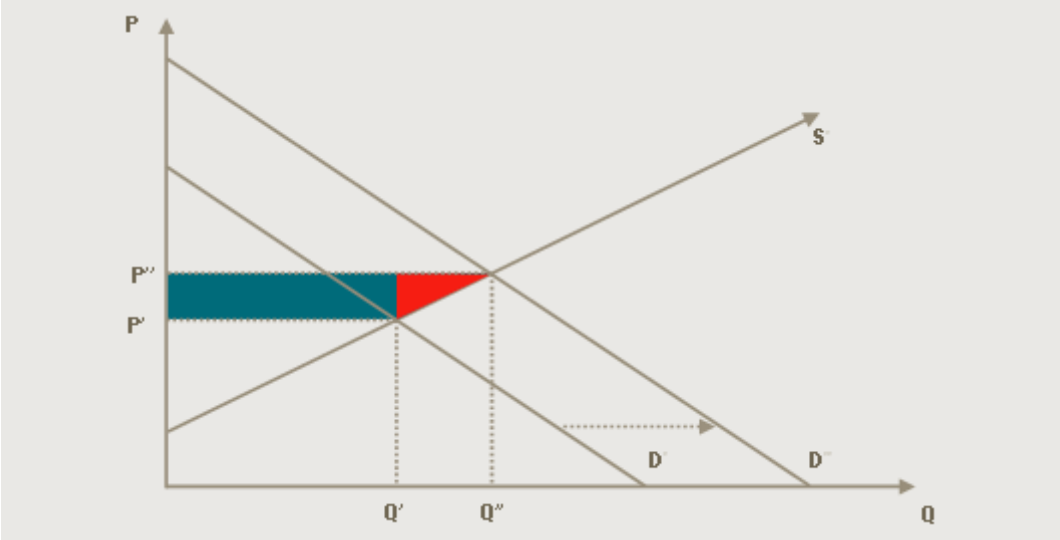
53 This assumes other mines in the region are locally owned and hence the additional producer surplus to industries supplying the broader mining industry (excluding the new mine) is not relevant as this represents a transfer from seller to buyer. This assumption means the estimate of economic benefit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

It is important to recognise that any increase in prices charged by suppliers would also result in higher costs for the Project which would reduce company tax payments and net producer surplus.

5.1 Estimating change in producer surplus to local suppliers



Data source: The CIE.

GE's estimate

GE has previously argued against the inclusion of this item in the CBA Guidelines stating,

> The draft guideline identifies that there may be economic benefits to local suppliers from higher surpluses from supplying the mining/coal seam gas project, and that these should be included in the CBA.
>
> However, these types of potential benefits meet the normal definition of "secondary" benefits. Most CBA guidelines (including the draft guideline) recommend against the inclusion of secondary benefits - see Sinden and Thampapillai (1995), Boardman et al. (2001) etc. This is because in a competitive market, all resources are assumed to be fully employed, and so increases in the production of goods and services required as inputs to the mining project will withdraw labour and raw materials from other industries. The additional net benefits (surpluses) to suppliers to a project will be offset by decreases in net benefits in other industries and so there is no net secondary benefit to the economy as a whole - normally assumed to be the nation.
>
> However, complications arise when CBA is undertaken at a sub-national level because secondary net benefits that accrue to firms within the NSW may be offset by a reduction in economic activity outside of NSW and hence additional secondary surpluses may accrue NSW. In these instances there is an argument for inclusion of some secondary benefits. However, the estimation of these would be complicated and highly contentious.

> Gillespie Economics considers that secondary benefits to suppliers should be removed from the guidelines as a relevant consideration for CBA undertaken at the National and State level.[54]

For the Project, GE states that

> The focus of CBA is generally on primary costs and benefits i.e. first round impacts. Secondary net benefits that accrue to firms that sell to or buy from a project are ignored. Conservatively, this convention is adopted and hence no secondary benefits to the economic are included.[55]

Therefore, for the Project, GE assumes that there are no supplier benefits.

CIE estimate

NSW DPIE has requested the CIE to provide guidance on the potential quantum of supplier benefit.

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 'other metal ore' mining production of $100 million in NSW by a new mine (not mine specific) results in expenditure of $46.82 million on intermediate inputs:

- $26.94 million sourced from NSW local suppliers
- $14.7 million sourced from interstate
- $5.16 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 5.1) 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 using the CIE-REGIONS model implies the following percentages:

- 59% for the trapezoid area, i.e. for every $100 million local inputs into the new mine, the total producer surplus is about $59 million.
- 0.018% for the red triangle area, i.e. for every $100 million local inputs into the new mine, the surplus benefit is about $18,360. That is, if a new mine spends $100 million on intermediate inputs, this implies the economic benefit to NSW suppliers supplying to the new mine is about $18,360.

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54 Gillespie Economics (2015), Submission to draft Guidelines, 24 November, p.6.

55 Gillespie Economics (2020), Economic Assessment, State Significant Development No. 5765, May, p.15-61.

Based on the expenditure of $51m per annum on intermediate inputs for the Project[56], the total producer surplus (the teal and red trapezoid area in chart 5.1) is about $30.1 million, and the producer surplus from the new mine (the red triangle area) is about only $9,180 per annum. So the economic benefit to NSW suppliers supplying to the new mine is about $92,000 (in present value terms over the 18 year life of the Project associated with the construction, mining and processing stages).

This small estimate of supplier benefits is consistent with other projects, such as the Rocky Hill and United Wambo coal mines (Deloitte Access Economics 2016) which indicate that the supplier benefits are immaterial.

- **CIE's estimates supplier benefits of around $92,000 (in present value terms) based on available data. In this context, GE's conservative assumption that there are no supplier benefits is reasonable.**

56 See Environmental Impact Statement, State Significant Development No. 5765, p.4-381.

6 Greenhouse gas emissions

The NSW Guidelines require the inclusion of the impact of greenhouse gas emissions in the economic evaluation of the Project. Further guidance was provided in the Technical Notes (April 2018).

The Technical Notes (April 2018) supporting the Guidelines are open to interpretation. NSW Government agencies are currently considering this issue. The discussion below summarises the issues.

NSW Guidelines

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.[57]

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.

Interpretation of the Guidelines

GE has estimated the impact of greenhouse gas emission applying three different shadow prices, consistent with the guidelines:

- Forecast European Union Emission Allowance Units price
- Australian Treasury Clean Energy Future Policy Scenario
- US EPA Social Cost of Carbon.

The shadow prices were based on 2019 carbon prices. Based on these prices, GE estimates the present value of the cost of greenhouse gas emissions (Scope 1 and 2) ranges between $9 million and $36 million. GE then apportioned to NSW by applying

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

Australia's share of the global population (around 0.31 per cent) and NSW's share of the Australian population (32 per cent), equivalent to:

- a damage cost of between $27 000 and $111 000 (present value) to Australia
- a damage cost of between $9 000 and $36 000 (present value) to NSW.[58]

GE's approach of only valuing 0.35 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".

Apportionment - NSW DPIE and IPC guidance

GE's use of the apportionment factor, based on his interpretation of the Guidelines, is a key issue of contention. The NSW Government is further considering this issue, however, a number of extracts of guidance has already been provided in past which (in our view) make it clear that the apportionment factor should not be applied.

In 24 November 2015, GE 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….:

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's response above 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 (paragraph 250, 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.[59]

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58 Gillespie Economics, 2020, *Bowdens Silver: Part 15 Economic Assessment.*

59 IPC (2021), Mangoola Coal Continued Operations Project (Mangoola Coal Continued Operations Project), Statement of Reason for Decision, 26 April

Apportionment - CIE interpretation

In our view, GE has misinterpreted the final Guidelines.

- These Guidelines provide a discussion of the 'scope' of the emissions and the alternative price assumptions. However, it provides no discussion of 'scaling down' the emissions from 100% to 0.35%. This is the single most important parameter in the calculation and, if the Government intended to apply a scaling factor, it would have presented a detailed discussion about the approach (similar to the discussion in the Guidelines on how to apportion income tax from Australia to NSW). The fact that there is no discussion about such a scaling factor, suggests that this was not the intention of the Guidelines.
- The draft Guidelines and associated spreadsheets present a very clear description of the calculations which require 100% of emissions to be included. If the NSW Government sought to diverge from the position clearly articulated in the draft Guidelines then it would have presented a clear reason for this particularly given that:
  - it is a highly contentious issue for the community
  - it would diverge from NSW Treasury Guidelines. *NSW Government Guide to Cost-Benefit Analysis (TPP17-03)* which discuss the approach to including externalities in the CBAs. Box 6.1 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.
  - it would be inconsistent with the majority of CBA's conducted for the NSW Government.

6.1 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.

- **In our view, the NSW Government Guidelines should be interpreted as requiring 100 per cent of the greenhouse gas emissions from the Project's to be included in the CBA (not 0.31% applied by GE). The NSW Government is considering this issue further and will provide clarification on the interpretation of the Guidelines.**

Carbon prices

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.

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.

Consistent with the guidelines GE presents the results using 3 alternative prices (Forecast European Union Emission Allowance Units price, Australian Treasury Clean Energy Future Policy Scenario, US EPA Social Cost of Carbon).

Based on these prices, GE estimates the present value of the cost of greenhouse gas emissions (Scope 1 and 2) ranges between $9 million and $36 million. These impacts can be replicated using the prices (starting in 2019) presented in the technical spreadsheets accompanying the draft Guidelines:

- Forecast EU Emission Allowance Units price – $10.07 to $19.88/tCO2e
- Treasury Clean Energy Future Policy Scenario – $ 33.56 to $102.13/tCO2e
- US EPA Social Cost of Carbon – $19.32 to $32.6/tCO2e.

However, 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 $10 million and $41 million.

While these price assumptions in the Guidelines provide a starting point there have been significant changes since the Guidelines. Some examples are provided below.

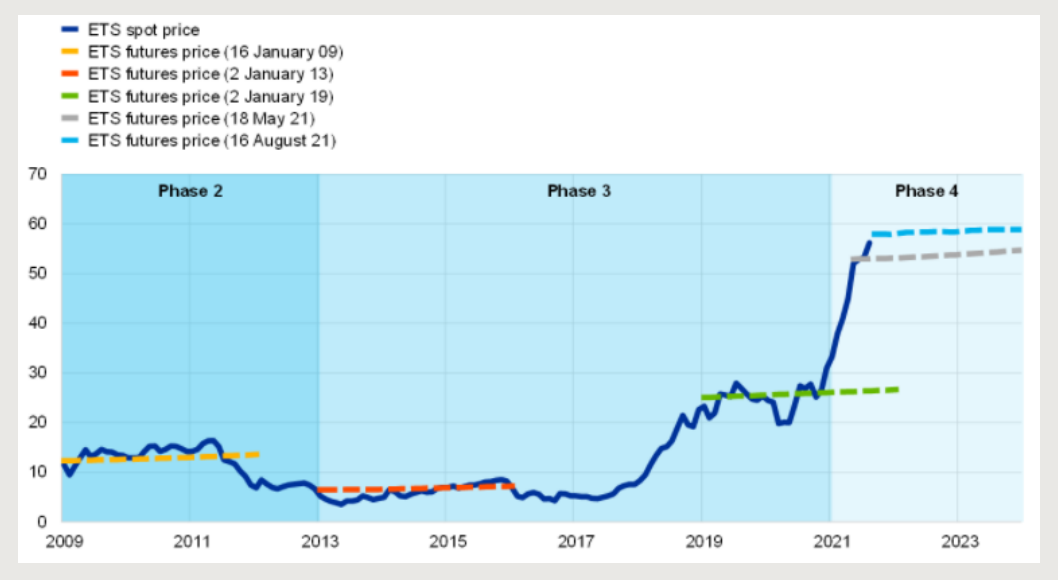
EU emission allowance units

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 6.2 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.[60]

6.2 EU emissions allowances — ETS spot and future spots



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

Drivers of the price in the medium term were the:

- Introduction of the Market Stability Reserve[61]
- 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[62] and the likelihood of an earlier end to the free

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

61 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

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

allocation of emissions allowances, as outlined in the *fit for 55* package.[63] 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.

Australian Transport Assessment and Planning Guidelines

The position on carbon pricing by the Australian Transport Assessment and Planning (ATAP) in its 2019 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 its guidance, ATAP use a central value of $60 per tonne CO2-e (in 2019 dollars), which is the average estimated price of carbon from the two most recent Australian studies by Austroads (2012[64] and 2014[65]). These values are derived from the guidance of the CE Delft Handbook on the external costs of transport[66]. CE Delft revised these estimates in the 2019 edition, which are shown in table 6.3.

6.3 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 2030 found in the literature. ATAP do not update their estimates using this value, but

63 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

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

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

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

rather aim to maintain consistency between Australian parameters and use the $60 estimate and scaling down CE Delfts estimates accordingly.[67]

Australian Government Long-Term Emissions Reduction Plan

On 26 October 2021 the Federal Government released *Australia's Long-Term Emissions Reduction Plan.*[68] 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 (but starting in 2021, instead of 2019) would result in a cost of greenhouse gas emissions (Scope 1 and 2) of between $10 million and $41 million. However, further consideration is required by the NSW Government to ensure that the Guidelines reflect updated information and there is consistency across all economic assessments in NSW.**

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

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

A Inter-industry wage differentials

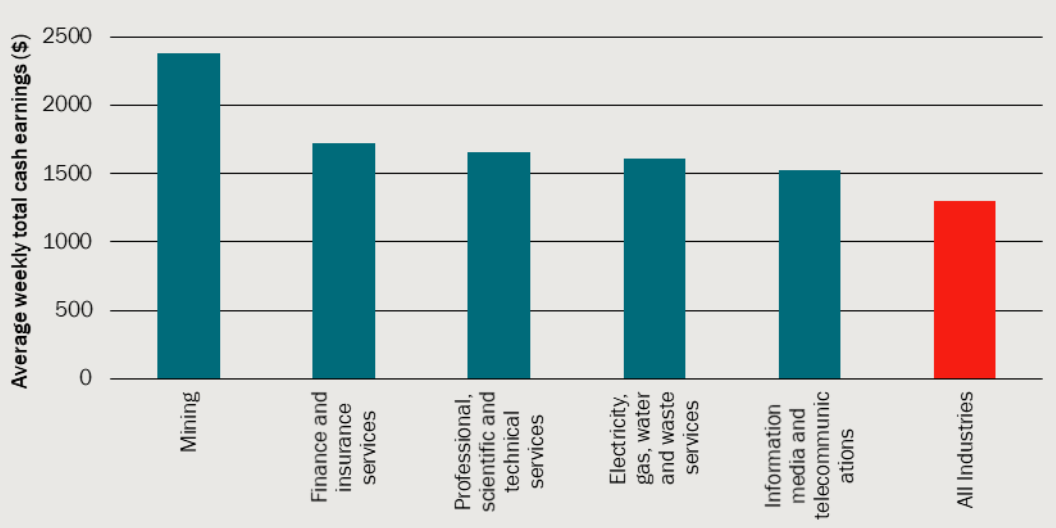
This appendix presents information to understand factors that explain observed inter-industry wage differentials.

Wages in the mining sector are higher than other sectors

The mining industry *currently* pays the highest average weekly earnings across Australia. Average employee earnings for all parts of the mining sector were $2,674 per week, (or $139,000 annually) based on the most up to date ABS industry wage data (November 2020). This is more than double the average weekly earnings across all industries, of $1,288 (or $67,000 annually).[69]

A comparison of normalised hours (i.e. a 40 hour work week) shows that average weekly earnings in the mining sector remain the highest of all industries, even after adjusting for hours worked (chart A.1). Based on a normalised 40 hour working week, the weekly wage in mining industry is approximately $2,380 – almost 85 per cent greater than the average weekly wage across all industries (approximately $1,300).

A.1 Top five industries by average weekly total cash earnings



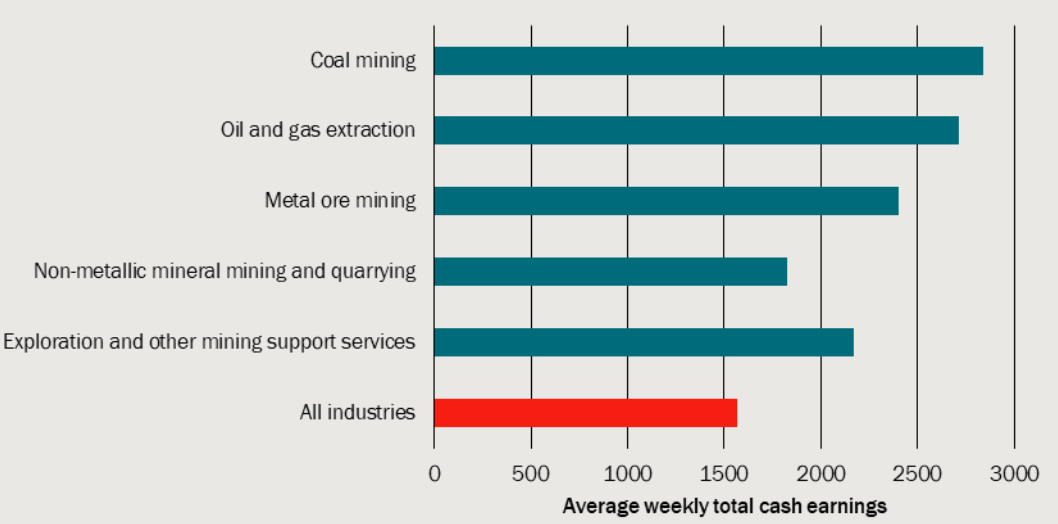
Note: Average weekly total cash earnings have been standardised across industries to a 40 hour week. Wages are reported in gross amounts (i.e. before income tax, superannuation or salary sacrifice amounts).

Data source: ABS, 2017, *Employee earnings and hours, Australia, May 2016,* Cat. No. 63060DO003_201605.

69 ABS, 2017, *Employee earnings and hours, Australia, May 2016,* Cat. No. 63060DO003_201605.

The average weekly total cash earnings ranges across the different segments of the mining industry from an average of $1,830 for employees in the non-metallic mineral mining and quarrying sector to $2,840 in the coal mining sector (chart A.2).

A.2 Average total weekly cash earnings across types of mining (Australia)

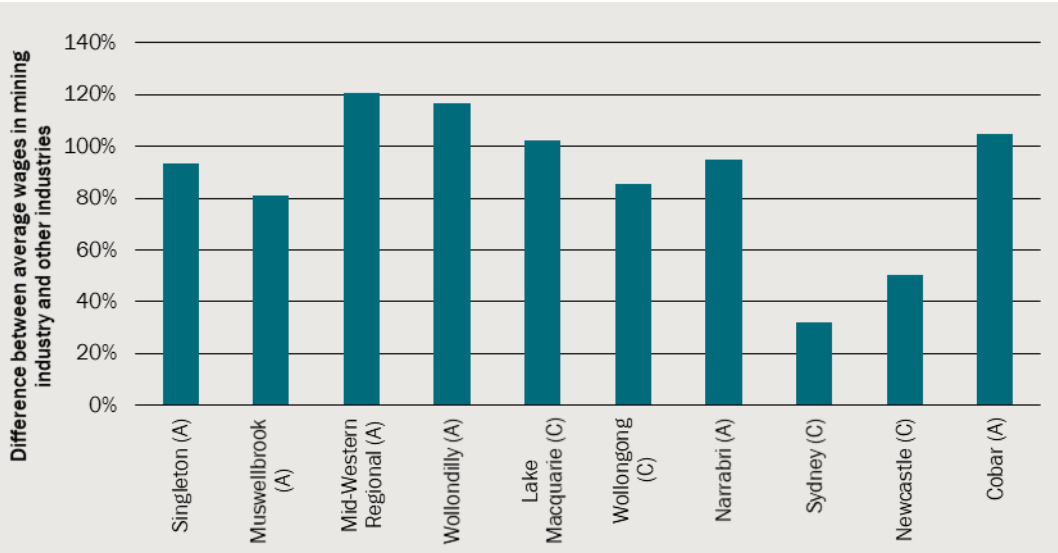


Note: 'Average weekly ordinary time hours paid for' differs across mining occupations. Wages are reported in gross amounts (i.e. before income tax, superannuation or salary sacrifice amounts).

Data source: ABS, 2017, *Employee earnings and hours, Australia, May 2016,* Cat. No. 63060D0003_201605.

This pattern of comparatively higher mining wages is consistent across NSW. In NSW, almost 30 per cent of all mining employment is concentrated in Singleton and Muswellbrook. Average mining wages in these LGAs is almost double the non-mining industry wages. In the Mid-Western Region, Wollondilly, Lake Macquarie and Cobar regions, mining wages were more than double non-mining wages (chart A.3).

A.3 Difference between wages in mining and other industries across top 10 mining local government areas, 2016



Data source: The CIE based on various ABS data sources.

Factors can explain inter-industry wage differentials

There are a number of factors that can explain the inter-industry wage differentials:[70]

- High wages are simply compensating for unmeasured undesirable aspect of the working conditions. These are usually called *disutilities* of labour and both require higher compensation of workers and impose labour supply constraints as a share of the total work force might not be willing to meet those requirements or accept the disutility:
  - Remoteness of the workplace, commute distance and time to work
  - Long working hours due to shifts
  - Working conditions.
- High wage industries hire and/or require 'better' workers (worker quality) which, in turn, imposes labour supply constraints as a specific skillset is needed:
  - Educational differences
  - Skill differences, which is a function of education, occupation and experience.

Further explanations also include correlations of capital intensity and higher wages as well as the degree of unionisations. Both explanations must be carefully interpreted as correlation does not infer causality. For example, are high wages induced due to the technology of highly capital-intensive firms or do firms that must pay high wages substitute capital for labour?[71] Similarly, do unions raise wages or are unions attracted to high wage industries?[72]

The following attempts to identify whether the first two explanations can explain the inter-industry wage-differentials, as those differentials can be more easily understood and analysed. Any wage differential that can be explained by those two explanations is *not* appropriate to include as wage premiums.

Remoteness and distance to work

Table A.4 provides additional information on the place of residence of coal mining workers in three specific mining LGAs (Singleton, Muswellbrook and Mid-Coast), drawn from the ABS Census 2016.[73] It highlights that coal mining workers travel large distances to work in these three coal mining regions. For example, there are 622 coal mining workers living in Lake Macquarie that work in Singleton, Muswellbrook and the Mid-Coast LGAs. Similarly, there are 1,214 coal mining workers that live in the Cessnock LGA but work in Singleton.

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70 Thaler, Richard H. "Anomalies: Interindustry wage differentials." *Journal of Economic Perspectives* 3.2 (1989): 181-193.

71 Ibid. p. 186

72 Ibid. p. 186

73 Gloucester is located in the Mid-Coast LGA.

A.4 Place of residence of coal mining workers in three mining regions

Place of residence	Singleton (A)	Muswellbrook (A)	Mid-Coast (A)	Total
	no.	no.	no.	no.
Singleton (A)	1 642	545	5	2 192
Maitland (C)	1 324	188	3	1 515
Cessnock (C)	1 214	187	4	1 405
Muswellbrook (A)	285	1 012	-	1 297
Upper Hunter Shire (A)	92	530	-	622
Lake Macquarie (C)	433	55	6	494
Newcastle (C)	347	52	-	399
Port Stephens (A)	148	20	9	177
Mid-Coast (A)	38	13	85	136
Central Coast (C) (NSW)	72	22	-	94
Other	151	31	10	192
Total	**5 746**	**2 655**	**122**	**8 558**

Data source: ABS 2016 Census - Counting Employed Persons, Place of Work (POW).

The possible explanations for high levels of non-local resident employment are 1) a lack of available labour (i.e. the unemployment rate is low), or 2) absence of appropriately qualified labour, or 3) a mis-match between the available job and the availability of the potential employee (e.g. someone may want to work part time, but the position may only be offered on a full-time basis; or disutility from the job).

Half of the top ten mining regions in NSW have an unemployment rate higher than the state average and of these, the majority source more than 20 per cent of their labour force from outside the LGA. From this it can be concluded that there is a mismatch between the labour available in these locations and the demand for labour (i.e. the existing available labour force in the LGA may not have the skills required to meet the increased demand for labour in that region).

This can be further underpinned by analysing travel distance to work across industries and occupations. According to the ABS Census 2016, the median distance to work is significantly higher for mining employees compared to all industries. Furthermore, over 14 per cent of all mining employees commute over 100km to work, while this ranges between 5 to 24 per cent (table A.5).

A.5 Distance to work

	Median distance to work, All NSW	Median distance to work, Mining	Share of employees travelling over 100km, NSW	Share of employees travelling over 100km, Mining
	km	km	per cent	per cent
Managers	11	23	2	10
Professionals	11	25	2	13

	Median distance to work, All NSW	Median distance to work, Mining	Share of employees travelling over 100km, NSW	Share of employees travelling over 100km, Mining
Technicians and Trades Workers	12	39	3	16
Community and Personal Service Workers	9	35	2	24
Clerical and Administrative Workers	11	18	1	5
Sales Workers	8	15	1	0
Machinery Operators and Drivers	14	40	3	14
Labourers	9	33	2	22
Total			**2**	**14**

Source: ABS, CIE.

We have not attempted to quantify the required compensation for the increase in commuting distance. Commuting to and/or living in another region for work leads to compressed work periods and alternating patters of residence. Both can result in conflicts with family arrangements and impact mental and physiological health which is reflected by higher wages.[74]

Based on a review of mining jobs advertised on Seek, the coal mining sector is increasingly requiring workers to live within 60km of the mines. Assuming $1.50/litre of petrol and assuming fuel use of 7 litres per 100km, a 60km round trip is around $63/week or $3,000/year. There is also vehicle 'wear and tear' costs. The mining wage would need to compensate workers for these additional costs.

Labour supply constraints from long working hours

Labour market theory

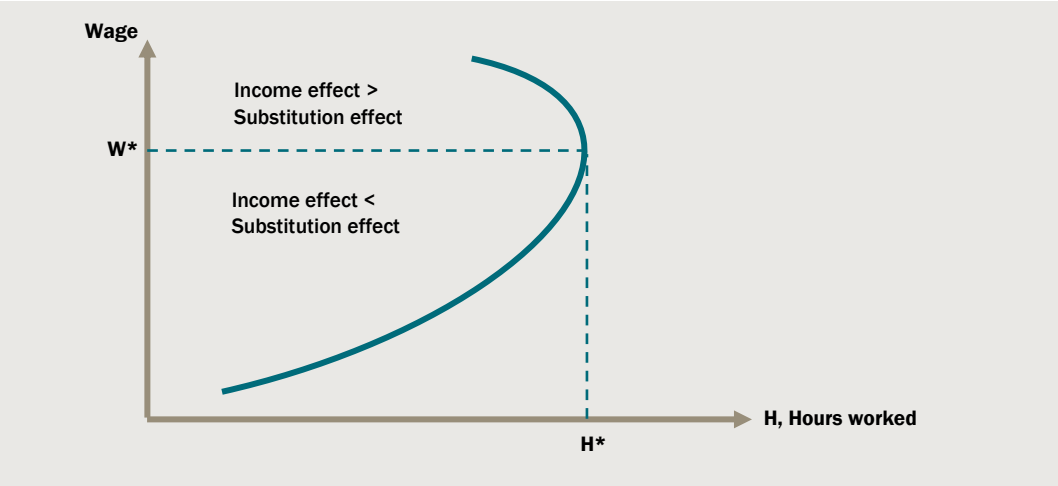
In the previous analysis we have adjusted the median income to a 40-hours week. Doing so we have applied a linear hours-worked-wage relationship, i.e. if the median hours worked for an occupation-skill combination is 38 hours we have adjusted the median income by the same percentage increase.[75] This relationship can be described as a constant labour elasticity, i.e., an employee is willing to increase the number of hours worked and decrease the amount of leisure when compensated for this trade-off accordingly. This effect is called *substitution effect* and ensures that when higher wages are paid labour supply or hours worked will increase. However, an individual's utility function or preferences is usually driven by the consumption of goods and leisure. As individuals need income to consume, they are willing to substitute leisure for income.

74 Brook, Elizabeth Ruth. *Fly-in/fly-out working arrangements: Employee perceptions of work and personal impacts*. Diss. Murdoch University, 2020.

75 $\frac{40-38}{38} - 1 = 5.3\%$.

Every individual has a different utility function, but at some point individuals do not what to substitute leisure for more income as they reach their personal optimum of leisure and consumption. This effect is called *income effect*. With an increasing wage, individuals do not derive any more utility from the substitution and rather 'purchase' more leisure (chart A.6).

A.6 Backward sloping supply of labour



Data source: The CIE.

In the literature it is common to combine both the substitution and income effect to a total effect, which can be estimated using economic models. Those estimated parameter are called wage elasticity of labour supply and describe the change of hours worked or supply in labour for an increase in wage.[76] There exists a wide literature estimating wage elasticities. Results from the US, UK, Europe and Australia range between -1 to 0.82 depending on the type of model generation and on the type of data used (micro v macro studies).[77] There are also significant differences between men and women, while estimated elasticities for women tend to be considerably higher and also greater than 1.[78]

A meta-analysis of over 239 wage elasticities estimates found that the range for men lies between 0 to 0.4 and for women between 0.3 to 0.6 on average.[79]

This means, on average, men and women need to be over-proportionally compensated for an increase in hours worked.

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76 Dandie, Sandra, and Joseph Mercante. "Australian labour supply elasticities: Comparison and critical review." *Treasury Working Papers* 2007-04 (2007).

77 Dandie, Sandra, and Joseph Mercante. "Australian labour supply elasticities: Comparison and critical review." *Treasury Working Papers* 2007-04 (2007), p. 19

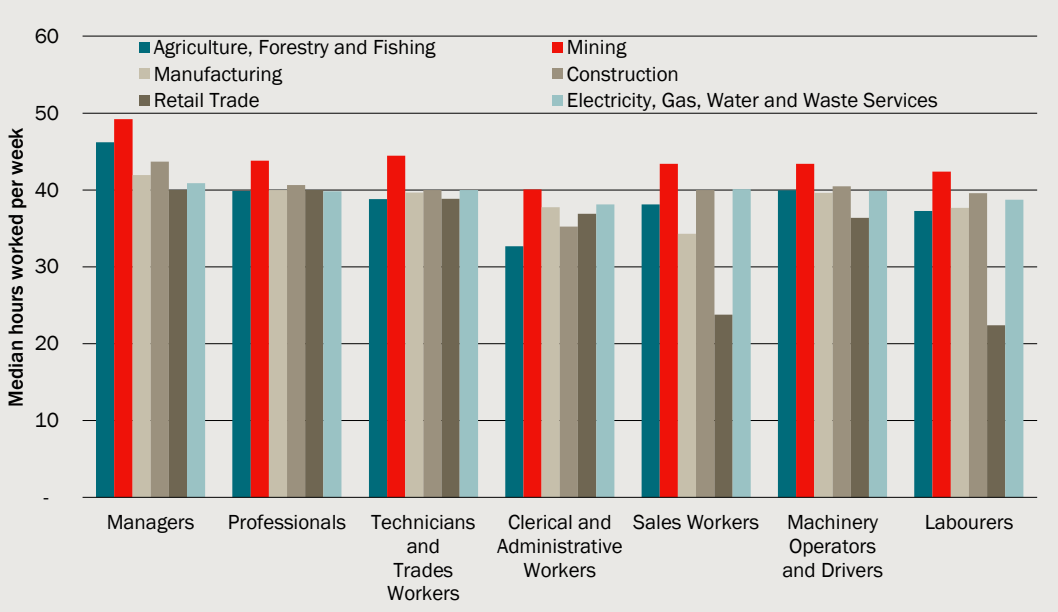
78 Ibid.

79 Evers, Michiel, Ruud A. De Mooij, and Daniel J. Van Vuuren. "What explains the variation in estimates of labour supply elasticities?." *Center for Economic Studies and Ifo Institute for Economic Research Working Paper Series* 1633 (2005).

Application to the mining sector

Examining the median hours worked per week by industry shows that employees in the mining sector work by far the longest hours per week, i.e., the median *reported* hours worked for every occupation within the mining sector lies between 42 to 49 hours (chart A.7).

A.7 Median hours worked by industry and occupation



Data source: ABS, CIE.

This number is line with a survey conducted by the Australian Research Council who found that the median mining employee worked 44 hours per week.[80] The survey also revealed that more than 61 per cent would like to work less than 41 hours and 50 per cent would like to work 40 hours per week. The high number of hours worked is mainly driven by shift work. There is consensus in the existing literature that there are negative externalities for both psychological and physiological health from working regularly long hours.

As pointed out in the above section individuals require over-proportional compensation to work more hours. Taking a conservative approach of assuming a wage elasticity of on average 0.5, employees require at least a 20 per cent higher wage to work 44 instead of 40 hours per week. This compensation increases even more when taking the midpoint elasticity of 0.3. Employees require then a wage increase of more than 33 per cent on average.

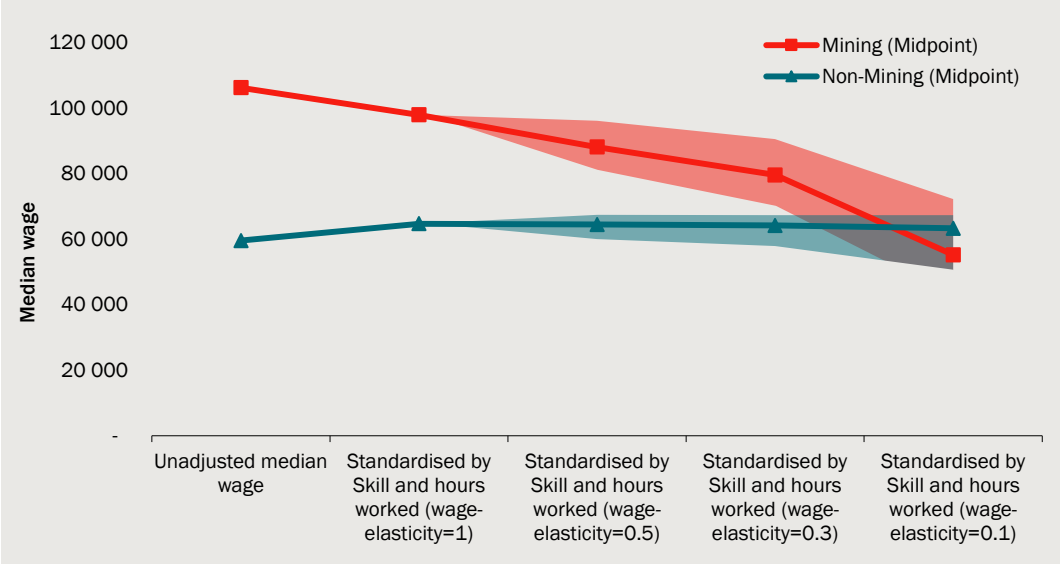
The following chart visualises this relationship. The methodology is similar as before:

- We apply the occupation-education pattern of the mining industry to the rest of NSW, and

80 Peetz, David, Georgina Murray, and Olav Muurlink. "Work and hours amongst mining and energy workers." *Centre for work, organisation and wellbeing, Griffith University* (2012).

- adjust for hours worked:
  - if median hours worked is *less* than 40 hours per week (sensitivity analysis for 38 and 42 hours) for any industry-occupation-education combination we adjust the median income proportionally (for example, the median technician with a postgraduate degree in the agricultural sector works 38 hours per week. Her median income will be adjusted to a 40-hour week by +5.3 per cent)
  - if the median hours worked is *greater* than 40 hours per week for any industry-occupation-education combination we assume that this must be compensated over-proportionally as the wage-elasticity of labour supply ranges between 0 to 0.6 on average. For example, assuming a wage elasticity of 0.5 for a median employee who works 42 hours we adjust the median income not by (40/42 -1 = - 4.8 per cent) but by -4.8 per cent /0.5 = -9.6 per cent to account for the higher required compensation.

A.8 Standardised minimum required wage for mining and non-mining sector, by skill and wage elasticity



Note: Confidence bands represent sensitivity estimates around the 40-hour assumption, i.e., disutility from working more hours take place if higher than 38 hours (upper bound) or 42 hours per week (lower bound). Skill is a combination of occupation and highest level of education.

Data source: The CIE.

The chart highlights that median wages have to be adjusted for hours worked and required skills to be comparable. The initial unadjusted wage difference between mining and non-mining median wages is approximately $47 000. Standardising mining and non-mining median wage to a standard 40-hour work week and controlling for the required occupational and educational skillset reduces the difference to ~$33 000. This is because of two main reasons:

- Median working hours in the non-mining industry are considerably *lower* than 40 hours and median working in the mining industry are considerably *higher* than 40 hours
- The required skillset to work in the mining industry is also better compensated in the non-mining industry

If we now assume in addition that working more than 40 hours requires an overproportioned compensation, i.e., a wage elasticity between 0 to 1, the differences between the mining and non-mining wages decrease further depending on the assumed wage elasticity.

In addition, as noted in the above section, many studies have also found negative wage elasticities. This implies that there is also a considerable share among the population who is not willing to work more even for a significantly higher wage.

In summary, due to the on average inelastic labour supply curve, i.e., a wage elasticity smaller than 1, there is a labour market supply constraint for jobs with long working hours. The Australia Coal and Energy Survey confirms this point as 65 per cent of mine and energy workers cite 'high rates of pay' as a reason for working shifts.[81]

Note that working long hours has a variety of implications and negative externalities on a person's life. We assume by applying the wage elasticity, which also includes an income effect, that those externalities recognised by an individual. Some of those accompanying externalities are summarised in the next section.

Disutilities of working in mining sector

There are a variety of other reasons why working in the mining sector requires an increased compensation. Many of those are correlated with the long working hours and remoteness and, therefore, we have not attempted to quantity them.

Some of those include:[82]

- Tenure and security:
  - While a large share (45 per cent) of mining workers have been in the industry over 20 years, labour turnover is amongst the highest of any industry despite the high level of wages
- Working time stability and rotation
  - Over 60 per cent of workers work more than two shift, and 10 per cent three shifts
  - Over 75 per cent have not free every second weekend, and over 10 per cent report no weekends entirely free.
- Shifts impacting sleep and alcohol use
  - Over 58 per cent have at least some degree of difficulties falling asleep between successive night shifts
  - 37 per cent of respondents admitted using alcohol to fall asleep
- Personal and family life balance
  - Working hours tend to not align with partners working hours

81 Peetz, David, Georgina Murray, and Olav Muurlink. "Work and hours amongst mining and energy workers." *Centre for work, organisation and wellbeing, Griffith University* (2012).

82 Ibid.

  - Mining employees are often to tired to help with household work and tend to have above average work-life interference and the mining industry was ranked second worst on an index measuring the degree of interference.
- Health
  - There are mental and physiological health externalities for both the mining employees and partners in particular due to the long working hours.
  - However, overall fatalities and injury rates are comparable with other industries or are even less.

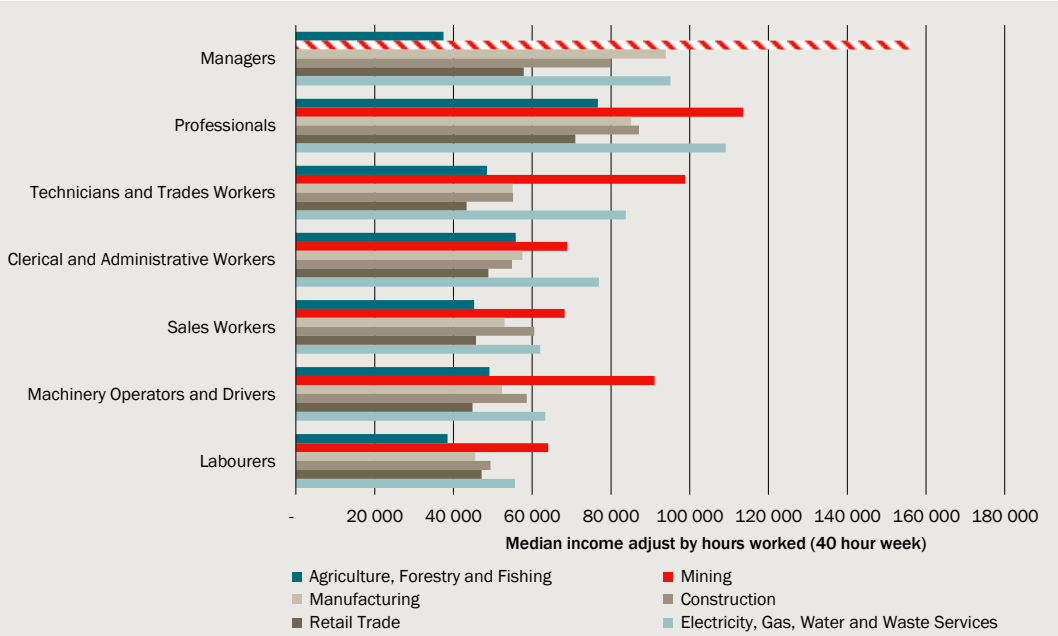
Education and skill differences

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. Chart A.9 presents the standardised median income by industry and occupation; please note that median income within each occupation very considerably by highest education attained and have, therefore, been weighted by the number of people accordingly:

- Industries have been selected based on a survey conducted by Gillespie Economics. Those industries represent the main source of employment for the mining industry.
- Median incomes by occupation in mining are considerable 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.9 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 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.10). 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.10).

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.10 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

Mining Occupation by Education	Mining	Selected Industries	All industries
	Median highest level of education	Median highest level of education	Median highest level of education
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.

Taking into account those educational differences and applying the educational pattern of the mining industry to the other industries reduces the wage differential even more (table A.11).

A.11 Median income of occupations adjusted to same level of education as mining

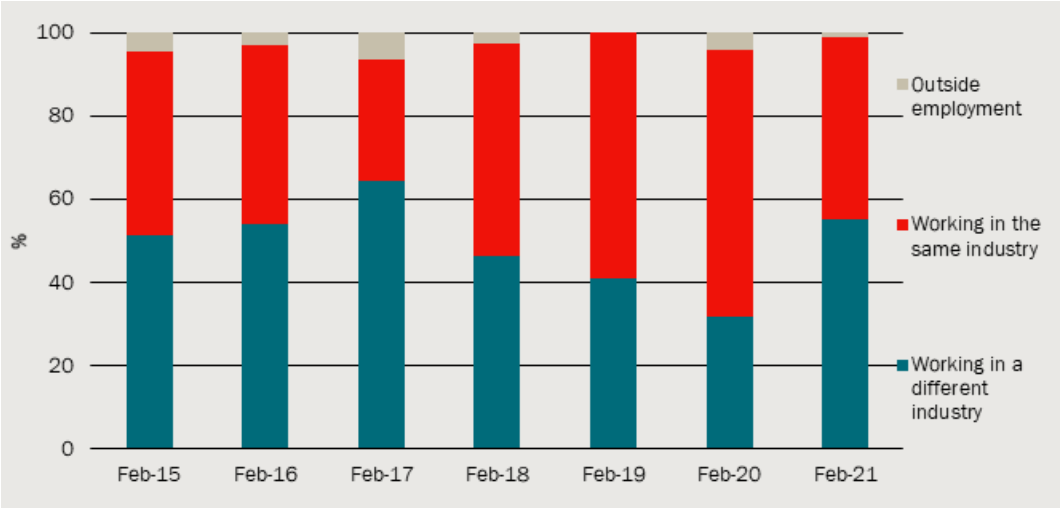
Occupation	Mining	Agriculture, Forestry and Fishing	Manufacturing	Construction	Retail Trade	Electricity, Gas, Water and Waste Services	NSW
	$/per year	$/per year	$/per year	$/per year	$/per year	$/per year	$/per year
Managers	More than 156 000	44 461	100 914	90 505	62 496	99 468	86 715
Professionals	113 560	79 211	86 521	88 824	71 847	108 812	84 225
Technicians and Trades Workers	98 870	50 681	58 707	59 271	45 933	83 389	62 346
Clerical and Administrative Workers	68 897	54 402	57 602	54 725	49 147	76 102	56 396
Sales Workers	68 250	40 842	44 337	55 471	45 126	54 080	48 691
Machinery Operators and Drivers	91 094	50 098	54 013	59 060	45 806	63 635	54 744
Labourers	64 106	38 442	46 889	50 070	46 223	55 949	49 105

Note: The occupation *Community and Personal Service Workers* was excluded due to low sample numbers.
Source: ABS Census, The CIE.

Labour inflow and movement within mining

By Feb 2021 current employed persons in mining amount to 224 445 in Australia, 12 per cent of which are employed less than 12 months. Among these workers who are relatively 'new' in their current jobs, 55 per cent worked in non-mining sector, 44 per cent moved within the mining sector, and 1 per cent was drawn from unemployment pool. Shares of labour inflow from a different sector and labour movement within the mining sector vary over time, while recruitment from unemployment pool remain relatively small (chart A.12).

A.12 Previous employment of current mining workers (less than 12 months in their main jobs)



Data source: ABS Job Mobility, Table 19.

While the share of employees coming from the unemployment pool varies over time, the share averages around 3 per cent in the last seven years and nowhere near the assumed 10 per cent by Gillespie Economics. The share of employees coming from the mining industry lies around 47 per cent, while around 50 per cent of employees come from another industry.

This figure aligns broadly with a survey conducted by Gillespie Economics for the Cadia Mine (38 per cent from mining. ~17 per cent from the agricultural sector, ~10 per cent from manufacturing, ~9 per cent from construction, ~8 per cent from retail trade and the remainder from other industries).

Mid-Western Regional LGA and Unemployment pool

Gillespie Economics assumes that 10 per cent of the workforce for the mine could be directly drawn from the unemployment pool. In addition, some employment will come from the local workforce.

The underlying assumption is that the regional and unemployment pool actually consists of the required skills. Unfortunately, the ABS Census data does not publish the occupation before an employee shifts from the employed to the unemployed labour force. Therefore, we have only considered the highest level of education as a proxy and only considered the part of the labour force looking for full-time employment.

In general, the regional workforce and unemployment pool offer a similar share of people with a highest level of education above the diploma level. However, there are significant differences in particular across the Secondary Education - Years 10 and above and Certificate III & IV Level.

This means there is a considerable overlap of matching education levels for occupations such as managers and professionals, which often require at least a diploma.

But, 44 to 92 per cent of mining employees working in occupations like Technicians and Trades Workers, Machinery Operators and Drivers, and Labourers have at least a Certificate III & IV or higher level as highest level of education. Those levels are relatively underrepresented in both the regional workforce and the unemployment pool.

A.13 Highest level of education by mining sector and unemployment pool

Education	Mining	Unemployment pool	Mid-Western Regional LGA
	per cent	per cent	per cent
Secondary Education - Years 9 and below	3	7	14
Certificate I & II Level	0	0	0
Secondary Education - Years 10 and above	25	41	36
Certificate III & IV Level	48	18	25
Advanced Diploma and Diploma Level	8	9	8
Bachelor Degree Level	11	16	10
Graduate Diploma and Graduate Certificate Level	1	1	1
Postgraduate Degree Level	4	8	2

Source: ABS Census 2016.

B Wage premium estimate

Workers in the mining project who would otherwise by unemployed, working part-time or working in other non-mining sectors may gain higher wages than they would without the project. This is a labour/wage premium and represents a gain to these workers.

The economic benefit to workers is the difference between the wage that he or she is paid in the mining project and the minimum (reservation)[83] wage at which they would be indifferent to working in the mining sector (chart B.1). The minimum wage reflects the employment opportunity costs, skill level required and the relative disutility of an employment position. However in practice, minimum (reservation) wages are not observable.

A cost benefit analysis 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 cost benefit analysis for NSW.

The proponent should estimate the proportion of NSW resident and non-NSW resident workers to be employed by the project for the purposes of attribution.

B.1 Identifying the economic benefit to workers

Data source: The CIE.

83 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.

Estimating wage premiums

The welfare measure (covering individual and Government welfare) that should be reflected in the wage premium is:

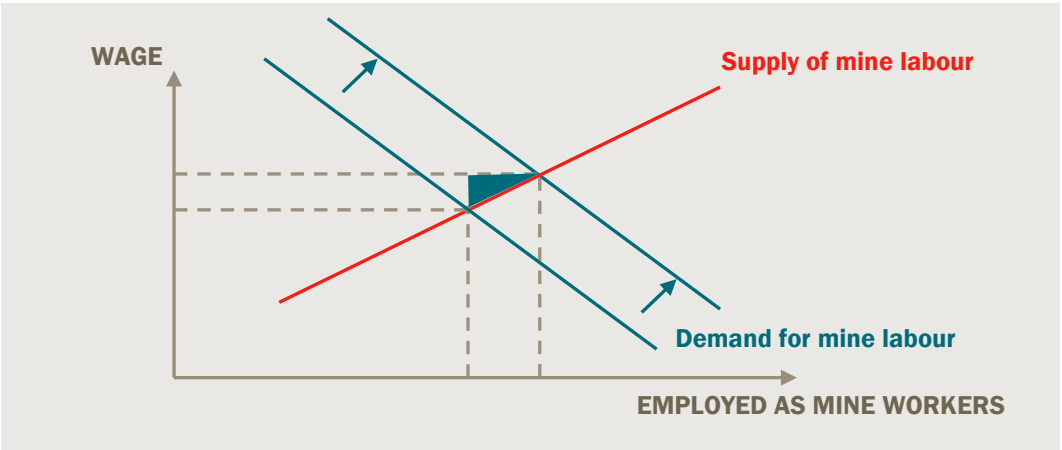
- where a mine worker is previously employed elsewhere — pre-tax wage in the mine less pre-tax wage employed in current occupation less any change in the disutility of work
- where a mine worker is otherwise unemployed — pre-tax wage in the mine less disutility of working in the mine

In practice, it is not possible to observe the disutility of work and changes in the disutility of work.

Hence we adopt an approach based on the labour market for mine workers which accounts for the disutility of work, as set out in chart B.2.

- The project leads to an increase in demand for mine labour
- This leads to an expansion of employment and an increase in wages
- The net welfare effect (in the blue triangle) can be approximated as the change in the wage of mine workers multiplied by the number of people employed at the new mine divided by two.

B.2 Measuring the wage premium



Data source: The CIE.

Note that the assumptions underpinning this approach are that:

- the labour market is in equilibrium in the baseline
- income (and payroll) taxes and welfare benefits are not factored in, but would lead to a gap between private supply (the private costs) and the social costs of labour supply – accounting for these impacts would tend to increase estimated benefits
- any increase in wages for other workers outside of the mine (such as in other mines or businesses) is a transfer from these other businesses.[84] No account is taken of this,

84 This assumes other mines in the region are locally owned and hence the increase in wages to workers in these other mines represents a transfer from employer to employee. This assumption

although in practice other businesses, particularly other mines, may not be NSW owned and hence pushing wages higher would result in a net NSW benefit.

These assumptions are likely to make the estimate conservative.

To measure the designated area we have used information from ABS Censuses about:

- how wages have changed for mine workers in towns where there have been major new mines;
- measure changes in employment levels and wage levels for mine workers in these towns; and
- understand how this differs across town sizes and initial socio-economic conditions

Econometric model

To estimate the economic premium to workers, the CIE developed an econometric model to identify the drivers of changes in mining wages. This model was used to:

- understand the relationship between mining employment growth and mining wages growth;
- analyse how growth in mining wages is influenced by the remoteness of the mining location (table B.3); and
- understand how other factors such as the unemployment rate and the share of mining employment influence the growth in mining wages.

B.3 ABS Remoteness Areas across NSW

Remoteness area	Remoteness code	Local government areas
Major cities of Australia	1	Newcastle, Wollongong, Strathfield
Inner regional Australia	2	Bathurst, Cessnock, Lithgow
Outer regional Australia	3	Gunnedah, Narrabri, Wellington
Remote Australia	4	Lachlan, Walgett
Very remote Australia	5	Bourke, Central Darling

Source: Australian Bureau of Statistics, *The Australian Statistical Geography Standard (ASGS) Remoteness Structure*, www.abs.gov.au/websitedbs/d3310114.nsf/home/remoteness+structure.

The model was populated with ABS employment by industry and income data for all local government areas across Australia for the three recent Census years of 2001, 2006 and 2011.

Chart B.4 shows the relationship between changes in mining income and mining employment. The main outlier in the data is the local government area of Bland between the ABS Census years of 2001 and 2006. The two variables have a high correlation of 32 per cent.

means the estimate of economic benefit to employees will be an underestimate if other mines in the region are foreign owned (foreign ownership is unknown) and continue to operate.

B.4 Relationship between changes in mining income and mining employment

Note: Excludes data points where reported observations of mining income in a given local government area was less than 10.

Data source: The CIE based on ABS data.

In the model, the dependent variable is the change in mining income between ABS census years 2001 to2006 and 2006 to 2011. The explanatory variables are:

- mining share of total employment interacted with the change in mining employment
- dummy variables for remoteness area
- change in mining employment in each of the five remoteness areas
- the unemployment rate in a LGA interacted with the change in mining employment.

The model is estimated using weighted regression, where weights reflect the average number of individuals (across the three census years) reporting that they were employed in the mining industry.

Key results

The key results from the econometric model are:

- Result 1: an increase in mining employment increases the mining wage, showing that there are worker benefits. The degree to which an increase in mining employment increases the mining wage is dependent on the remoteness area of the local government area where the new mine is located.
- Result 2: the positive effect of a change in mining employment on mining income declines as the initial share of mining employment increases. This means that areas that have a relatively larger mining sector are less influenced by additional mining employment.
- Result 3: the positive effect of a change in mining employment on mining income declines as the initial unemployment rate increases. For example, the impact of additional mining employment on mining income will be 2 per cent lower in an area with an initial unemployment rate of 6 per cent compared to an area with an initial unemployment rate of 5 per cent.

The full model results are presented in Appendix A, all explanatory variables are statistically significant.

Result 1: Positive relationship between mining employment and mining income and influence of remoteness area

There is a positive relationship between mining employment and mining income in three of the five remoteness area categories across NSW. That is when mining employment increases (e.g. due to establishment of a new mine), mining income also increases.

The mining income/mining employment elasticity varies by remoteness area. Mining income is most positively influenced by a change in mining employment in Inner Regional Australia where a 100 per cent increase in mining employment increases mining income by 10.7 per cent (table B.5). Large mining towns located in Inner Regional Australia include Singleton, Cessnock, Newcastle and Broken Hill.

Mining income is also positively influenced by a change in mining employment in Outer Regional Australia and Remote Australia.

For major cities and very remote areas the elasticities estimated are not well-estimated. This is not surprising as most LGAs in major cities have very little mining and results for changes are not meaningful. Similarly, there is little employment in very remote areas.

B.5 Mining income/Mining employment elasticity by remoteness area

Remoteness area	Elasticity
	per cent
Major cities of Australia[a]	0
Inner regional Australia	10.7
Outer regional Australia	5.8
Remote Australia	4.3
Very remote Australia[a]	0

[a] The estimated elasticities for Major Cities of Australia and Very Remote Australia were -1.7 and -6.7 respectively. However, we have assumed the elasticity to be 0 in these two remoteness areas due to limited constraints on labour supply for new mines due to minimal mining activity in Major Cities of Australia and the fly-in fly-out labour market servicing Very Remote Australia.

Note: The wage premium due to changes in mining employment may be underestimated as the modelling is based on ABS income data which specifies the highest income bracket of "$2500 plus". Conversely the estimate is slightly biased upwards because the ABS income estimate includes all income sources, not just income from direct employment.

Source: The CIE based on ABS data.

Result 2: Share of mining employment

The existing share of mining employment in a given local government area affects the positive relationship between mining employment and mining income. The coefficient from the model for the explanatory interaction variable *mining employment share*change in mining employment* is -0.30. Hence the positive impact of mining employment growth on mining income is lower in local government areas with a higher initial share of mining employment. Put simply a 10 per cent growth in mining employment in a region with 30 per cent share of mining employment will have a lower increase in mining income

than a region with an initial 10 per cent share of mining employment. The average share of mining employment within each remoteness area is shown in table B.6.

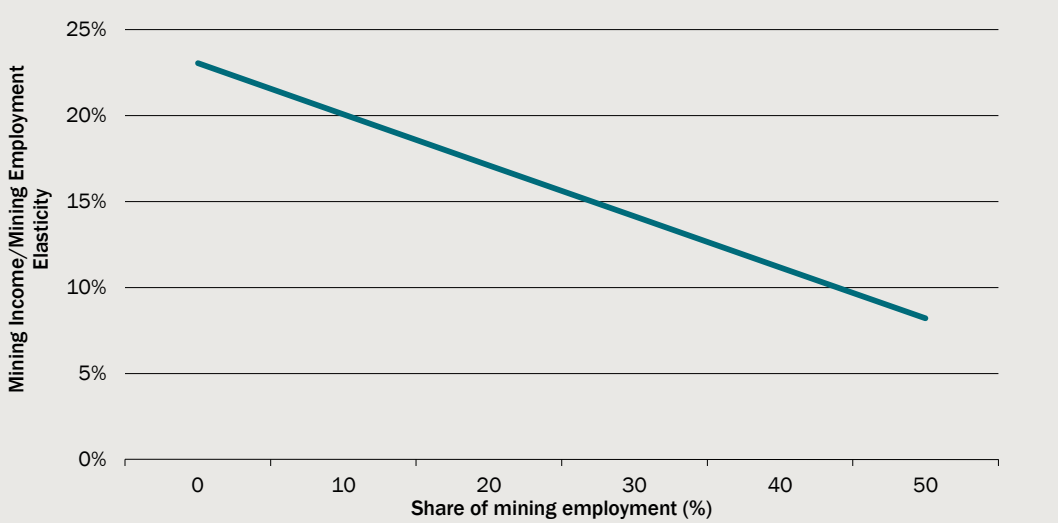
B.6 Average share of mining employment

Remoteness area	Average share of mining employment
	Per cent
Major cities of Australia[a]	1
Inner regional Australia	2
Outer regional Australia	3
Remote Australia	9
Very remote Australia[a]	15

Source: ABS.

Chart B.7 shows how the mining income/mining employment elasticity declines as the share of mining employment increases. Results are presented for Inner Regional Australia.

B.7 Influence of mining employment share on mining income/mining employment elasticity



Note: Based on results for Remoteness Area Inner Regional Australia only. A negative relationship is present in all five remoteness areas across NSW.

Data source: The CIE.

Result 3: Influence of initial unemployment rate

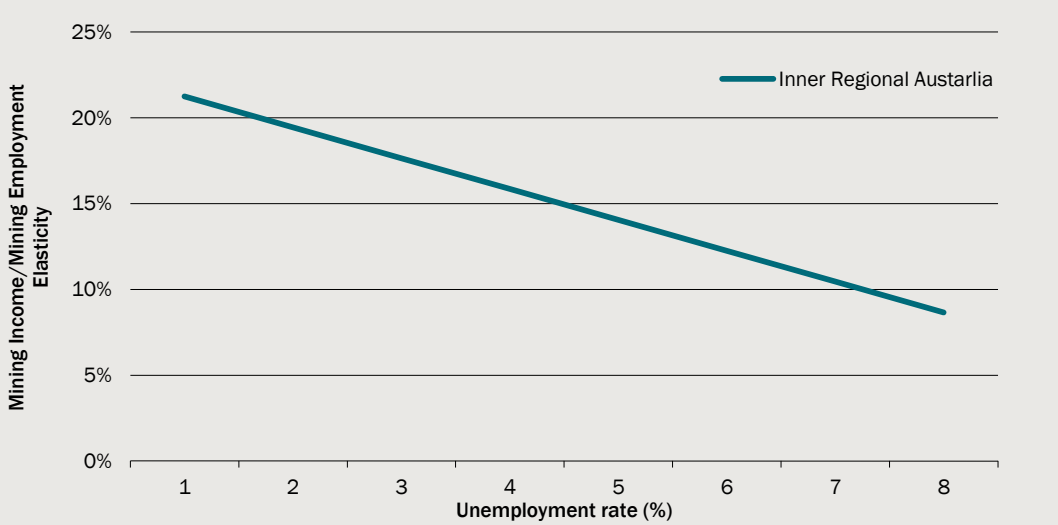
The econometric model was used to assess whether the unemployment rate influences the relationship between mining employment and mining income. The model found a higher initial unemployment rate in a given LGA reduces the positive impact of mining employment on mining income. The model coefficient of -0.02 represents that for a 100 per cent increase in mining employment, the impact of additional mining employment on mining income will be 2 per cent lower in an LGA with an unemployment rate of 6 per cent compared to an LGA with 5 per cent unemployment.

Over the ten year period between 2001 and 2011, the average unemployment rate within a remoteness area ranged between 5.5 per cent and 6.5 per cent.

Chart B.8 shows how the unemployment rate negatively influences the positive relationship between mining employment and mining income in Inner Regional Australia. With an unemployment rate of 1 per cent, the mining income/mining employment elasticity is approximately 21 per cent and drops to 10 per cent where the unemployment rate is 7 per cent.

This result is intuitive. Where there is excess labour then a smaller impact of additional demand for employment would be expected.

B.8 Influence of unemployment rate on mining income/mining employment elasticity



Note: Based on results for Remoteness Area Inner Regional Australia only. A negative relationship is present in all five remoteness areas across NSW.

Data source: The CIE.

Relationship between mining employment and total employment

An econometric model was also developed to determine the relationship between mining employment and total employment in a given LGA. The dependent variable is the change in total employment between ABS census years 2001, 2006 and 2011. The explanatory variables are:

- change in mining employment
- mining share of total employment interacted with the change in mining employment
- dummy variables for remoteness areas

The two key results are:

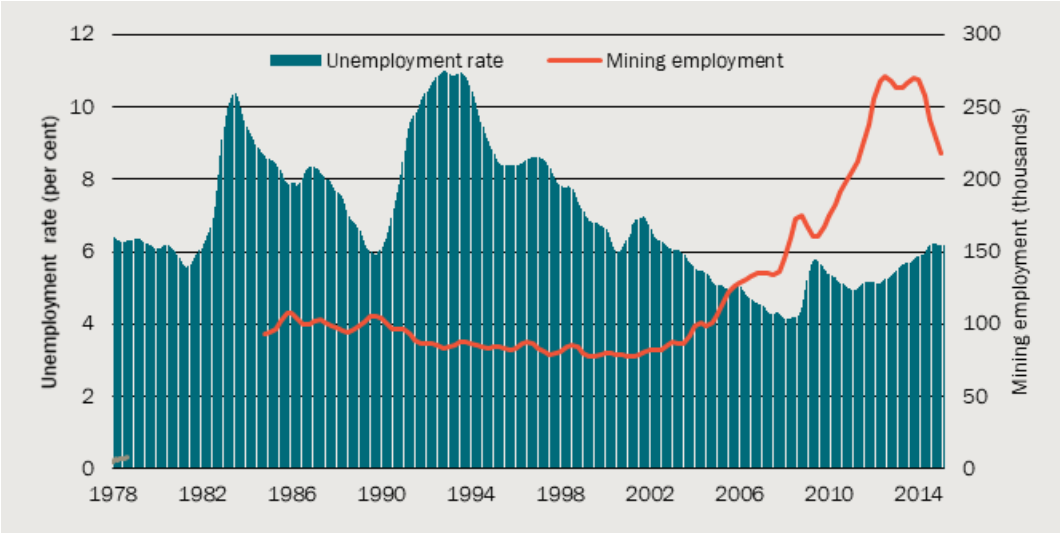
- a change in mining employment has a small positive effect on change in total employment, where a 10 per cent increase in mining employment increases total employment by 0.1 per cent. This means that there is little impact of a mining project on employment outside of its direct impact; and

- the positive impact of mining employment growth on total employment growth increases as the mining share of employment increases, which makes sense as the direct employment effect increases.

Relationship between mining employment and unemployment

The model provided an inconclusive result for the relationship between changes in mining employment and the unemployment rate at the local government area level. At the Australia level it is also clear that mining is not the major driver of unemployment rates.

B.9 Mining employment and unemployment rate — Australia



Data source: ABS Catalogue Number 6202.0; ABS Catalogue Number 6291.0.

Note that the definition of mining employment may be narrow relative to the total employment in the mine, particularly during construction.

Estimating the default value for wage premiums

The estimated mining income/mining employment elasticity can be used to estimate default values for wage premiums. An example of how to apply the default values for wage premiums is outlined in box B.10.

B.10 Example of how to estimate wage premiums using default values

A new mine is established in LGA X which is in remoteness area Inner Regional Australia. The new mine will increase total mining employment in 'X' from 100 persons to 120 persons. This is equivalent to a 20 per cent increase in mining employment for LGA X.

The average mining wage in 'X' prior to the new mine is $100 000.

The mining income/mining employment elasticity estimated for Inner Regional Australia is 10.7 per cent for a 100 per cent increase in mining employment. Therefore the mining wage in 'X' increases by 2.14 per cent. The average mining wage in the new mine is therefore $102 140 and the wage premium per worker in the new mine is $2 140.

The total economic benefit to workers for the new mine is equivalent to the wage premium per worker ($2 140) multiplied by the number of NSW based workers employed in the new mine. The increase in wages for other workers outside of the mine in LGA X (such as in other mines or businesses) is a transfer from these other businesses and is not included in the calculation of the wage premium.

Assuming all workers employed in the mine are NSW based, the economic benefit to mining workers is $21 400 after halving the change in total wages to capture disutility of marginal workers entering the mining industry.

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