APPENDIX
17

Economic Impact Assessment

Economic Impact Assessment - Ulan Coal Mine Modification 6

Ulan Coal Mines Pty Ltd

17 November 2022

EY

Building a better working world

Release notice

Ernst & Young ("EY") was engaged on the instructions of Ulan Coal Mines Pty Ltd ("Client") to perform an economic impact assessment in relation to the proposed life of mine extension to the Ulan Coal mine (the "Proposed Modification"), in accordance with the engagement agreement dated 31 August 2020, including the General Terms and Conditions ("the Engagement Agreement").

The results of Ernst & Young's work, including the assumptions and qualifications made in preparing the report, are set out in Ernst & Young's Draft report dated 17 November 2022 ("Report"). The Report should be read in its entirety including the transmittal letter, the applicable scope of the work and any limitations. A reference to the Report includes any part of the Report. No further work has been undertaken by Ernst & Young since the date of the Report to update it.

Ernst & Young has prepared the Report for the benefit of the Client and has considered only the interests of the Client. Ernst & Young has not been engaged to act, and has not acted, as advisor to any other party. Accordingly, Ernst & Young makes no representations as to the appropriateness, accuracy or completeness of the Report for any other party's purposes.

No reliance may be placed upon the Report or any of its contents by any party other than the Department ("Third Parties"). Any Third Party receiving a copy of the Report must make and rely on their own enquiries in relation to the issues to which the Report relates, the contents of the Report and all matters arising from or relating to or in any way connected with the Report or its contents.

Ernst & Young disclaims all responsibility to any Third Parties for any loss or liability that the Third Parties may suffer or incur arising from or relating to or in any way connected with the contents of the Report, the provision of the Report to the Third Parties or the reliance upon the Report by the Third Parties.

No claim or demand or any actions or proceedings may be brought against Ernst & Young arising from or connected with the contents of the Report or the provision of the Report to the Third Parties. Ernst & Young will be released and forever discharged from any such claims, demands, actions or proceedings.

Ernst & Young have consented to the Report being published electronically on the Client's website for informational purposes only and as part of the broader environmental impact statement being submitted by the client in relation to the Project. Ernst & Young have not consented to distribution or disclosure beyond this. The material contained in the Report, including the Ernst & Young logo, is copyright. The copyright in the material contained in the Report itself, excluding Ernst & Young logo, vests in the Client. The Report, including the Ernst & Young logo, cannot be altered without prior written permission from Ernst & Young.

Ernst & Young's liability is limited by a scheme approved under Professional Standards Legislation.

Table of contents

Executive Summary

The Ulan Coal Complex (UCC) is located approximately 38 km north-east of Mudgee and 19 km north-east of Gulgong in New South Wales. Ulan Coal Mines Pty Limited (UCMPL), a wholly owned subsidiary of Glencore Coal Assets Australia (Glencore) operates the UCC. Approved mining operations within the UCC consist of underground mining in the Ulan Underground and Ulan West Underground areas as well as open cut mining, and associated coal handling and processing, and transport through to 30 August 2033. The open cut operations are currently in care and maintenance.

UCMPL is seeking a modification to maximise resource recovery within existing mining lease areas (Proposed Modification). The Proposed Modification is expected to extend the life of the existing operations by two years and allow for the recovery of approximately 27.5 Mt ROM coal where, 25 Mt of is product (saleable) coal. UCMPL has provided EY with the information required to complete an economic impact assessment of the Proposed Modification, including environmental studies, projected financial data, projected physicals and operation requirements such as employment.

Information from UCMPL is combined with our own research based on publicly available information such as data from the Australian Bureau of Statistics (ABS) and KPMG *Coal Price and FX Market Forecasts*, in addition to long-term macroeconomic forecasts provided by the Office of the Chief Economist.

The information underpinning this assessment therefore is a combination of publicly available information and commissioned expert studies assessing the Proposed Modification's financials and environmental impacts. EY has not verified the information in the studies provided as they have been prepared by relevant experts in the field. Where there is uncertainty around key assumptions, such as the coal price, sensitivity analysis has been conducted to test the robustness of the assessment to these key inputs.

The analysis

This report provides an Economic Impact Assessment (EIA) for the Proposed Modification and follows the economic assessment framework set out in the *Guidelines for the economic assessment of mining and coal seam gas proposals* (the Guidelines) released by the New South Wales (NSW) Government in December 2015.[1]

To estimate the environmental, social and transport-related costs generated by the Proposed Modification as required by the Guidelines, the EIA uses the methods outlined in the *Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals*.[2]

Consistent with these Guidelines, the EIA includes a Cost Benefit Analysis (CBA) and a Local Effects Analysis (LEA). The CBA provides an estimate of the net benefits of the proposed development to NSW. The LEA is based on analysis for the Lithgow-Mudgee local region (as defined by the Australian Bureau of Statistics SA3 region).

In addition, we have included the results of assessing economy-wide impacts of the Proposed Modification to both the local region of Lithgow-Mudgee and to NSW. The economic modelling is undertaken using our inhouse Computable General Equilibrium (CGE) model.

Results of the Cost Benefit Analysis

As estimated by UCMPL, the Proposed Modification will produce an additional 27.5 Mt Run-of-Mine (ROM) coal, where 25 Mt of product (saleable) coal, comprised entirely of thermal coal.

The Proposed Modification is expected to provide a net benefit to NSW, estimated to be $292.6 million in net present value (NPV)[3] terms. The estimated net benefit is comprised of

---

[1] New South Wales Government (2015)

[2] Department of Planning and Environment (2018)

[3] All NPV figures reported are in real 2021 Australian dollars based on a 7 per cent real discount rate (unless otherwise stated). A 7 per cent discount rate is the central discount rate to be used by the Guidelines

$144.9 million and $147.7 million in direct and indirect benefits respectively. Incremental indirect costs to NSW are estimated to be negligible. The indirect costs shown below are $0.02 million in NPV terms.

These estimates are based on central case assumptions in relation to the Proposed Modification and replacement and sustaining capital expenditure related to the Proposed Modification of $88.93 million in NPV terms and a realised coal price ranging between $172.6 and $93.9 per tonne for thermal coal in real 2021 Australian Dollar terms.

The *direct benefits* of a project are a function of the profitability of the proposed development which, in turn, depends on the prevailing coal price and the mines' cost structure. The analysis shows that the combination of relatively high value of thermal coal and relatively low capital requirements, extraction and processing costs underpins the direct economic viability of the Proposed Modification. The capital expenditure for the Proposed Modification is greatly outweighed by the high net direct benefits as the ratio equates to slightly greater than $3 million in NPV per tonne.

This results in the Proposed Modification generating:

► An overall net producer surplus of $285.5 million in NPV terms, of which it is conservatively assumed that 0 per cent is attributable to NSW and Australia due to the foreign ownership of the mine. This means that we have assumed that any net producer surplus generated by the Proposed Modification is not retained in Australia.[4]

► Total corporate taxes of $133.9 million in NPV terms for Australia, of which $42.8 million is attributed to NSW.

► Other government revenue for NSW of $102.1 million in NPV terms, the largest component of this being royalties of $100.5 million (based on a royalty rate of 7.2 per cent of revenue taking into account a discount of $3.5 per ROM tonne applied for coal wash), plus payroll taxes of $1.6 million[5] .

The *indirect benefits* of the Proposed Modification are related to the linkages that the development has to the NSW economy through both the labour market and suppliers. The analysis shows that of the $147.5 million in NPV terms of indirect benefits:

► Worker benefits are $15.8 million in NPV terms attributable to UCC employees associated with the Proposed Modification, due to higher average wages paid to employees at the UCC relative to average wages paid to similar occupations outside the mining sector in NSW (Appendix D).

► Supplier benefits are $131.9 million in NPV terms, representing direct value add generated by NSW suppliers providing goods and services to the UCC for the Proposed Modification, based on NSW-based operational expenditure for the Proposed Modification of $1,314.1 million, assuming that 84 per cent of the spend on intermediate goods is procured from within NSW (based on the current spend for operations in UCC).

The *indirect costs* of the Proposed Modification are related to the costs borne on the NSW community through the generation of externalities by the Proposed Modification which have not been offset by investments by UCMPL. These costs include:

► Scope 1 and 2 Greenhouse gas emissions costs of $0.019 million in NPV terms.

The total value of the externality of greenhouse gas emissions are based on a study conducted by Umwelt (Australia) Pty Limited (Umwelt), which assessed the additional expected Scope 1 and 2 greenhouse gas emissions that would occur due to the Proposed Modification. Greenhouse Gases associated with the burning of coal from this facility are excluded from this assessment. This is

---

[4] Given that Glencore is 100 per cent foreign owned. Whilst it is possible that residents in NSW have some ownership of these shares, it is not possible to ascertain the level of this ownership.

[5] Given the nature of the Proposed Modification, it is conservatively assumed that there would be no incremental payments to council, as it expected that Glencore would pay the same rates irrespective of whether the Proposed Modification gains approval.

because the EIA Guidelines and Technical notes do not require consideration of Scope 3 emissions. The impacts on climate change from Scope 3 emissions are therefore excluded from this analysis.

The value of this externality is estimated from interim estimates of the social cost of carbon[6], these estimates are restated into real 2021 Australian dollars. Over the assessment period, the estimated social cost of carbon ranges from $76.52 per tonne of carbon dioxide (tCO_2-e) in 2021 to $95.65 per tCO_2-e in 2032. The total value of this externality is then apportioned as the ratio of the population of NSW to the world population, consistent with the approach outlined in the Guidelines.

Sensitivity analysis

Consistent with the Guidelines, a systematic sensitivity analysis of the estimated net benefits is undertaken in this report (see Appendix B). This sensitivity analysis shows that the estimated net benefits are *robust* in the sense that they remain (strongly) positive after testing all key assumptions underpinning the analysis.

In isolation, the estimated net benefit of the Proposed Modification is most sensitive to the coal price assumptions underpinning the analysis. For example, assuming coal prices are 25 per cent lower than the central case assumptions, the net benefits to NSW are estimated to be $236.9 million in NPV terms (a 19 per cent reduction in net benefits), as shown in Figure 1. The indirect costs were found to be relatively insignificant at $0.02 million in NPV terms and are expanded more upon in section 2.7.

The lower bound estimate of net benefits, which takes the most pessimistic assumptions[7] around coal prices, capital expenditure, operational expenditure, worker and supplier benefits as well as indirect costs, yields an estimated net benefit to NSW of $226.7 million in NPV terms. The upper bound estimate, based on the most optimistic assumptions[8], is $356.0 million in NPV terms.

The results are sensitive to the choice of discount rate chosen due to the relatively long timeframe of the UCC operations. The NPV of the estimated net benefits to NSW range from between $240.3 million and $359.5 million under real discount rates of 10 and 4 per cent, respectively.

Figure 1: Systematic sensitivity analysis of the CBA to key assumptions (NPV*, $ million)

---
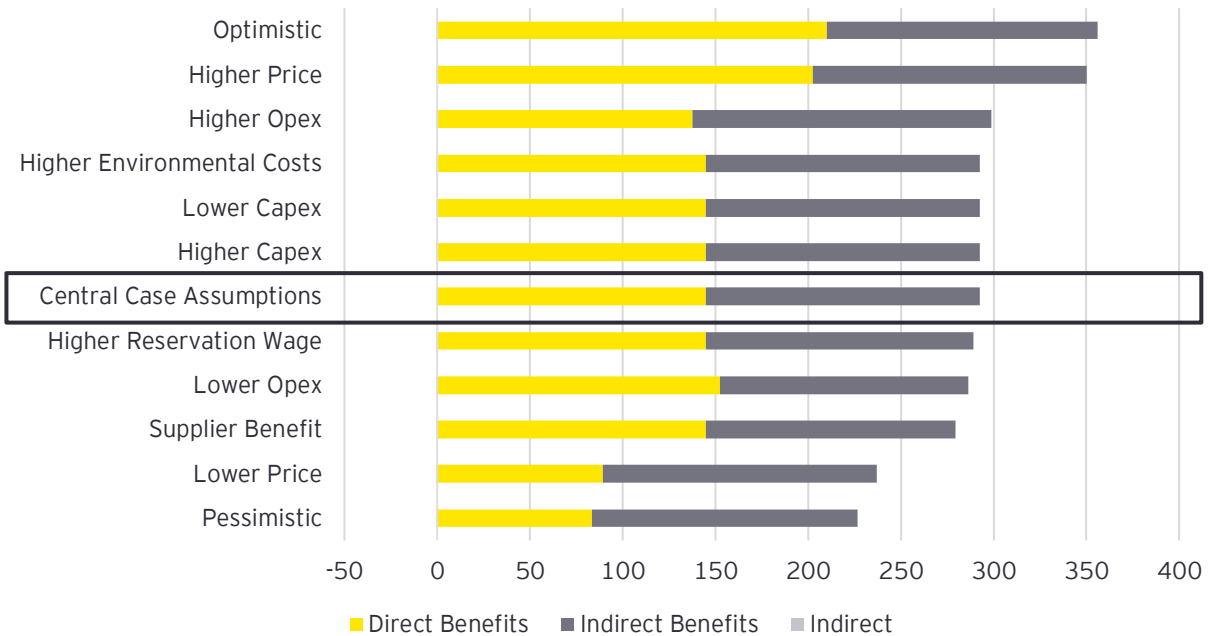
[6] The Interagency Working Group, 2021, Technical Support Document: Social Cost of Carbon, Methane and Nitrous Oxide

[7] Assumes a decrease in coal prices by 25%, increase in operational expenditures, capital expenditure, environmental costs by 10% respectively, decrease in supplier benefits by 10% and increase in reservation wage by 25%

[8] Assumes an increase in coal prices by 25%, decrease in operational expenditures, capital expenditure, environmental costs by 10% respectively and increase in supplier benefits by 10%

In addition, the sensitivity analysis has been extended to test the impact of a full range of worker and supplier benefits, (see Appendix D.4 for full results). In the case where we reduce worker benefits to 25% of the full estimate, the Proposed Modification still yields a net benefit of $280.8 million in NPV terms, while reducing supplier benefits to 75% of its original value has the impact of reducing the benefit of the Proposed Modification to $259.6 million in NPV terms.

Results of the Local Effects Analysis

The LEA considers the costs and benefits of the Proposed Modification on residents of the Lithgow-Mudgee SA3 region of NSW. The analysis shows an estimated net benefit of $45.2 million to the Lithgow-Mudgee region in NPV terms. This is driven largely by:

► Benefits to local workers of $15.4 million in NPV terms, as most of the employees at the UCC live around the Lithgow-Mudgee region.

► Benefits to local suppliers of $29.8 million in NPV terms, based on the assumption that 19 per cent of the inputs to production are sourced from the region.

It should be noted that the direct benefits to the Local Area have been reduced to zero due to the removal of the benefits of council rates. Benefits of council rates are not considered as the project is a modification, rather than a mine extension, therefore, no additional years of land is being used. Therefore, there are no additional payments to council assumed as a result of the modification.

This assessment also demonstrates that the estimated local effects are *robust* under the sensitivity analysis (conducted in **Appendix B**) with a lower bound estimate of net benefits to the Lithgow-Mudgee region of $36.3 million and upper bound estimate of $57.0 million in NPV terms.

Economy-wide modelling of the proposed development

To corroborate these findings, the economy-wide impacts of the Proposed Modification are assessed based on our inhouse CGE model. EY General Equilibrium Model (EYGEM) is a large scale, dynamic, multi-region, multi-sector model of the global economy, with an explicit representation of the Lithgow-Mudgee SA3 and the NSW economy.

CGE modelling is the preferred technique to assess the impacts of large investments, such as the Proposed Modification, as it is based on a more detailed representation of the economy, including the complex interactions between different sectors of the economy.

EYGEM projects change in macroeconomic aggregates such as real gross state product (real GSP) which is an output measure of the NSW economy and real gross state income (real GSI) which is a welfare measure for NSW residents. At a regional level, the model projects change in real gross regional product (real GRP) and real gross regional income (real GRI). The model also projects state-wide and regional employment, taking into account employment in supplier industries and any crowding out effects.

The Proposed Modification is projected to provide significant positive economy-wide impacts to both the local region of Lithgow-Mudgee and to NSW. In the Lithgow-Mudgee region, the Proposed Modification is projected to increase GRP by $1,240 million in NPV terms, as outlined in Figure 4. For NSW, the projected increase in GSP is $1,295 million in NPV terms. GRI, or regional welfare, is projected to increase by $1,022 million in NPV terms. The projected increase in GRI is significant to the relatively small region of Lithgow-Mudgee. GSI is projected to increase by $1,341 million.

Figure 2: Economy-wide impacts of the Proposed Modification, 2022 – 2033 (NPV*, $ million (left) and Dollars (right))

■ Lithgow-Mudgee ■ NSW
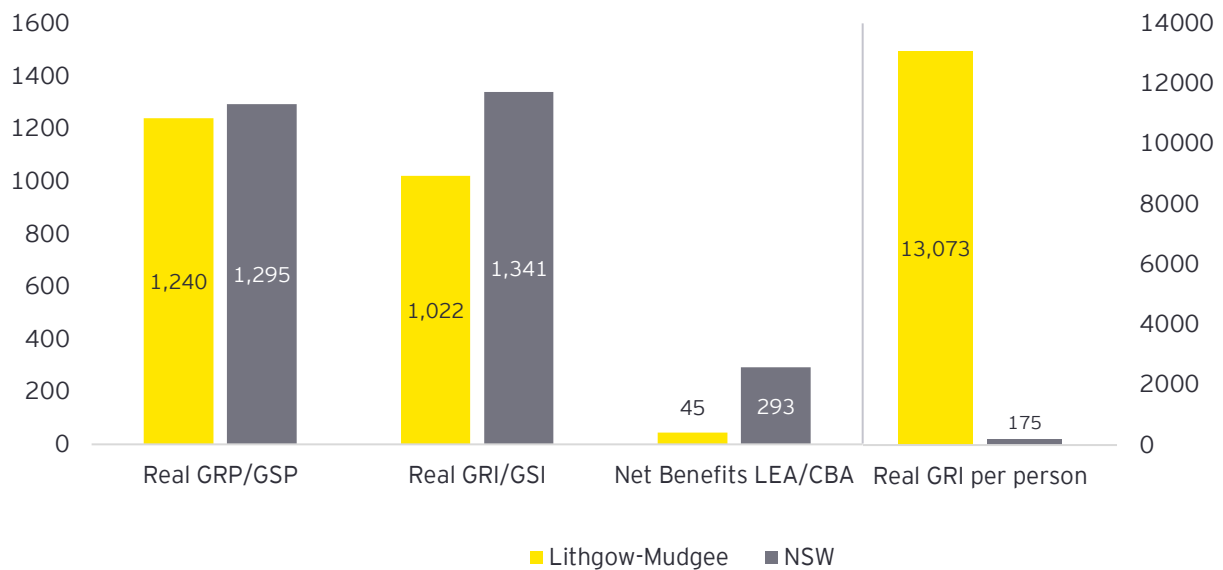
Source: EY Computable General Equilibrium (CGE) modelling. * NPV in real 2021 Australian dollars based on a 7 per cent real discount rate.

The relative size of the local region and the NSW economy-wide impacts is reflective of how each region is impacted by the Proposed Modification. As outlined in Section 4, the CGE modelling takes into account the capital expenditure, the coal output, the migration of workers, both directly through the employment within the Proposed Development, and indirectly, in the broader region, into the region and the payment of royalties from Lithgow-Mudgee into NSW and the repatriation of profits and uses the same input assumptions as the CBA assessment outlined in this report.

Figure 3: Economy-wide average employment impacts of the Proposed Modification, 2022 – 2033 (FTE^^)
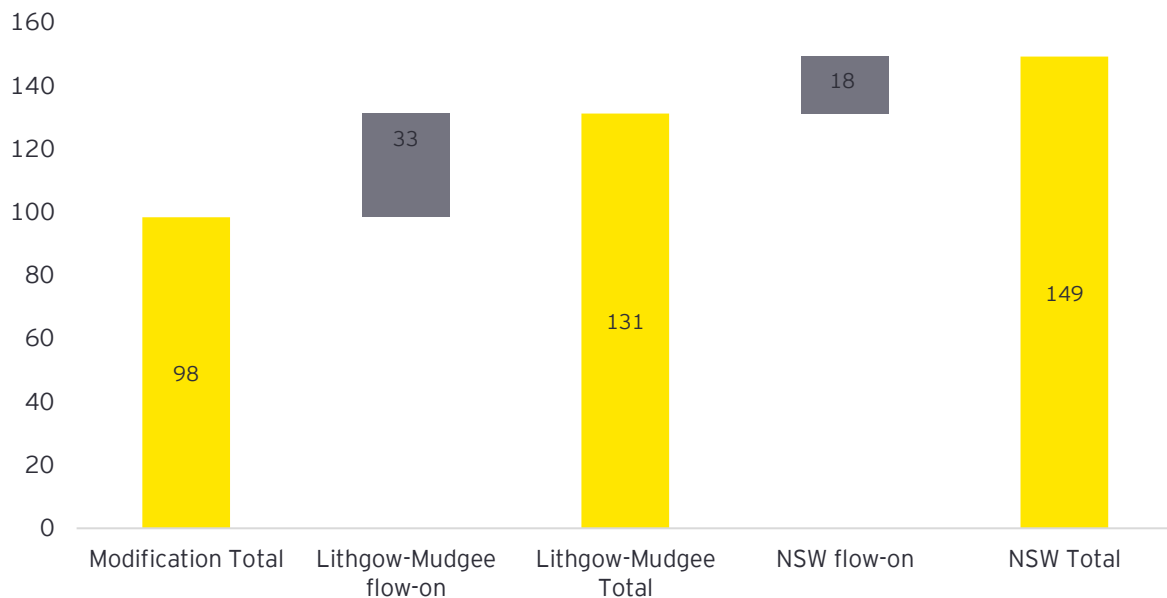
Source: EY Computable General Equilibrium (CGE) modelling. ^^Average full-time equivalent (FTE) over the period 2022 to 2033

Total employment in the region is projected to increase by an incremental 131 FTE workers on average, as outlined in Figure 3. The Proposed Modification will employ an additional 98 FTE[9] workers over the period analysed from 2022 to 2035, as a result 32 additional workers will be employed in other sectors of the economy in the Lithgow-Mudgee region, taking into account employment in supplier industries and any crowding out effects. Across NSW, employment is projected to increase by 149 FTE comprising of 131 direct FTE and 18 flow-on FTE.

---

[9] It is assumed that throughout the currently approved life of UCC, that there would be no additional employment that would be attributable to the Proposed Modification. Therefore, the additional employment generated by the Proposed Modification is only attributed to the years in which the life of mine has been extended.

1.   Introduction

The Ulan Coal Complex (UCC) is located approximately 38 km north-east of Mudgee and 19 km north-east of Gulgong in New South Wales (see Figure 6). The UCC is owned by Glencore Coal Assets Australia Pty Limited (Glencore) and operated by Ulan Coal Mines Pty Ltd (UCMPL), a subsidiary of Glencore.

UCMPL was granted Project Approval (PA) 08_0184 under Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act) on 15 November 2010 for the Ulan Coal – Continued Operations Project (UCCO Project). UCMPL is proposing a modification to PA 08_0184 to maximise resource recovery from the existing underground mining operations within existing mining lease and exploration lease areas. In addition to identifying additional mineable resources within existing mining lease areas, UCMPL has determined that there is a valuable mineable resource within Exploration Lease (EL) 7542 and is seeking to modify the PA 08_0184 to enable access to this coal resource by extending the currently approved longwall panels in these areas.

UCMPL is seeking a modification application under section 4.55 (2) of the EP&A Act for the Proposed Modification. EY was commissioned by UCMPL to undertake an Economic Impact Assessment (EIA) for the Proposed Modification to the UCC, the assessment contains the economic impacts of the proposed development on the Lithgow-Mudgee region and the state of NSW. This EIA is based on a cost benefit analysis (CBA) and local effects analysis (LEA) prepared under the framework established in the *Guidelines for the economic assessment of mining and coal seam gas proposals* (the Guidelines) released by the New South Wales (NSW) Government in December 2015.[10] The CBA requires an assessment of the net benefits that accrue to the proponent, government, workers, and suppliers of the Proposed Modification.

In addition, the Guidelines require an estimate of the potential costs generated by the Proposed Modification. These costs may include residual public infrastructure costs and environmental, social and transport-related costs. To estimate the environmental, social and transport-related costs, we have incorporated into our analysis relevant requirements of the *Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals*.[11]

1.1   Description of existing operations

Approved operations at the UCC consist of underground mining in the Ulan Underground and Ulan West, open cut mining and associated coal handling, processing and transport through to August 2033. The open cut operations have been in care and maintenance since 2016.

1.2   Description of the proposed development

UCMPL is proposing a modification to PA 08_0184 pursuant to section 4.55(2) of the EP&A Act to maximise resource recovery from the existing underground mining operations within existing mining lease areas.

The Proposed Modification will extend the life of the existing operations by two years until 2035, with incremental production attributed to the Proposed Modification nominally expected to end by around 2033 and allow the recovery of an additional approximate 25 Mt of product coal. The Proposed Modification involves:

► extending Ulan Underground longwall (LW) panels LWW9 to LWW11 to the west

► widening Ulan Underground LWW11 by approximately 30 metres

► extending Ulan West LW9 to LW12 to the north

---

[10] New South Wales Government (2015).

[11] Department of Planning and Environment (2018)

► widening Ulan West LW12 section by approximately 180 metres.

Figure 4: Regional context of the Ulan Coal Complex
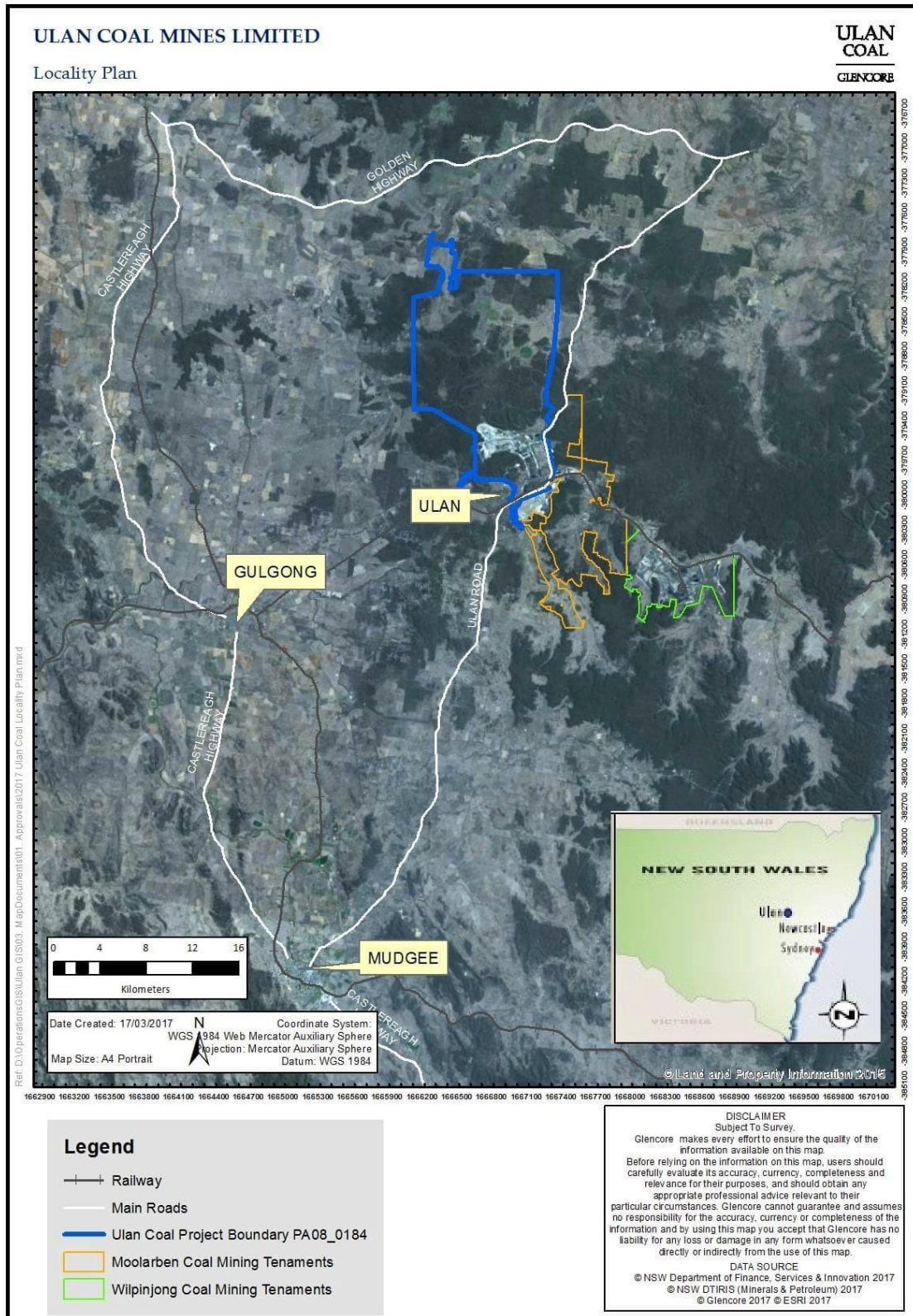
Source: Figure provided by Ulan

A summary of the key elements of the Proposed Modification are presented in Table 1. According to UCMPL, expected development capital expenditure of $86.2 million is required with an additional $2.7 million of replacement and sustaining capital during the operating life of the mine associated with the Proposed Modification. All capital and operational expenditure has been estimated as additional costs over and above those to be incurred throughout the currently approved mine. On this basis, the Proposed Modification is expected to produce an additional 25 Mt of thermal coal output.

Table 1: Summary of operations under the Proposed Modification

	Description of operations
Product Coal	25 Mt
Metallurgical Coal (HCC)	-
Thermal Coal	25 Mt
PCI	-
New mine development capital*	$86.2 million
Replacement and sustaining capital*	$2.7 million
Mining Methods	Underground extraction using longwall mining methods
Life of Project	Extension of life of mine until 30 August 2035 (an additional two years)
Operational Workforce	Approximately 931 people (Ulan Coal Complex) Average incremental 98 FTE^^ over the life of the Proposed Modification, 244 FTE (in 2031)

Source: EY estimates based on information provided by UCMPL. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate. ^^ full time equivalent (or FTE), it is assumed that there are no incremental employees employed at the mine throughout 2022 - 2032, any additional employment generated by the Proposed Modification is only attributed to the years in which the life of mine has been extended.

UCMPL has provided EY with the information required to complete an economic impact assessment of the Proposed Modification, including environmental studies, projected financial data, projected physicals and operation requirements such as employment (see **Appendix A**). Information from UCMPL is combined with our own research based on publicly available information such as data from the Australian Bureau of Statistics (ABS) and KPMG *Coal Price and FX Market Forecasts – March/April 2022*, accessed on 01 October 2022, in addition to long-term macroeconomic forecasts provided by the Office of the Chief Economist (see **Appendix A**).

The information underpinning this assessment therefore is a combination of publicly available information and commissioned expert studies assessing the Proposed Modification's financials and environmental impacts. EY has not verified the information in the studies provided as they have been prepared by relevant experts in the field. Where there is uncertainty around key assumptions, such as the coal price, sensitivity analysis has been conducted to test the robustness of the assessment to these key inputs.

The CBA is presented in Section 2 and measures the net incremental benefits to the state of NSW should the Proposed Modification be approved. The LEA, which focusses on the benefits accruing to the Lithgow-Mudgee (SA3) region is presented in Section 3.

In addition to the CBA and LEA, the report also contains an assessment of the economic impacts of the proposed development on the Lithgow-Mudgee region and the State of NSW based on computable general equilibrium (CGE) modelling. This modelling is presented in Section 4.

The list of Appendices is as follows:

► **Appendix A** details information underpinning this assessment, including a list of information provided by UCMPL and a list of publicly available information used by EY.

- ► **Appendix B** provides an account of the year-on-year production, output and prices for the Proposed Modification scenario, and provides details on the sensitivity analysis to both the CBA and the LEA.

- ► **Appendix C** provides details on environment and other external costs of the Proposed Modification.

- ► **Appendix D** outlines the methodology for determining worker and supplier benefits of the Proposed Modification.

- ► **Appendix E** outlines additional external references.

2.   Cost-Benefit Analysis

The Guidelines released by the NSW Government in December 2015 set out the CBA framework to measure the net benefits of a proposed mining project to the NSW community. This approach has been adopted in the economic analysis outlined in this report. Table 2 provides a summary of how these net benefits are measured.

Table 2: Cost Benefit Analysis framework as defined in the Guidelines

Direct Benefits	Indirect Benefits	Indirect Costs
The net benefits that accrue to NSW from the direct operations of the proposed mine	The net benefits that are generated for parties that economically interact with the proposed mine	Social costs generated by the proposed mine, borne by the NSW community
Includes: ► Net producer surplus attributable to NSW ► Royalties payable ► Company and other taxes attributable to NSW	Includes: ► Net economic benefits to landowners ► Net economics benefits to NSW employees ► Net economic benefits to NSW suppliers	Includes: ► Net environmental, social and transport-related costs ► Net public infrastructure costs ► Loss of surplus to other industries

Source: NSW Government (2015).

The direct benefits are those that accrue to the project proponent and payments made to government. The indirect benefits are those that accrue to economic agents that engage with the proponent. These include employees, suppliers, and landowners. The indirect costs are the costs borne by the community of NSW, through environmental and social impacts or public infrastructure costs.

A major emphasis of the Guidelines is on transparency of assumptions made. The remainder of this section describes in detail the assumptions underpinning the CBA.

The costs and benefits outlined in this report only include the costs and benefits from the operation of the Proposed Modification only. It does not include the costs and benefits of the use of coal output in NSW.

In addition, the analysis does not include any of the costs associated with coal use in NSW, including Scope 3 greenhouse gas emissions. Greenhouse Gases associated with the burning of coal from this facility are excluded from this assessment. This is because the EIA Guidelines and Technical notes do not require consideration of Scope 3 emissions. The impacts on climate change from Scope 3 emissions are therefore excluded from this analysis.

2.1   Baseline

The starting point for any CBA is the baseline, or counterfactual. This scenario considers all costs and benefits if the proposed development does not proceed and is predicated on the assumption that there are no underlying changes to overall economic activity. This effectively implies that all existing approved and currently proposed (subject to pending development applications or modification applications) mining activity in NSW also continues. For example, UCMPL currently has approved underground operations within both the Ulan Underground and Ulan West Underground. As such, the economic benefits and costs associated with extraction of coal within these areas have been excluded for the purposes of assessing the incremental net benefits of the Proposed Modification. In further extending this argument, it is also assumed in the base case that both the production of coal, and the demand for coal workers decrease over time.[12] This is consistent with current approved development and currently pending development applications in NSW, therefore it is expected that over time, those

---

[12] Nick Wood, Maddy Beauman & Philip Adams, 2021, The sensitivity of the NSW economic and fiscal outlook to global coal demand and the broader energy transition for the 2021 NSW Intergenerational Report

currently employed in the coal mining sector will find it increasingly more difficult to secure employment at other coal mines.

The baseline includes closure costs associated with decommissioning the currently approved site infrastructure and undertaking rehabilitation. If the Proposed Modification is approved, these costs would be delayed into the future, representing a saving in NPV terms.

The remainder of Sections 2 and 3, considers the net impacts of the Proposed Modification, allowing for the recovery of an additional 25 Mt of thermal coal.

2.2   Cost-Benefit Analysis results

Consistent with the Guidelines, the CBA is based on comparing the net direct and indirect benefits and subtracting the indirect costs of the proposed development compared against the baseline scenario where the proposed development does not occur. The results are summarised in Table 3.

Based on the CBA methodology outlined in the Guidelines, and information provided by UCMPL, the Proposed Modification is estimated to provide a net benefit to NSW. This net benefit is estimated to be $292.6 million in NPV[13] terms. This is comprised of $144.9 million and $147.7 million in direct and indirect benefits respectively and estimated incremental indirect costs of $0.0191 million in NPV terms.

Table 3: Central case - estimated net benefits of the proposed development ($ million^)

Benefits	NPV* ($M)	Costs	NPV ($M)*
Direct benefits		Direct costs	
Net producer surplus attributed to NSW	0.0		
Royalties, payroll tax and Council rates	102.1		
Company income tax apportioned to NSW	42.8		
Total direct benefits	144.9	Total direct costs	-
Indirect benefits		Indirect costs	
Net economic benefit to landholders	-	Air quality	-
Net economic benefit to NSW workers	15.8	Greenhouse gas emissions^^	0.0191
Net economic benefit to NSW suppliers	131.9	Noise impact^^	-
		Transport impact	-
		Net public infrastructure cost	-
		Surface water impact^^	-
		Groundwater^^	31.4
		Biodiversity impact^^	1.3
		Loss of surplus to other industries	-
		Visual amenity	-
		Aboriginal cultural heritage^^	-
		Historical heritage^^	-
		Other	-
Total indirect benefits	147.7	Indirect Costs	32.72
Total Project economic benefit	292.6	Total incremental cost of project	0.0191
NPV of project - ($m)	292.6		

---

[13] All NPV figures reported are in real 2021 Australian dollars based on a 7 per cent real discount rate (unless otherwise stated). A 7 per cent discount rate is the central discount rate to be used by the Guidelines

The **direct benefits** of the Proposed Modification are a function of the profitability of the proposed development which, in turn, depends principally on the prevailing coal price. This results in:

► Total corporate taxes of $133.9 million in NPV terms for Australia, of which $42.8 million is attributed to NSW (based on the NSW share of the total Australian population).[14]

► $102.1 million in other government revenue for NSW in NPV terms, the largest component of this being royalties of $100.5 million, with payroll taxes contributing $1.6 million.

The **indirect benefits** of the Proposed Modification are related to the linkages that the proposed development has to the NSW economy through both the labour market and suppliers. The analysis shows that of the $147.7 million in estimated indirect benefits:

► Worker benefits are $15.8 million in NPV terms attributable to an average additional direct employment of 98 FTE workers[15] over the additional two years of operation of the Proposed Modification and due to higher average wages paid to UCMPL employees than average wages paid to similar occupations outside the mining sector in NSW (see **Appendix D).**

► Supplier benefits are $131.9 million in NPV terms, representing direct value add generated by NSW suppliers providing goods and services to the Proposed Modification, based on NSW-based procurement for the proposed development of $1,314 million (or $807.8 million in NPV terms). The analysis takes the amount of local spending on goods and services the Proposed Modification will incur over its lifetime, and apportions an estimate of gross operating surplus (around 20 per cent, which has been derived by EYs in-house regional input output model) to this local spending. This represents the additional profits that could be generated from the additional demand associated with the Proposed Modification.

The **indirect costs** of the Proposed Modification are related to the costs borne on the NSW community through the generation of externalities by the Proposed Modification. These costs are primarily limited to:

► Scope 1 and Scope 2[16] GHG emissions costs of $0.019 million in NPV terms (where total costs are apportioned based on the relative proportion of the population of NSW to the world).

It is noted that costs associated with ecology, rehabilitation, groundwater and surface water impacts are included in the Project's operational costs.

2.3   Proposed development – central case assumptions

The following analysis sets out the financial assumptions underpinning the Proposed Modification, including the capital expenditure, the output and price assumptions and the operating cost assumptions, including labour input costs and intermediate inputs. These assumptions are used to estimate the direct and indirect benefits to NSW and forms the basis of the LEA presented later in the report.

---

[14] Noting that, whilst liabilities or tax payments may be offset by other assessed losses in larger firms with multiple projects, these should not be considered as relevant for the assessment of the Proposed Modification. Whether taxes are paid or used to offset other losses is immaterial, as the actual operation of the proposed Modification, relative to the base case, means that tax liabilities will be created, and should be recognised as part of the benefits of the Proposed Modification.

[15] It is conservatively assumed that from 2023 to 2030 that there would be no additional workers employed over and above the baseline operations.

[16] This is because the EIA Guidelines and Technical notes do not require consideration of Scope 3 emissions. The impacts on climate change from Scope 3 emissions are therefore excluded from this analysis.

2.3.1 Capital costs

UCMPL provided EY with the capital expenditure profile of the proposed amendment which is summarised in Figure 5. As shown, the development capital to enable the proposed modification is planned to take place mostly from 2024 to 2027 and the replacement and sustaining capital ramping up from 2027 to 2033, reflecting the additional longwall development and longwall production timelines.

Figure 5: Profile of capital expenditure under the Proposed Modification ($ million^)
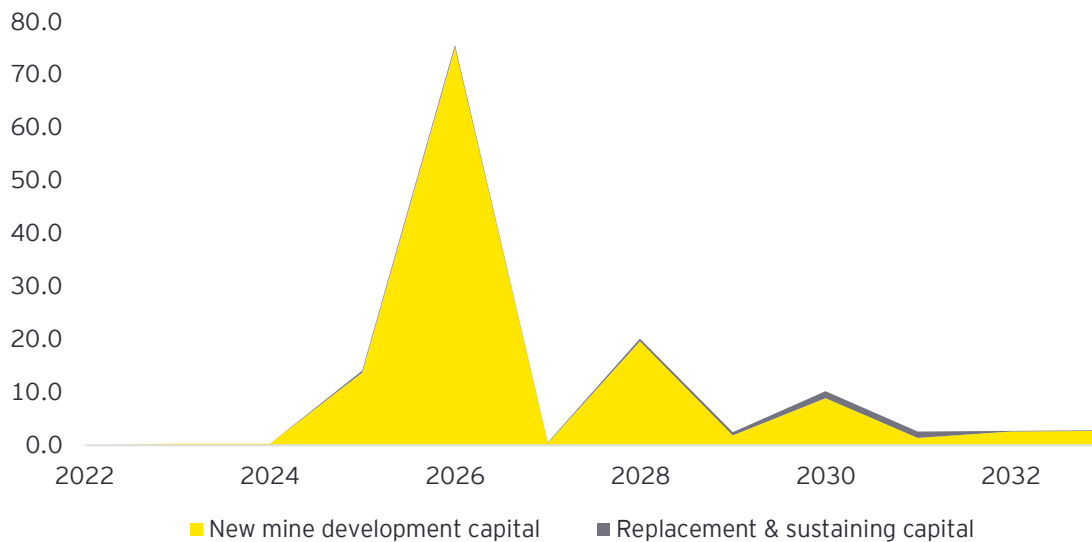
Source: UCMPL ^ Real 2021 Australian dollars

In total the Proposed Modification requires $88.9 million in NPV[17] terms ($131.4 million in real terms) of capital expenditure. This includes mine development capital expenditure of $86.2 million in NPV terms ($127.1 million in real terms), and replacement and sustaining capital expenditure of $2.7 million in NPV terms ($4.3 million in real terms).

2.3.2 Production assumptions

UCMPL has provided EY with the production figures for the Proposed Modification which are summarised in Figure 6. The Proposed Modification will extract additional 25 Mt of thermal coal over the 13-year period from 2023, allowing mining to occur up to 2035 under the updated mine plan. However, the expected production figures under the current estimates see production completing in 2033.

Figure 6: Key production figures (Mt)

---

[17] All NPV figures reported are in real 2021 Australian dollars based on a 7 per cent real discount rate (unless otherwise stated). A 7 per cent discount rate is the central discount rate to be used by the Guidelines.
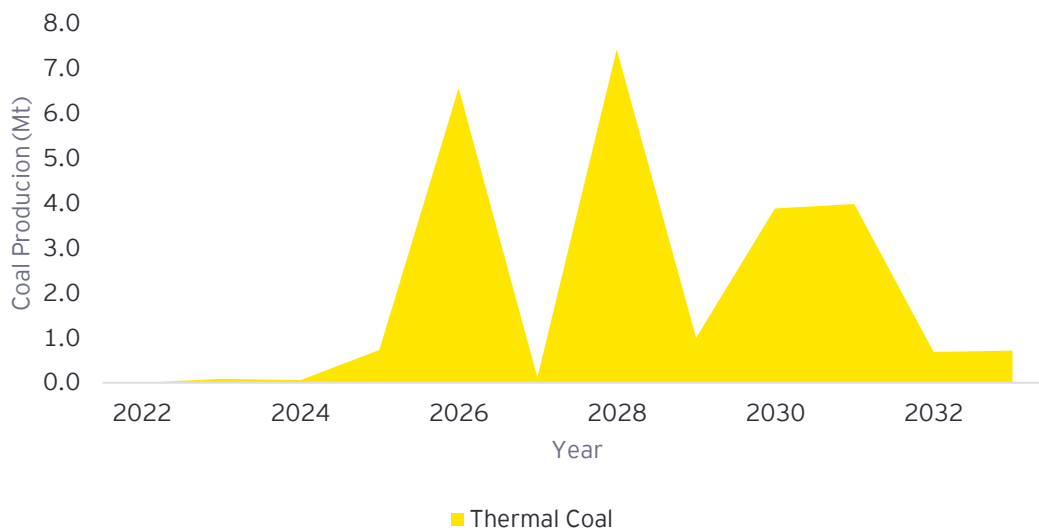
2.3.3 Price assumptions

The price assumptions used for this analysis is comprised from several sources, including forecasts from KPMG, the Office of Chief Economist and other information sources as outlined below.

Coal price assumptions are estimated based on information from KPMG published *Coal Price and FX consensus forecasts March/April 2022*. KPMG publishes HCC, thermal and PCI price forecasts in nominal US dollars out to 2025. The price forecasts are converted to nominal Australian dollars using the exchange rate forecasts from the KPMG report[18]. The exchange rate varies between $0.77 and $0.73 US dollars per AUD until 2025 and then is fixed long term at $0.75 US dollars per AUD. All nominal coal price forecasts are converted into real 2021 AUD using Office of the Chief Economist *Resources and Quarterly March 2022* inflation rate forecast.

Taking these coal price assumptions into account, it is assumed that the Proposed Modification would be able to sell thermal coal in real 2021 Australian dollars from $172.6 per tonne in 2022 to $93.9 per tonne for over the life of the Proposed Modification.

Figure 7: Thermal coal price assumptions (real 2021 Australian dollars)

---

[18] https://assets.kpmg/content/dam/kpmg/au/pdf/2022/coal-price-fx-market-forecast-march-april-2022.pdf
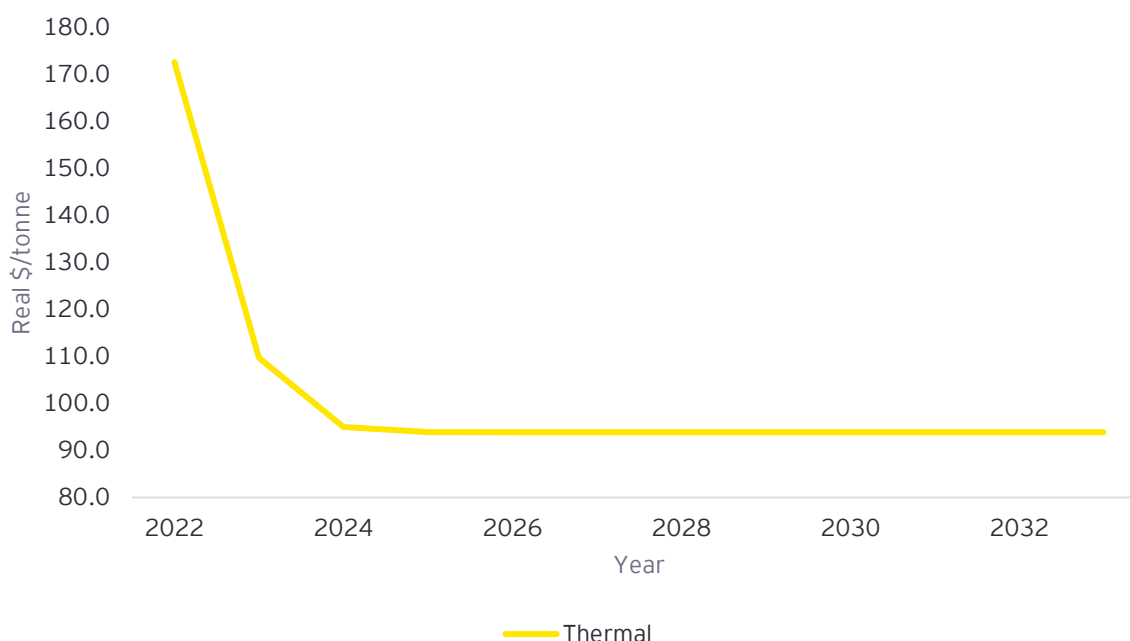
Source: EY estimates based on KPMG published Coal Price and FX consensus forecasts March/April22

2.4   Projected revenue and financials

Based on the production assumptions outlined in Figure 6 and the real price assumptions in Figure 7, the proposed development is expected to generate revenues of $2,371.5 million over 11 years in undiscounted real 2021 Australian dollars. This equates to $1,449.3 million revenue in NPV terms based on 7 per cent real discount rate as shown in Table 4 (this table shows selected years; full results are presented in **Appendix B**). In the context of this analysis, these are deemed to be *central case assumptions*, and subject to sensitivity analysis later in this report.

Table 4: Central case assumptions – coal production, real prices^, total revenue (selected years)

	Total	2022	2026	2030	2032
Production (Mt)					
Hard Coking Coal (Mt)	-	-	-	-	-
Thermal coal (Mt)	25.2	-	6.6	3.9	0.7
PCI coal (Mt)	-	-	-	-	-
Real price^					
Hard Coking Coal (Mt)		269.3	169.6	169.6	169.6
Thermal coal (Mt)		172.6	93.9	93.9	93.9
PCI coal (Mt)		144.3	126.4	126.4	126.4
Total Sales Revenue	2,371.5	-	616.7	364.4	64.0
Total Sales Revenue – NPV*	1,449.3				

*Source: UCMPL and EY estimates ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

Based on information provided by UCMPL, the operating costs for the proposed development are summarised in Table 5. The Proposed Modification is expected to generate revenue of $1,449.3 million in NPV terms, however, asset sales associated with the modification's end of life are conservatively assumed to be zero.

Operating costs including decommissioning costs were provided by UCMPL in undiscounted real rates and were estimated with a discount rate of 7 per cent to be $808.2 million in NPV terms. Mitigation

and management costs are estimated to be $32.7 million in NPV terms, which includes costs associated with the additional water licencing requirements and biodiversity offsetting arising due to the Proposed Modification's operations.

In terms of other costs:

► All capital expenditure is depreciated by the end of the operations.

► Royalties are based on standard NSW Government royalty rates of 7.2 per cent *ad valorem* for underground mines. A discount of $3.50 per ROM tonne is applied for washing as is allowed by the NSW Government.

These are deemed to be **central case assumptions**, and subject to sensitivity analysis later in this report.

Table 5: Central case assumptions –financials (selected years, $ million^)

	NPV*
Revenue	
Revenue from coal sales	1,449.3
Residual value of capital	-
Total Revenue	1,449.3
Costs	
Operating costs (incl. closure costs)	808.2
Mitigation costs	32.7
Depreciation	75.2
Royalties	100.5
Total Costs	1,016.5
Operating Profit	432.8

*Source: EY estimates based on information provided by UCMPL. ^ Real 2021 Australian dollars. ^^ Includes intermediate inputs, labour costs and payroll taxes paid * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

2.5 Direct benefits

Based on the Guidelines, the direct benefits to NSW of the proposed development are derived from three sources:

► The net producer surplus (profits) generated by the Proposed Modification that is attributable to NSW.

► The share of company tax payments (or net liabilities) that are attributable to NSW.

► Other tax payments such as royalties and payroll tax that are paid to the NSW and local government.

2.5.1 Summary of direct benefits to NSW

Based on the central case assumptions, the Proposed Modification is estimated to generate $144.9 million in total direct benefits to NSW in NPV terms, as outlined in Table 6.

Table 6: Central case - summary of direct benefits of the Proposed Modification to NSW ($ million^)

Direct benefits to NSW	NPV*
Net producer surplus attributable to NSW	0.0
Company income tax attributable to NSW	42.9
Payments to the NSW and local Government	102.1
Total financial benefit attributable to NSW	144.9

*Source: EY estimates based on information provided by UCMPL. ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

These benefits are comprised of $42.9 million in company tax attributable to NSW and $102.1 million in NPV terms paid to the NSW and local governments, in the way of coal royalties and payroll tax.

2.5.2 Net producer surplus attributable to NSW

Consistent with the Guidelines, the net producer surplus of the proposed development represents the private benefit, or operating surplus, generated that is attributable to NSW.

The Proposed Modification is estimated to generate an operating surplus of $419.1 million in NPV terms, see Table 7. The operating surplus is estimated using cash earnings and cash costs (cash costs are made up of both capital expenditure and operating costs (excluding depreciation)). $133.9 million in NPV terms is payable in the form of corporate taxes, levied on accrued Proposed Modification profits. Whilst it is possible that Glencore could offset some of the taxes paid with projects which generate a loss in a given year, it is expected that the Proposed Modification would generate around an additional $433.8 million in profit, which would counter some of the potential tax offsets that are being generated in the base case.

In total, the Proposed Modification generates a net producer surplus of $285.2 million in NPV terms. However, it is conservatively assumed that due to significant foreign ownership of the Proposed Modification, that zero per cent of the net producer surplus would be attributable to NSW.

Table 7: Central case - estimate of net producer surplus attributable to NSW ($ million^)

Key Data	NPV*
Total Revenue	1,449.3
Cash Costs	
Operating costs (incl. closure costs)	808.2
Mitigation and management costs	32.7
Capital	88.9
Royalties	100.5
Council rates and land tax	-
Total Costs	1,030.3
Net Producer Surplus before Tax	419.1
Company Tax^^	133.9
Net Producer Surplus	285.2
NSW share of modification ownership	-
Value of net producer surplus attributable to NSW	-

*Source: EY estimates based on information provided by UCMPL. ^ Real 2021 Australian dollars. ^^ Based on a 30 per cent company tax rate. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

2.5.3 Company tax attributable to NSW

Consistent with the Guidelines, the company tax payments made to the Australian Government are levied on the profits generated under the proposed development as summarised in Table 6. A company tax rate of 30 per cent is used to estimate the tax payments made to the Australian

Government under the assumption that all the operating profit generated by the Proposed Modification is subject to company tax in Australia (for example, ignoring debt financing costs). Consistent with the Guidelines, company tax is attributable to NSW based on the State's share of population, which is 32 per cent.

As summarised in Table 8, it is estimated the proposed development will generate $432.8 million in taxable profit in NPV terms (this is an estimate of the accounting profit from which company taxes are calculated). At a company tax rate of 30 per cent, the company tax estimate is $133.9 million in NPV terms, of which $42.8 million is attributable to NSW.

Company taxes are estimated based on operating profits, which is on an accrued basis and recognises yearly depreciation costs rather than the full capital costs upfront. Operating profit is generally higher than operating surplus (the basis for estimating net producer surplus), which is on a cash basis and thus recognises the full capital costs upfront.

Table 8: Central case - company income tax attributable to NSW ($ million^)

Company tax attributable to NSW	NPV*
Total Revenue	1,449.3
Total Operating Costs	1,016.5
Operating Profit	432.8
Company Tax^^	133.9
NSW share^^^	42.8

*Source: EY estimates based on information provided by UCMPL. ^ Real 2021 Australian dollars. ^^ Based on a 30 per cent company tax rate. ^^^ Based on a 32 per cent population share. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

2.5.4 Payments to the State and the local Council

Under the proposed development, various payments will be made to NSW Government to extract and process coal in the State.

These are made up of three types of payments: coal mining royalties and payroll tax paid to the NSW Government. Over the life of the proposed development, a total of $102.1 million in payments are made in NPV terms (Table 9). This is made up of $100.5 million of royalty payments and $1.6 million in payroll tax to the State of NSW.

Table 9: Central case - total payments to State Government and local Council ($ million^)

Payments to NSW	NPV*
Total Royalties paid	100.5
Payroll taxes	1.6
Total Payments	102.1

*Source: EY estimates based on information provided by UCMPL. ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

2.6 Indirect Benefits to NSW

Based on the Guidelines, the indirect benefits to NSW of the proposed development are derived from three sources (see Appendix D for detailed methodology):

► The net economic benefit to workers in NSW

► The net economic benefit to suppliers in NSW

► Any landowner premiums attributable to the Proposed Modification.

2.6.1 Summary of indirect benefits to NSW

Consistent with the Guidelines, the indirect benefits of the proposed development that accrue to workers, suppliers and landowners are summarised in Table 10. The total indirect benefits are estimated to be $147.7 million in NPV terms. The main source of these benefits is $15.8 million to workers and $131.9 million to suppliers in NPV terms. There are no anticipated benefits to landowners as a result of the Proposed Modification. A further discussion and justification for the inclusion of these benefits are outlined in **Appendix D**.

Table 10: Central case - summary of indirect benefits of the Proposed Modification to NSW ($ million^)

Indirect benefits to NSW	NPV*
Net economic benefit to workers	15.8
Net economic benefit to suppliers	131.9
Landowner premiums (land sales made above market rates)	0.0
Total indirect benefit	147.7

*Source: EY estimates based on information provided by UCMPL. ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

2.6.2 Benefit to workers

Consistent with the Guidelines, a key factor in determining the benefit to workers are defined as the:

► Wages earned at the UCC

► Minus the opportunity cost of labour for working in the mining sector, that is compared to working in non-mining sectors (or being unemployed)

► Minus the wage difference due to skills and the disutility to work in the mining industry.

UCMPL provided EY with full-time equivalent (FTE) employment under the Proposed Modification, as well as average wages paid per broad level of occupation.

UCMPL advises that there would be no additional employment generated by the Proposed Modification throughout the currently approved life of mine. However, the Proposed Modification seeks to extend the current life by an additional two years, with mining activities nominally expected to cease by 2033. As a result, only the those employed on the Proposed Modification from 2031 to 2033 have been considered in the estimation of worker benefits.

UCMPL advises that the average pre-tax wage (including leave entitlements and superannuation) for an FTE employee at the UCC is $199,789.4 per annum on average upon commencement of the Proposed Modification (and is assumed to remain fixed over the period).

Total incremental wages paid to employees is estimated at $29.6 million in NPV terms.

Table 11: Central case – employee wages under the proposed development (selected years)

	NPV*	2022-2030	2031	2032	2033
Employment (FTEs)		-	243.8	25.2	26.5
Average wages ($ per annum^)		199,789.4	199,789.4	199,789.4	199,789.4
Total wages paid ($ million^)	29.6	-	48.7	5.0	5.3

Note: Those employed throughout the currently approved lifetime of the mine are excluded from the analysis. Source: UCMPL and EY estimates. ^Real 2021 Australian dollars. NPV in 2021 Australian dollars based on a 7 per cent real discount rate.

To measure the **opportunity cost** compared to working in the non-mining sector, the average wage earned by workers at the UCC is compared to the likely wages that would be earned by employees at outside of the Proposed Modification if the Proposed Modification does not proceed. Employment throughout the current approved lifetime of the mine is not expected to increase, as such, any

indirect benefits arising from employment have been assessed based only on the two expected additional years of operation.

The reservation wage is constructed as a weighted average of the wages paid to occupations not in the mining sector in NSW. The weights are given by the occupational distribution of those found working in the coal mining sector. Additionally, the reservation wage is adjusted upwards to account for the differential in hours worked between those in the coal mining sector and those employed in the wider economy. This implies that, should the Proposed Modification not go ahead, those who would have been employed at the UCC would instead find alternative work at the average wage afforded to their occupation in NSW, this driven in part by projected slowdowns in production in the coal sector[19]. These arguments are further justified and expanded upon in **Appendix D**. The weighted average *reservation wage* is estimated to be $93,141.3 per annum in real 2021 Australian dollars (Table 12).

Table 12: Central case – estimated NSW worker benefit (selected years)

Indirect benefits - workers	NPV*	2022-2030	2031	2032	2033
Reservation wage ($ per annum^)		93,141.3	93,141.3	93,141.3	93,141.3
Mining wage ($ per annum^)		199,789.4	199,789.4	199,789.4	199,789.4
Total wages paid ($ million^)					
Reservation wage	13.8	-	26.0	2.7	2.8
Mining wages at Ulan Complex	29.6	-	48.7	5.0	5.3
Estimated worker benefit ($ million^)	15.8	-	22.7	2.3	2.5

*Note: Those employed throughout the currently approved lifetime of the mine are excluded from the analysis. Source: Ulan, ABS (Table W17) Census (2016) Occupational Total Personal Income (Weekly) by Hours Worked and EY estimates. ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

As shown, there is a significant premium incorporated in mining wages compared with the average wage paid in NSW. There are a number of likely reasons for this premium that might be explained by relative skill and productivity levels. In relation to the latter, mining employees are more productive than workers in other industries as they operate with higher levels of capital (for example, based on capital stock figures produced by the ABS, miners work with over 10 times the amount of capital than average employees across Australia). A discussion on the justification for the use of the weighted-average wage paid to occupations not in the mining sector is included in **Appendix D.**

A further consideration is whether workers would experience more or less disutility being employed at the UCC, and working on the Proposed Modification, compared with any alternate employment. In this context, it is assumed that employees would find alternative, and potentially non mining-related, employment once the currently approved operations end, should the Proposed Modification not go ahead. It is the relative disutility of such work against mining related work that is a key consideration.

However, any metrics around the disutility of working in mining are very difficult to ascertain in both an absolute (mining specific) or relative (compared with other industries) manner. One reasonable approximation for the mining specific levels of disutility are the hardship allowances paid to employees. For example, the Black Coal Mining Industry Award 2010[20] provides for the payment of an Underground allowance at 0.23 per cent per day above the standard rate/reimbursement to an adult employee who works underground in any shift. These rates appear to be non-material in comparison to the differences in wages paid to workers not in the mining industry.

Furthermore, in assessing the safety of the mining sector relative to comparable industries, we find that according to statistics gathered by Safe Work Australia[21], the mining sector has recently outperformed on a claims per million hour basis relative to comparable industries such as

---

[19] Nick Wood, Maddy Beauman & Philip Adams, 2021, The sensitivity of the NSW economic and fiscal outlook to global coal demand and the broader energy transition for the 2021 NSW Intergenerational Report

[20] Fair Work Ombudsman, Black Coal Mining Industry Award 2010

[21] Safe Work Australia National Data Set for Compensation-based Statistics (NDS).

construction, agriculture and manufacturing. Thus, it is unclear whether there is any significant disutility incurred from working in the mining sector relative to other industries. As is shown in Table D.26, in **Appendix D.2.3**, not only has the mining sector as a whole reduced its claims per million hours worked by 57 per cent since 2000, the sector, from 2013 to 2019 enjoyed lower claims per million hours worked relative to the construction and manufacturing industry, having levels comparable to retail trade.

Given these minor allowances for working in a coal mine and the measurement difficulties associated with measuring these disutilities generally, EY have assumed that the disutility for workers at the UCC relative to other employment sectors in NSW is zero, after accounting for the hours worked[22]. This implies, effectively, that those workers employed at the UCC experience minimal additional disutility from working at the UCC compared with any alternative employment they would have secured in the absence of the Proposed Modification.

Based on these assumptions, the estimated *worker benefit* is $15.8 million in NPV terms. A sensitivity analysis of the impact of varied supplier benefits is included in **Appendix D**.

2.6.3 Benefit to suppliers

Consistent with the Guidelines, the economic benefit to suppliers is estimated as a producer surplus generated for NSW firms that provide goods and services to the proposed development. These supplier benefits are effectively the operating profits made by suppliers associated with the additional provision of good and services relative to the base case. As summarised in Table 13, based on the input cost data provided by UCMPL, the proposed development is estimated to use $778.3 million in intermediate inputs supplied from NSW over its life-cycle in NPV terms. Currently, 84 per cent of the inputs for the complex are supplied from NSW-based businesses and it is assumed this would also be the case with the Proposed Modification.

The estimated economic benefit to suppliers (producer surplus) is based on the EY Regional Input-Output Model (EYRIOM). This model was customised to generate an NSW-specific Input-Output table to not include benefits generated in other Australian states.

The producer surplus estimates are based on Type I multipliers which limit the benefit to direct value added generated by NSW suppliers. This methodology does not account for second round, nor induced consumption, effects, that are captured within the CGE modelling. Using this relatively conservative technique, the total supplier benefits are estimated to be $131.9 million in NPV terms.

Table 13: Central case – estimated supplier benefits

Indirect benefits - suppliers	NPV*
Total intermediate inputs ($ million^)	778.3
Share from NSW (Per cent)	84.0
Total intermediate inputs supplied from NSW ($ million^)	653.8
Gross operating surplus ratio	0.2
Total benefits to suppliers (NPV*)	131.9

*Source: EY estimates based on information provided by UCMPL. ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.*

---

[22] It should be noted that typical arguments for the inclusion of a disutility premium for working in a mine are due to the fact that those employed in the mining industry will typically work longer hours and would be generally working in shifts. Whilst longer hours worked may be typical for the mining sector, the reservation wage has been adjusted upwards to account for these differentials in hours worked. Conversely, shift work is not unique to the mining sector, and is observed throughout the labour market in various sectors, any disutility that could potential arise from working in the mining sector, due to shift work, could also potentially be observed throughout the economy. Therefore, on a net basis, it is assumed this effect is zero.

2.7 Indirect Costs to NSW

Consistent with the Guidelines, the Proposed Modification's indirect costs cover a range of net environmental, social and transport-related costs, the net public infrastructure costs, and finally the estimated loss of surplus to other industries (listed in Table 14).

Consideration of these costs are based on a range of assessments undertaken by specialised consultants for the Proposed Modification such as Greenhouse Gas Assessment and Groundwater Assessment. A detailed list of specialised assessments considered is provided in **Appendix A**.

This section outlines the calculation of both the total indirect costs, as well as the incremental costs of the Proposed Modification. It is the calculation of incremental costs that are accounted for in the CBA.

The incremental costs are those attributable by the Proposed Modification that are not already included in the Proposed Modification financials (and therefore already accounted for in the CBA). The total indirect incremental costs for the Proposed Modification to NSW are $0.019 million.

Appendix C provides more detail on how the indirect environmental costs have been assessed based on the relevant environmental assessments provided.

In addition, there are several environmental costs that are internalised by UCMPL, of which the company would spend $32.7 million in NPV terms over the life of the operation. These costs include:

► Purchasing requisite water rights; and

► Implementing a biodiversity off-set strategy.

These costs are classified as indirect costs of the Proposed Modification, however, to avoid double counting, are excluded from the incremental costs as they are already included in the operational costs of the Project. UCMPL has provided EY with the year-on-year cost estimates for each of the environmental mitigation and management measures. Several of these anticipated costs are subject to commercial negotiation and therefore have been aggregated into mitigation and management costs and included in the total UCC costs.

Table 14 provides a summary of the assessment methods used for calculating the Proposed Modification's indirect costs. In total, the Proposed Modification is estimated to generate $32.7 in NPV terms of incremental indirect costs (being comprised of the incremental costs associated with the Proposed Modification's Scope 1 and 2 greenhouse gas (GHG) emissions, impacts to surface water, groundwater impacts and biodiversity impacts). Material incremental costs include:

► GHG emissions costs of $0.019 million in NPV terms (based on population)

► Water licencing

► Offsetting costs

GHG emissions costs are based on the life-of-mine GHG emissions (Scope 1 and Scope 2 emissions)[23], per ROM tonne, scaled to the Proposed Modification plan figure (i.e. 27 Mt of ROM coal for the Proposed Modification). The year-on-year emissions [24] are multiplied by an estimated social cost of carbon[25], ranging from $76.52 per tonne of emitted CO_2-e to $95.65 over the life of the Proposed Modification. The total global externality costs of $17.9 million are estimated based on the growth in

---

[23] Greenhouse Gases associated with the burning of coal from this facility are excluded from this assessment. This is because the EIA Guidelines and Technical notes do not require consideration of Scope 3 emissions. The impacts on climate change from Scope 3 emissions are therefore excluded from this analysis.

[24] Estimated by Umwelt (Australia) Pty Limited for UCC in *Greenhouse Gas and Energy Assessment*

[25] Technical Support Document: Social Cost of Carbon, Methane, (whitehouse.gov)

the price per tonne of $76.52 per tonne of emitted CO2-e to $95.65 over 2023 to 2032, and the respective annual GHG gas emissions per annum.

Attributing the GHG costs based on the NSW population, consistent with the Guidelines, results in an attributed GHG cost of $0.019 million to NSW in NPV terms.

Table 14: Summary of indirect costs impacts ($ million^)

Scope of environmental costs	Assessment type	NPV*
Indirect costs		
Greenhouse gas emissions (Scope 1 and Scope 2 only)	Quantitative	0.019
Air quality impacts	Quantitative	0.0
Loss of surplus to other industries	Quantitative	0.0
Net public infrastructure costs	Quantitative	0.0
Residual value of land	Quantitative	0.0
Transport/ traffic impacts	Quantitative	0.0
Visual amenity	Quantitative	0.0
Mitigation and management cost		
Aboriginal cultural heritage and historical heritage	Qualitative	^^
Ambient noise impacts	Quantitative	^^
Biodiversity impacts	Quantitative	^^
Greenhouse gas emissions	Quantitative	^^
Subsidence impacts	Quantitative	^^
Water impact - including surface and ground water	Quantitative	^^
Total mitigation and management costs		32.7
Indirect costs		0.019

*Source: EY estimates based on information provided from Ulan and relevant environmental assessments for the Proposed Modification. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate. ^^ Confidential, included in the total internalised costs.*

2.8   Net Benefits – Sensitivity analysis

Consistent with the Guidelines, this section outlines a summary of the systematic sensitivity analysis undertaken for the Proposed Modification. The sensitivity analysis considers all key areas of the CBA, particularly coal prices, key costs (both capital expenditure and operating costs) as well as worker benefits. Where there are considered to be higher levels of potential uncertainty with the figures, a range of plus/minus 25 per cent is used. In areas where the figures are deemed more certain, a range of plus/minus 10 per cent is used. The sensitivity analysis is comprised of the following:

► Revenue sensitivity

    ► Higher/lower price assumptions, where coal prices are increased/decreased by 25 per cent based on the central case assumptions over the life of the operation[26]

► Cost-base sensitivity

---

[26] The World Bank (April 2022) Commodity Market Outlook forecasts estimate a nominal U.S Dollars estimate of coal prices to range between USD 250 and USD 154.7, between 2022 and 2024, these estimates are broadly within the upper 25 per cent sensitivity bound tested, relative to the KPMG Consensus Forecasts utilised within the CBA modelling. However, in 2024, the current prices utilised are roughly half of those estimated by the World Bank. This could suggest persistent and long-term price strength could be observed in the thermal coal market, with the CBA modelling assuming a much more conservative stance.

- ► Higher/lower operational expenditure (increase/decrease by 10 per cent based on the central case)

- ► Higher/lower capital expenditure (increase/decrease by 10 per cent based on the central case)

► Worker and Supplier assumptions

- ► Increased the reservation wage by 25 per cent due to a higher assumed disutility of working at the UCC

- ► Reduced supplier benefits of 10 per cent from central case assumptions

► Higher environmental costs (increased by 10 per cent)

► Discount rate sensitivity, using a 4 per cent and a 10 per cent real discount rate (see **Appendix B**).

In addition, upper and lower bound estimates are undertaken which assume:

► *'Pessimistic' scenario*, the coal price is reduced by 25 per cent, operational and capital expenditure are increased by 10 per cent, the reservation wage for mining is increased by 25 per cent, and supplier benefits are lowered by 10 per cent compared with central case assumptions.

► *'Optimistic' scenario*, the coal price is increased by 25 per cent, operational and capital expenditure are decreased by 10 per cent, the disutility of the mining wage premium is set to zero and supplier benefits are increased by 10 per cent compared with central case assumptions.

2.8.1 Results of sensitivity analysis

The results of the systematic sensitivity analysis are summarised in Figure 8. This sensitivity analysis shows that the estimated net benefits are *robust* in the sense that they remain (strongly) positive after testing all key assumptions underpinning the analysis.

In isolation, the estimated net benefit of the Proposed Modification is most sensitive to the coal price assumptions underpinning the analysis, but even assuming coal prices are 25 per cent lower than under the central case assumptions the net benefits are estimated to be $236.6 million in NPV terms, a reduction of 19 per cent from the central case assumptions.

The lower bound, or pessimistic case, estimate of net benefits, which takes the combined assumptions around coal prices, capital expenditure, operational expenditure as well as worker, environmental impacts and supplier benefits, yields an estimated net benefit of $226.4 million in NPV terms. The upper bound, or optimistic, estimate, based on the combined optimistic assumptions, is $355.7 million in NPV terms.
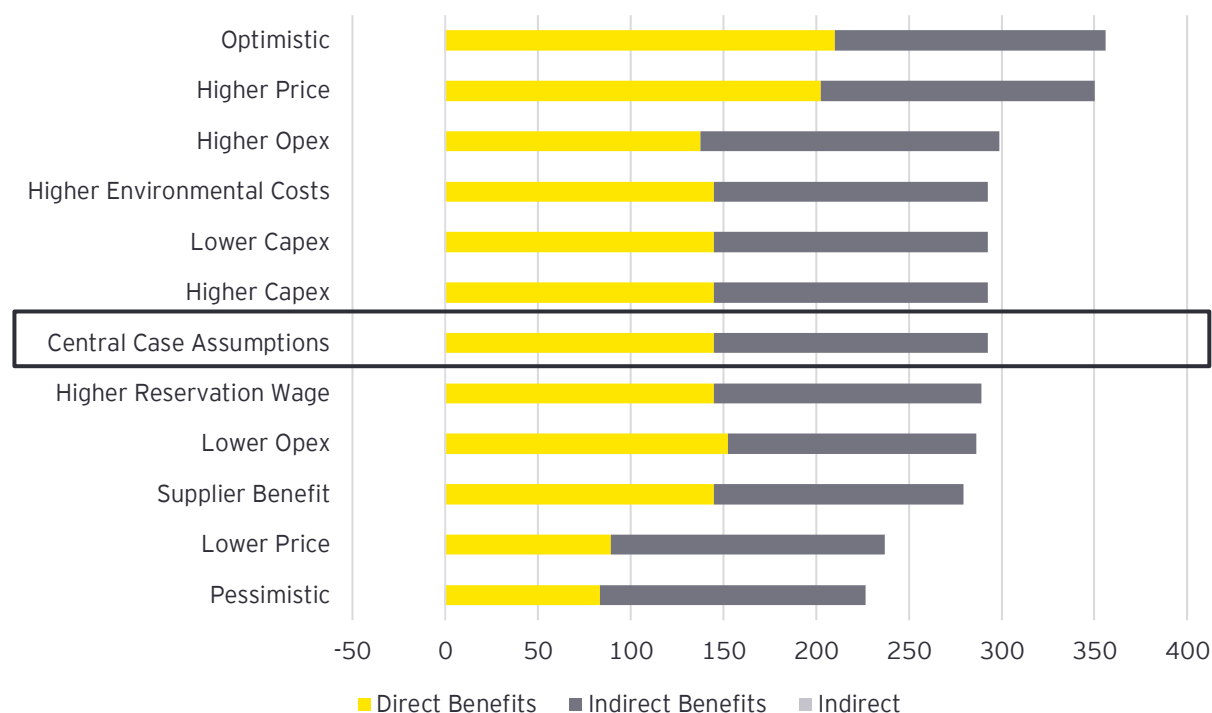
Source: EY estimated based on information from various sources. * NPV in real 2021 Australian dollars based on a 7 per cent real discount rate. Indirect costs have been included in the figure.

It can also be inferred from the sensitivity analysis how large the non-quantified negative externalities would need to be before the proposed development would no longer represent a net benefit to the NSW community. Using the most conservative estimate, the most pessimistic assumptions, these externalities would need to be $226.7 million in NPV terms before the proposed development would represent a net negative return to NSW. Even if assuming that all indirect benefits were zero, the value of externalities would have to be around $83 million to outweigh the direct benefits that the Proposed Modification will generate for the state of NSW.

Given the relatively long timeframe of the Proposed Modification (2022 to 2035) the net benefits are sensitive to the discount rate used for the analysis. Under central case assumptions, the proposed development is expected to generate $292.6 million of net benefit using a 7 per cent discount rate. Using a 4 per cent discount rate increases the net benefit to $359.5 million; conversely a 10 per cent discount decreases the net benefit to $240.3 million. Sensitivities based on a discount rate of 4 per cent and 10 per cent are required by the Guidelines.

In addition, the sensitivity analysis has been extended to test the impact of a full range of worker and supplier benefits, (see **D.4** for full results). In the case where we reduce worker benefits to 25% of the full estimate, the Proposed Modification still yields a net benefit of $280.8 million in NPV terms, while reducing supplier benefits to 75% of the full estimate has the impact of reducing the benefit of the Proposed Modification to $259.6 million in NPV terms.

Appendix B provides a detailed account of the direct and indirect benefits and the indirect costs for each of the sensitivities conducted. The analysis shows that the net benefits of the Proposed Modification remain *robust* under various assumptions. In addition, if conservatively the indirect benefits were all set to zero, that is suppliers were assumed to gain no benefit and workers reservation wages are equal to those earned in the Ulan mine, the net benefits to NSW would remain positive.

3.   Local Effects Analysis

Consistent with the Guidelines, the LEA uses a similar framework to the CBA presented in the previous section but is focussed on the net economic impacts to the local community. The Guidelines refer to the local area as being consistent with the relevant SA3 as defined by the Australia Bureau of Statistics. In the case of this Proposed Modification the Lithgow-Mudgee SA3 area is used for the LEA.

3.1   The Lithgow-Mudgee region

As shown in Figure 9, the Lithgow-Mudgee region is located to the north-west of Sydney. In 2020 the Lithgow-Mudgee region has an estimated resident population of approximately 48,148 (ABS, 2021). The region is home to several coal mines such as the Moolarben Coal Complex and the Wilpinjong Coal Mine.
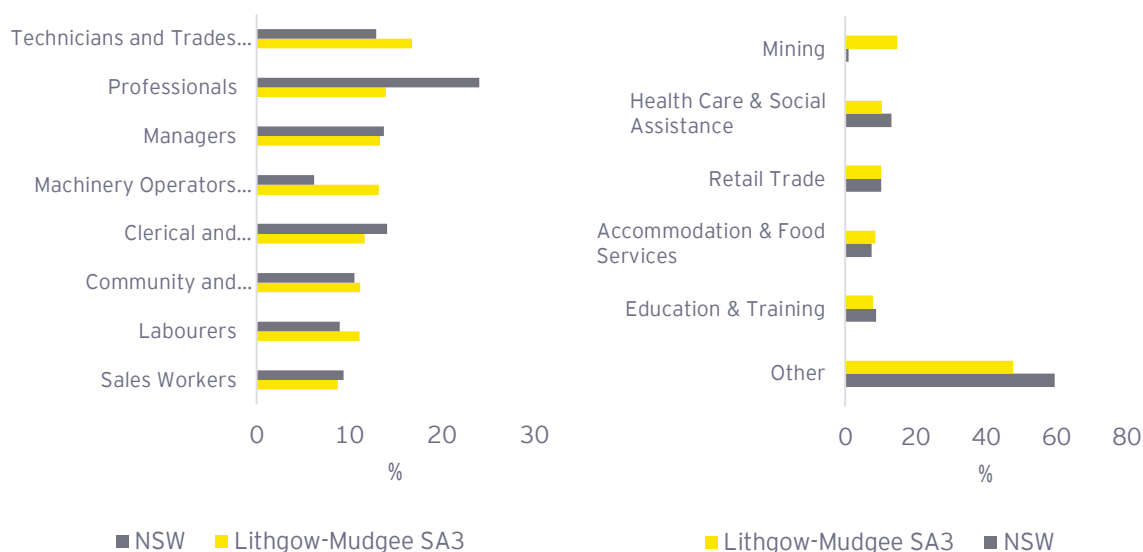
Figure 9: Lithgow-Mudgee SA3
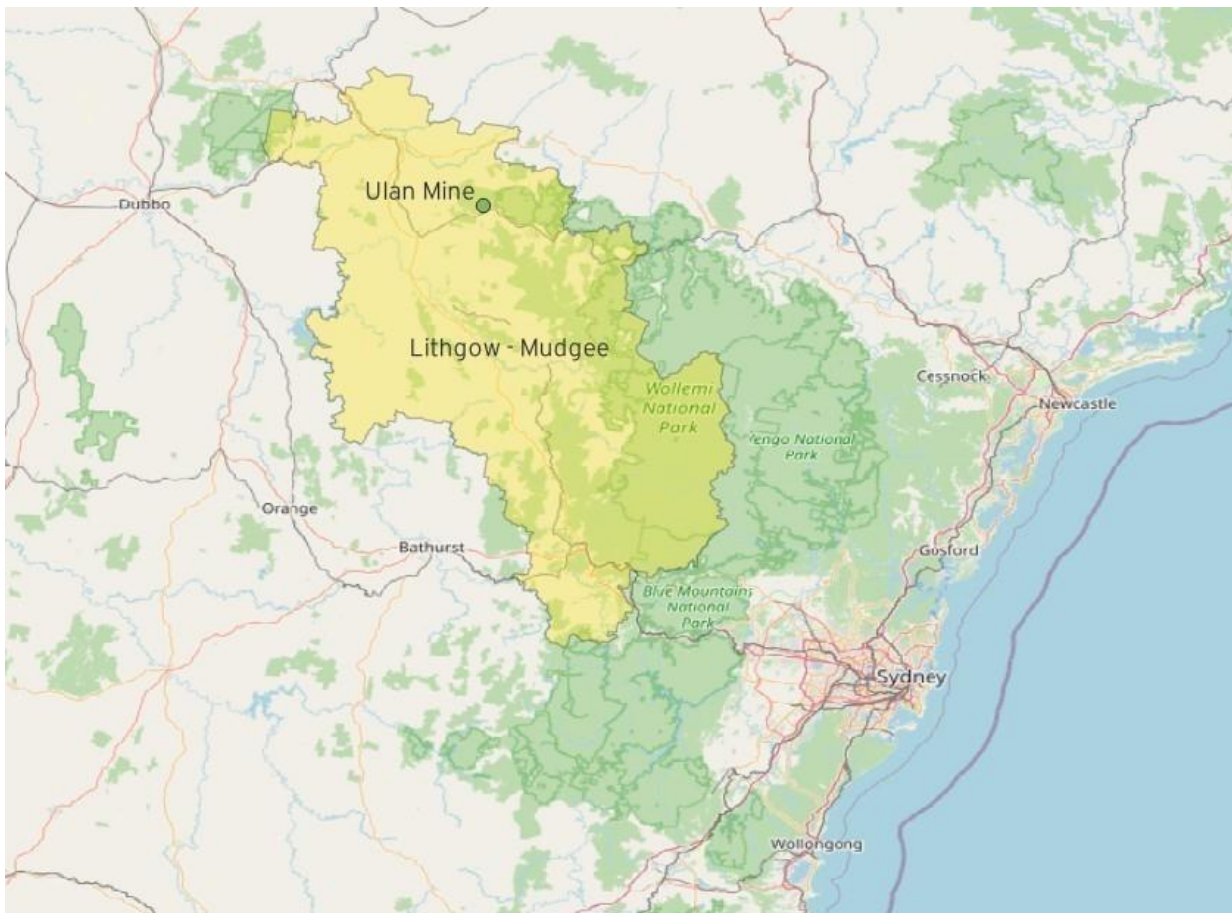
Source: Australian Bureau of Statistics (2018B), Openstreetmap

The UCC and access areas are in the northern part of the SA3 and situated north-east of Mudgee.

3.1.1 Regional characteristics

Figure 10 and Figure 11 describe the employment and education characteristics of persons who reside within the Lithgow-Mudgee SA3 region. The region can generally be classified as being dependent on the mining industry, with a higher-than-average proportion of trades workers, machinery operators and drivers working within the mining sector.

Figure 10: Employment shares by occupation (left) and by industry (right, top 5 and mining), per cent of total employed

The region is a major producer of coal exports, with approximately 14.8 per cent of residents in the region employed in the mining sector. As such, the mining sector is the largest employer in the Lithgow-Mudgee region, and share of those employed within the mining sector relative to NSW is almost 15 times higher. In terms of occupations, technicians and trade workers account for around 16.7 per cent of the workforce in the region, compared to 12.9 per cent for NSW. Similarly, machinery operators and drivers account for 13.7 per cent, more than double the state-wide average of 6.2 per cent.

Figure 11: Education attainment in each region, per cent
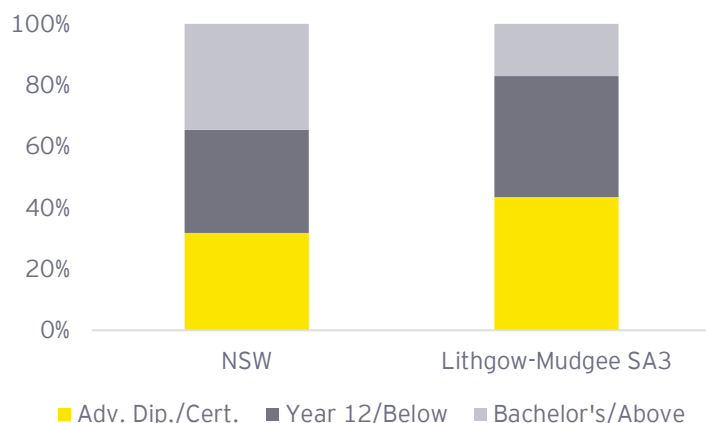
The region's workforce also has a relatively high proportion of workers with a Certificate III and IV attainment. Workers with Certificate III and IV account for 43.5 per cent of the region's workers, compared to 31.7 per cent for NSW.

Both the educational attainment and occupational structure is a result of the high share of mining employees in the region.

3.1.2 Employment outcomes

Figure 12 shows total employment in the Lithgow-Mudgee SA3 region and the NSW economy, from December 2010 to September 2021. Employment in the region has been growing since July 2018, remaining relatively strong despite the labour market impacts of COVID-19. Employment in the region currently stands at around 23,000 workers.
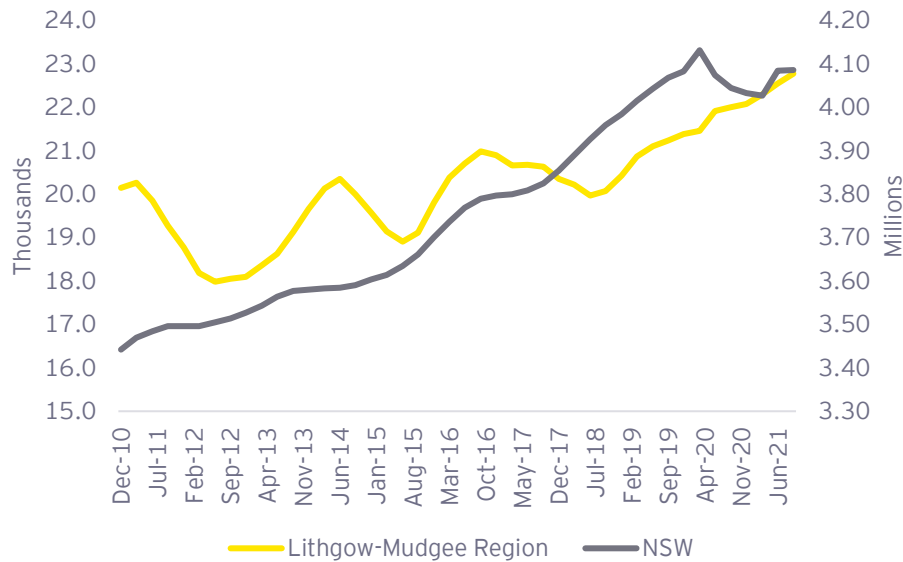
Source: Department of Jobs and Small Business, *SA2 Data tables – Small Area Labour Markets – September quarter 2021* (September 2021)

As shown in Figure 13, unemployment in the region has been consistently higher than NSW until late 2019, where unemployment has remained slightly below the NSW average. Throughout 2020, the region experienced an unemployment rate at between 4 per cent and 5.5 per cent.

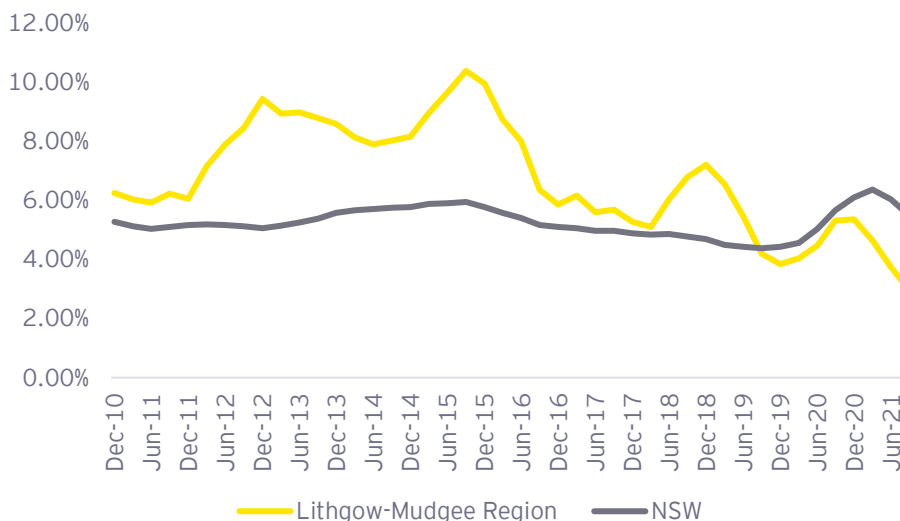Figure 13: Unemployment rate (per cent), Lithgow-Mudgee SA3 and New South Wales

Source: Department of Jobs and Small Business, SA2 Data tables – Small Area Labour Markets – September quarter 2021 (September 2021)

3.2   Local Effects Analysis results

The LEA accounts for the economic benefits to the Lithgow-Mudgee region only. It does not include any economic benefits that may accrue to the major regional centres that are located adjacent, including the wider Newcastle and Sydney regions.

Given the nature of coal operations and the proximity to major population centres, many of the inputs may be supplied from the broader region. In addition, analysis from the UCC indicates over the life of the development only a proportion of the inputs will be supplied from the Lithgow-Mudgee region, however, most employees at the mine reside within the area. As a result, this Proposed Modification would generate economic benefits to these regions; for example, those supplies that are sourced from the Sydney and Newcastle communities to the east of the UCC.

Underpinning the LEA are the assumptions that:

► No net producer surplus accrues to the region (conservative assumption)

► No company income tax accrues to the Lithgow-Mudgee SA3 region (conservative assumption)

► Based on information provided by UCMPL, 93 per cent of the workforce requirement of the proposed development come from the SA3 region

► 19 per cent of suppliers are located within the Lithgow-Mudgee

► While the indirect costs associated with GHG have been apportioned to the estimated residential population within the region.

As a result of these assumptions, it is expected the proposed development will generate indirect benefits to local suppliers and employees of $29.8 million and $15.4 million respectively in NPV terms over the no Proposed Modification case, as outlined in Table 15. The incremental indirect costs associated with the Proposed Modification are allocated to the SA3 region. The proposed development is estimated to confer a net benefit on the Lithgow-Mudgee SA3 region of $45.2 million in NPV terms.

Table 15: Estimated Local Effects Analysis of the proposed development ($ million^)

Benefits	NPV*	Costs	NPV*
Direct benefits		Direct costs	
Net producer surplus attributed to NSW			
Royalties, payroll tax and Council rates			
Company income tax apportioned to NSW			
Total direct benefits		Total direct costs	-
Indirect benefits		Indirect costs	
Net economic benefit to landholders	-	Air quality	-
Net economic benefit to NSW workers	15.4	Greenhouse gas emissions^^	0.000
Net economic benefit to NSW suppliers	29.8	Noise impact^^	-
		Transport impact	-
		Net public infrastructure cost	-
		Surface water impact^^	-
		Groundwater^^	-
		Biodiversity impact^^	-
		Loss of surplus to other industries	-
		Visual amenity	-
		Aboriginal cultural heritage^^	-
		Historical heritage^^	-
		Other	-
Total indirect benefits	45.2	Indirect Costs	0.0
Total economic benefits	45.2		
NPV of the Proposed Modification - ($m)	45.2		

*Source: EY estimated based on information from various sources. ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate. ^^ Incorporated in operational costs.*

## 3.3   Sensitivity analysis

As outlined above the LEA relies on a number of modelling assumptions. Consistent with the Guidelines, this assessment provides a summary of the systematic sensitivity analysis undertaken for the proposed development. The sensitivity analysis tests the same assumptions outlined in the CBA.

The main drivers for the regional impact are the supplier and employee benefits. Those sensitivities that change the supplier benefits through lower operational costs, lower supplier benefit or employee benefit have the greatest impact on the regional net benefit.

The results of the systematic sensitivity analysis are summarised in

Figure 14. This sensitivity analysis shows that the estimated net benefits are robust in the sense that they remain (strongly) positive after testing all key assumptions underpinning the analysis. Full details of the sensitivity analysis is presented in Appendix B. The lower bound, or most pessimistic case, estimate of net benefits, which takes the most pessimistic assumptions around coal prices, capital expenditure, operational expenditure as well as worker and supplier benefits, yields an estimated net benefit of $45.2 million in NPV terms. The upper bound, or the optimistic, estimate, based on the most optimistic assumptions, is $48.3 million in NPV terms.

Figure 14: Systematic sensitivity analysis of the LEA to key assumptions (NPV*, $ million^)
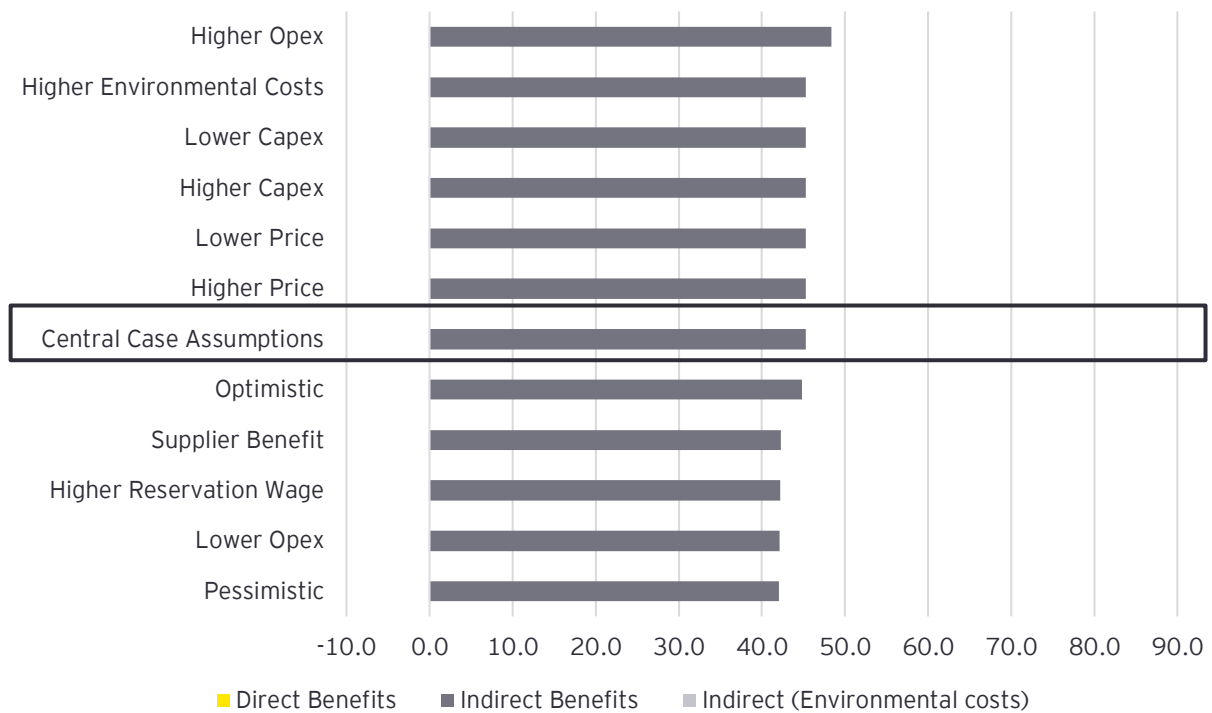
Source: EY estimated based on information from various sources. ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate.

Given the relatively long timeframe of the UCC operations including the Proposed Modification (2022 to 2035) the net benefits are sensitive to the discount rate used for the analysis. Under the central case assumptions, the Proposed Modification is expected to generate $45.2 million of net benefit using a 7 per cent discount rate. Using a 4 per cent discount rate increases the net benefit to $57 million; conversely a 10 per cent discount decreases the net benefit to $36.3 million.

4. Computable General Equilibrium Modelling Framework

The economy-wide impacts of the proposed development have been undertaken using a CGE model of the regional and NSW economy.

The aim of an economic impact study based on applied CGE modelling is to estimate the net benefit of the proposed development on economic activity and the living standards of those residing within the Lithgow-Mudgee SA3, the same region used for the LEA analysis, and in NSW.

CGE modelling is the preferred technique to assess the impacts, and second round flow on effects[27] of large projects, as they are based on a more detailed representation of the economy, including the complex interactions between different sectors of the economy.[28] As a CGE model is able to analyse the impacts of the proposed development in a comprehensive, economy-wide framework meaning the modelling captures:

► *Direct increases in demand* associated with the proposed development (short term construction activity) as well as the assumed increases output attributable to increased coal production.

► *Indirect increases in demand*, or flow-on effects associated with increased economic activity relating to both the construction phase of development and additional coal production.

► *Labour market displacement* caused by the direct increase in demand from a project of this nature (and the associated investment) on other sectors of the economy bidding up wages and 'crowding out' other sectors of the economy.

► *Revenue leakage* associated with the expropriation of profits from the Proposed Modification to overseas interests (in this case, Ulan).

4.1 About the EY CGE model

Economy-wide impacts of the Proposed Modification are assessed based on the EY General Equilibrium Model (EYGEM). EYGEM is a large scale, dynamic, multi-region, multi-sector model of the global economy, with an explicit representation of the Lithgow-Mudgee SA3 and the NSW economy. EYGEM is based on a substantial body of accepted microeconomic theory.

The model projects change in macroeconomic aggregates such as real gross state product (real GSP) which is an output measure of the NSW economy and real gross state income (real GSI) which is a welfare measure for NSW residents. At a regional level the model projects change in real gross regional product (real GRP) and real gross regional income (real GRI). The model also projects state-wide and regional employment, export volumes, investment and private consumption. At the sectoral level, detailed results such as output, exports, imports and employment are also produced. A brief description of the model is presented in Box 1.

Importantly, in terms of interpreting the results as well as for consistency with the CBA analysis, real GSI represents the preferable welfare measure to the commonly reported change in real GSP (a measure of production). As a measure of income, Pant et al (2000) show how the change in real GSI is a good approximation to the *equivalent variation* welfare measure in global CGE models such as EYGEM. This measure is widely used by practitioners and can also be decomposed into various components to assist in the analysis of results. Real GSI is computationally more convenient than (say) an equivalent variation, and a more familiar concept to explain to decision makers (Layman, 2004).

---

[27] NSW Government (2015) Guideline for the economic assessment of mining and coal seam gas proposals.

[28] See for example the Policy & Guidelines Paper produced by the NSW Treasury (2009).

As noted by Pant et al (2000), in considering welfare results in global CGE such as EYGEM, the main components are the change in: output (measured by real GSP), terms of trade and payments to foreigners. Of relevance in the discussion around estimating the net benefits of the proposed development are the terms of trade effects. These can be closely linked to changes in labour market conditions because any increase in real wages as a result of higher levels of coal exports will result in an improvement in the terms of trade and, hence, welfare.

Box 1: An overview of EYGEM

The EY General Equilibrium Model (EYGEM) is a multi-commodity, multi-region, dynamic model of the world economy. Like all economic models, EYGEM is based on a range of assumptions, parameters and data that constitute an approximation to the working structure of an economy. Its construction has drawn on the key features of other economic models such as the global economic framework underpinning models, such as GTAP and GTEM, with state and regional modelling frameworks such as Monash-MMRF and TERM.

Labour, capital, land and a natural resource comprise the four factors of production. On a year-by-year basis, capital and labour are mobile between sectors, while land is mobile across agriculture. The natural resource is specific to mining and is not mobile. A representative household in each region owns all factors of production. This representative household receives all factor payments, tax revenue and interregional transfers. The household also determines the allocation of income between household consumption, government consumption and savings.

Capital in each region of the model accumulates by investment less depreciation in each period. Capital is mobile internationally in EYGEM where global investment equals global savings. Global savings are made available to invest across regions. Rates of return can differ to reflect region specific differences in risk premiums.

The model assumes labour markets operate in a model where employment and wages adjust in each year so that, for example, in the case of an increase in the demand for labour, the real wage rate increases in proportion to the increase in employment from its base case forecast level.

EYGEM determines regional supplies and demands of commodities through optimising behaviour of agents in perfectly competitive markets using constant returns to scale technologies. Under these assumptions, prices are set to cover costs and firms earn zero pure profits, with all returns paid to primary factors. This implies that changes in output prices are determined by changes in input prices of materials and primary factors.

In terms of specifying the elasticity of labour supply, this analysis follows the lead of the Australian Treasury and use a labour supply elasticity assumption of 0.15, which indicates a relatively 'inelastic' response from workers.

The below diagram is a visual representation of the EYGEM model.
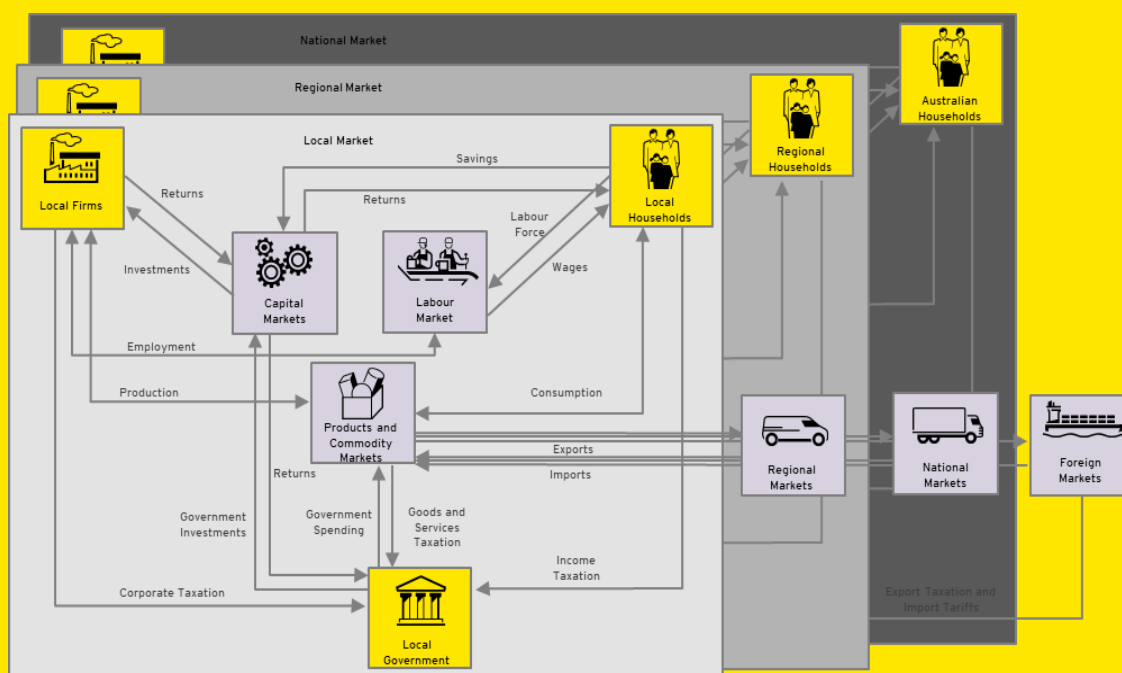
That noted, real GSI does not capture some non-market effects that can impact on the living standards of NSW residents. These could include impacts such as the noise impacts for residents or pollution as considered in the detailed CBA above.

EYGEM is a recursive dynamic model that solves year-on-year over a specified timeframe. The model is used to project the relationship between variables under different scenarios over a predefined period. A typical scenario is comprised of a reference case projection (or the Base case scenario) that forms the basis of the analysis. In this instance, the reference case assumes no proposed development investment or coal output from the Proposed Modification. Set against this scenario is the policy scenario (or the project case) under consideration.

4.2   Overview of scenarios

All scenarios outlined in the modelling below use the central case assumptions:

▶   Capital expenditure of $89.1 in NPV terms

▶   Coal output of $1,449.3 million in NPV terms.

EY have also factored into our scenarios the benefits that flow from the proposed development outside of the Lithgow-Mudgee region and the NSW economy. This includes the repatriation of profits out of the region to foreign shareholders, along with wages and the payments out of the region for royalties to the NSW Government and corporation tax to the Australian Government. EY have conservatively assumed these royalty payments accrue to the rest of NSW.

In addition, EY have factored into our scenarios the level of migration of workers from the rest of NSW into the Lithgow-Mudgee SA3. As outlined above, 93 per cent of the workers at the UCC reside in Lithgow-Mudgee, where the remainder are sourced from the Rest of NSW.

The key macroeconomic variables projected under the core scenario is shown in Table 16. In the Lithgow-Mudgee region, the Proposed Modification is projected to increase GRP by $1,239.8 million in NPV terms. GRI or regional welfare, is projected to increase by $1,022.3 million in NPV terms. The projected increase in GRI is significant to the relatively small region of Lithgow-Mudgee. In total, the Proposed Modification is projected to increase welfare per capita in Lithgow-Mudgee by $13,073 in NPV terms.

For NSW, the projected increase in GSP is $1,295.1 million in NPV terms. GSI is projected to increase by $175 per capita.

Table 16: Economy-wide impacts of the Proposed Modification, 2022 - 2034

Variable	Description	Lithgow-Mudgee	NSW Total
Real GRP/GSP^	NPV* - $m	1,239.8	1,295.1
Real GRI/GSI^	NPV* - $m	1,022.3	1,341.1
Employment	Average FTE^^	131	149
Real Wages	Average – Per cent^^	2.4%	0.0%
Real GRI per capita^	NPV* - Dollars	$13,073	$175

*Source: EY estimates based on information provided by UCMPL. ^ Real 2021 Australian dollars. * NPV in 2021 Australian dollars based on a 7 per cent real discount rate. ^^ Average over the period 2031 to 2033.*

Total employment in the region is projected to increase by 131 FTE workers on average. As outlined above the Proposed Modification will employ 98 FTE workers on average, as a result 33 additional workers will be employed in other sectors of the economy in the Lithgow-Mudgee region, on average, taking into account employment in supplier industries and any crowding out effects. Across NSW, employment is projected to increase by 149 FTE comprising of 131 direct FTE and 18 flow-on FTE.

The analysis above outlines the impacts of the Proposed Modification over the entire timeline of the proposed development. The Proposed Modification includes several phases, these are:

- ► Capital intensive phase with development of the Proposed Modification

- ► Longwall operations

- ► Longwall completion.

Table 17 provides an account of the economy-wide impacts during each of these phases, for an indicative year, for the Lithgow-Mudgee region. The relative impacts do shift during each phase of the Proposed Modification. During the capital-intensive phase, welfare in the region, as measured by real GRI, is similar in relative size with the gross regional product. As we move into the operational phases of the modification, the welfare measure falls in relative size to GRP, reflecting the impacts of the repatriation of income to other regions.

Table 17: Economy-wide impacts of the Proposed Modification to Lithgow-Mudgee, 2022 – 2034

Variable	Description	Capital Intensive	Longwall Operations	Peak Extraction	Longwall Completion
		2023	2025	2030	2033
Real GRP	$million^ [% change]	5.9 [0.2]	68.8 [1.9]	350.9 [8.4]	61.1 [1.4]
Real GRI	$million^ [% change]	0.4 [0]	71.7 [1.9]	281.5 [6.7]	96.9 [2.1]
Employment	FTE [% change]	1 [0]	21 [0.2]	99 [0.9]	38 [0.3]
Real wages	% change	0.00	0.01	0.07	0.00
Real GRI per Capita	Dollars^	$8	$1,523	$5,765	$1,743

Source: EY estimates based on information provided by UCMPL. ^ Real 2021 Australian dollars, undiscounted.

Table 18 outlines the economy-wide impacts to NSW during each phase of the Project.

Table 18: Economy-wide impacts of the Proposed Modification to NSW, 2022 – 2034

Variable	Description	Capital Intensive	Longwall Operations	Peak Extraction	Longwall Completion
		2023	2025	2030	2033
Real GRP	$million^ [% change]	6.2 [0]	70.7 [0.01]	366.4 [0.05]	68.1 [0.01]
Real GRI	$million^ [% change]	2.6 [0]	84.6 [0.01]	368.3 [0.05]	117.7 [0.01]
Employment	FTE [% change]	2 [0]	27 [0]	136 [0]	46 [0]
Real wages	% change	0.00	0.00	0.00	0.00
Real GSI per Capita	Dollars^	$0.3	$11.3	$47.5	$15.1

Source: EY estimates based on information provided by UCMPL. ^ Real 2021 Australian dollars, undiscounted.

Appendix A   Information Received

The data inputs for the analysis presented in this report are derived primarily from:

► The Statement of Environmental Effects prepared by Umwelt

► Various social and environmental consultant reports

► *Resources and Energy Quarterly, December 2021*, Department of Industry, Science, Energy and Resources

► Various data from the Australian Bureau of Statistics (ABS) including the most recent Census data

In addition, EY was provided the financial model prepared by UCMPL, which includes capital expenditure, operational costs, output and employment for an optimised mine plan scenario for each year of the Proposed Modification. All values in the financial model were in real 2021 Australian dollars.

The mine plan scenario includes mining in both Ulan Underground and Ulan West Underground. EY was provided both the capital costs and the operational costs for each of these mining areas based on the optimised mine plan. The development capital and the replacement and sustaining capital costs and operational costs for both parts of the complex are considered in the net benefit estimation of the Proposed Modification. In addition, employment estimates for each of the areas was provided by UCMPL and the operational employment associated with these areas is included in the net benefits calculation.

In addition to the operational costs, UCMPL has provided EY with several costings to meet required environmental mitigation and management costs of the Proposed Modification. Some of these costs are subject to commercial negotiation and are not therefore available to publish on an individual basis. The economic analysis therefore combines all the environmental costs into one item called "mitigation and management" to ensure commercial confidentiality and are included in the cost of the Proposed Modification. The costs included in mitigation and management are:

► Biodiversity offsets

► Water licences.

Consistent with the Guidelines, the Proposed Modification's indirect costs cover a range of net environmental, social and transport-related costs as well as the net public infrastructure costs as well as the estimated loss of surplus to other industries (listed in Table 14). Consideration of these costs are based on a range of assessments undertaken by specialised consultants for the Proposed Modification. The list of social and environmental consultant reports includes:

► Greenhouse Gas and Energy Assessment undertaken by Umwelt presented in the report.

Appendix B   Full Results and Sensitivity Analysis

Full-year inputs

Table 19 provides a detailed schedule of year-on-year coal production and coal prices (after quality adjustment) as key inputs into total coal sales revenue generated by the Proposed Modification between 2023 and 2035. The UCC focuses on thermal coal, accounting for the additional 25 Mt of coal produced by the Proposed Modification.

Incremental extraction rates from the Proposed Modification increase substantially throughout, peaking at 7.4 Mt of product coal in 2028. In total, the Proposed Modification is estimated to generate 25 Mt of product coal and revenue of $1,449.3 million in NPV terms.

Table 19: Central case assumptions – incremental revenue projection for the proposed modification (all years)

Year	Thermal Coal (Mt)	Thermal Coal Price^	Total Revenue^
2023	0.1	109.7	9.5
2024	0.1	95.0	6.0
2025	0.7	93.9	67.9
2026	6.6	93.9	616.7
2027	0.1	93.9	11.2
2028	7.4	93.9	697.1
2029	1.0	93.9	94.0
2030	3.9	93.9	364.4
2031	4.0	93.9	373.3
2032	0.7	93.9	64.0
2033	0.7	93.9	67.2
Total	25.2		2,371.5
NPV			1,449.3

*Source: EY estimates ^ Real 2021 Australian dollars. * NPV to 2021 based on a 7 per cent real discount rate.*

Table 20: Proposed Modification financial performance under central case assumptions (all years). All figures in Real 2021 Australian Dollars, millions

Year	Revenue from coal sales	Residual value of capital	Total Revenue	Operating costs (incl. closure costs)	Mitigation and management costs	Depreciation	Royalties	Total Costs	Operating Profit
2021	-	-	-	-	-	-	-	-	-
2022	-	-	-	-	-	-	-	-	-
2023	9.5	-	9.5	3.9	-	0.3	0.7	4.9	4.6
2024	6.0	-	6.0	2.9	-	0.3	0.4	3.5	2.5
2025	67.9	-	67.9	57.8	-	0.2	4.7	62.7	5.2
2026	616.7	-	616.7	349.0	-	15.1	42.7	406.9	209.8
2027	11.2	-	11.2	5.4	-	15.3	0.8	21.4	-10.2
2028	697.1	-	697.1	374.2	-	15.3	48.3	437.8	259.3
2029	94.0	-	94.0	54.6	-	19.0	6.5	80.1	13.9
2030	364.4	-	364.4	189.9	-	20.0	25.3	235.2	129.3
2031	373.3	-	373.3	213.4	22.0	20.3	25.9	281.6	91.7
2032	64.0	-	64.0	30.8	22.0	12.8	4.4	70.0	-6.1
2033	67.2	-	67.2	32.3	24.9	12.8	4.7	74.7	-7.5
2034	-	-	-	0.8	-	-	-	0.8	-0.8
Total	2,371.5	-	2,371.5	1,314.9	68.9	131.4	164.4	1,679.7	691.8

Source: UCMPL, EY estimates

Sensitivity Analysis – CBA and LEA

The results of the systematic sensitivity analysis for the CBA are summarised in Table 21 (see Section 2.8 for descriptions of each assumption tested). This sensitivity analysis shows that the estimated net benefits are robust in the sense that they remain (strongly) positive after testing all key assumptions underpinning the analysis. In isolation, the estimated net benefit of the proposed development is most sensitive to the coal price assumptions underpinning the analysis, but even assuming coal prices are 25 per cent lower than under the central case assumptions, the net benefits are estimated to be $236.9 million in NPV terms, a reduction of 19 per cent from the central case assumptions.

It is worth noting that the direct benefits do not become negative, even under the most pessimistic assumptions, decreasing to around $83.3 million in NPV terms. In the optimistic scenario, however, the direct benefits are estimated at $210.2 million.

Table 21: CBA – sensitivity analysis of the net benefits of the Proposed Modification (NPV*, $ million)

	Central Case	Higher Price	Lower Price	Higher Opex	Lower Opex	Higher Capex	Lower Capex	Higher Reservation Wage	Supplier Benefit	Higher Environ. Costs	Pessimistic	Optimistic	Central Case (4%)	Central Case (10%)
Direct Benefits	144.9	202.5	89.3	137.5	152.4	144.9	144.9	144.9	144.9	144.9	83.3	210.2	177.6	119.3
1. Net producer surplus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2. Royalties, payroll tax and Council rates	102.1	128.2	76.0	102.1	102.1	102.1	102.1	102.1	102.1	102.1	76.0	128.2	125.4	83.8
3. Company income tax apportioned	42.8	74.4	13.3	35.4	50.3	42.8	42.8	42.8	42.8	42.8	7.4	82.1	52.2	35.5
Indirect Benefits	147.7	147.7	147.7	161.4	134.0	147.7	147.7	144.2	134.5	147.7	143.4	145.8	182.0	121.0
1. Net economic benefit to existing landholders	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2. Net economic benefit to Local workers	15.8	15.8	15.8	15.8	15.8	15.8	15.8	12.3	15.8	15.8	12.3	15.8	21.1	11.9
3. Net economic benefit to Local suppliers	131.9	131.9	131.9	145.6	118.2	131.9	131.9	131.9	118.7	131.9	131.1	130.1	160.9	109.1
Indirect (Environmental costs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potential Net Benefits	292.6	350.2	236.9	298.9	286.3	292.6	292.6	289.1	279.4	292.6	226.7	356.0	359.5	240.3

*Source: EY estimates based on information from various sources. Estimated as the benefits of the Proposed Modification case less the Baseline case. *NPV in real 2021 Australian dollars based on a 7 per cent real discount rate, except for "Central Case (4%)" which is based on a 4 per cent real discount rate and "Central Case (10%)" which is based on a 10 per cent real discount rate. See Section 2.8 for descriptions of each assumption tested.*

The results of the systematic sensitivity analysis for the LEA are summarised in Table 22 (see Section 2.8 for descriptions of each assumption tested). This sensitivity analysis shows that the estimated net benefits to the Lithgow-Mudgee SA3 region are robust in the sense that they remain positive after testing all key assumptions underpinning the analysis.

The estimated net regional benefit of the Proposed Modification is strongly sensitive to reservation wage assumptions, given benefits to workers ($15.4 million in NPV terms under central case assumptions) make up one of the largest portions of total direct and indirect benefits to the region. Assuming the disutility of mining wage premium increases by 25 per cent on central case assumptions, the net benefits are estimated to be $42.2 million in NPV terms, a reduction of 7 per cent from the central case assumptions.

Table 22: LEA – sensitivity analysis of the net regional benefits of the Proposed Modification (NPV*, $ million)

	Central Case	Higher Price	Lower Price	Higher Opex	Lower Opex	Higher Capex	Lower Capex	Higher Reservation Wage	Supplier Benefit	Higher Environ. Costs	Pessimistic	Optimistic	Central Case (4%)	Central Case (10%)
Direct Benefits	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1. Net producer surplus	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2. Royalties, payroll tax and Council rates	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3. Company income tax apportioned	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indirect Benefits	45.2	45.2	45.2	48.3	42.2	45.2	45.2	42.2	42.3	45.2	42.0	44.8	57.0	36.3
1. Net economic benefit to existing landholders	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2. Net economic benefit to Local workers	15.4	15.4	15.4	15.4	15.4	15.4	15.4	12.4	15.4	15.4	12.4	15.4	20.6	11.6
3. Net economic benefit to Local suppliers	29.8	29.8	29.8	32.9	26.7	29.8	29.8	29.8	26.9	29.8	29.6	29.4	36.4	24.7
Indirect (Environmental costs)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Potential Net Benefits	45.2	45.2	45.2	48.3	42.2	45.2	45.2	42.2	42.3	45.2	42.0	44.8	57.0	36.3

Source: EY estimated based on information from various sources. Estimated as the benefits of the Proposed Modification case less the Baseline case. *NPV in real 2021 Australian dollars based on a 7 per cent real discount rate, except for "Central Case (4%)" which is based on a 4 per cent real discount rate and "Central Case (10%)" which is based on a 10 per cent real discount rate. See Section 2.8 for descriptions of each assumption tested.

Appendix C   Environmental and Other External Costs

The following sections provide more detail on how the indirect environmental costs have been assessed based on the relevant environmental assessments provided.

C.1   Greenhouse gas emissions

The Technical Notes include specific commentary around the use of market prices as a proxy for the costs of climate change impacts associated with greenhouse gas emissions[29]. However, it is likely that most domestic carbon trading processes would be influenced by the particular characteristics of its scheme, and emissions targets set by countries, which could limit their appropriateness as a proxy for externalities.[30]As a result, the US EPA Social Cost of Carbon estimates have been utilised as a proxy for the monetary value of the net externality attributed to society associated with adding an incremental amount of GHG to the atmosphere in a given year.

Consistent with Australia's international obligations under the United Nations Framework Convention on Climate Change the level of GHG emissions attributable to the Proposed Modification is measured by the:

► Scope 1 emissions: representing the direct GHG emissions from the Proposed Modification (e.g., from the use of diesel in plant and equipment); and

► Scope 2 emissions: representing the indirect emissions from the purchases of inputs, (generally associated with the purchase of electricity).

The estimation of GHG emissions associated with the Proposed Modification was undertaken by Umwelt. The estimation of the GHG emissions in the Air Quality and Greenhouse Gas Assessment is outlined in the report.

The GHG emissions were estimated using information from the Australian Government Department of the Environment and Energy's National Greenhouse Accounts Factors and the requisite workbooks, methodologies and technical guidelines.

The Air Quality and Greenhouse Gas Assessment provides an account of the annual GHG emissions for all the Proposed Modification's sources (i.e. including the additional extraction from Ulan West and Ulan Underground), as well as the GHG emissions from the transport and processing of coal for the approved Mine. Greenhouse Gases associated with the burning of coal from this facility are excluded from this assessment. This is because the EIA Guidelines and Technical notes do not require consideration of Scope 3 emissions. The impacts on climate change from Scope 3 emissions are therefore excluded from this analysis. Hence, the assessment of GHG emissions undertaken by Umwelt includes the total GHG emissions resulting from the approved Mine operations of 27 Mt of ROM. To estimate the level of GHG emissions associated with the Proposed Modification:

► The Life-of-Mine GHG emissions (Scope 1 and Scope 2 emissions), per ROM tonne, as specified in the Air Quality and Greenhouse Gas Assessment was calculated, then

► The level of GHG emissions is adjusted by simple scaling to the Proposed Modification plan figure (i.e., 27 Mt of ROM over the life of the Proposed Modification).

To price the GHG emissions, EY has applied the latest interim social costs of carbon emissions derived from the 3 per cent discount rate figures, published by the Interagency Working Group on Social Cost of Greenhouse Gases. This has resulted in a price per tonne of CO2-e of $76.52 to $95.65 over the

---

[29] NSW Government, 2018, Technical Notes supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals

[30] Umwelt, 2021, Response to the peer review of the Economic Impact Assessment of the Glendell Continued Operations Project

assessment period.[31] These estimates are highly sensitive to the discount rate used and are currently under review by the Interagency Working Group that established them. It should be noted that the USEPA SCC estimates are global costs associated with each tonne of CO_2-e emitted, therefore these costs would need to be apportioned to NSW for the purposes of assessing the costs to NSW in isolation. This has been implemented through apportioning the costs of the externality relative to the population of NSW to the rest of the world.

The externalities arising from GHG emissions associated with the Proposed Modification are derived by taking the year-on-year emissions and multiplying these figures by the respective tCO_2-e carbon prices over the life of the Proposed Modification.

On a global basis, the total estimated GHG cost is $17.9 million in NPV terms, see Table 23. Attributing the GHG costs based on the NSW population, consistent with the Guidelines, results in an attributed GHG cost of $0.019 million to NSW in NPV terms.

Table 23: Greenhouse gas emissions attributable to the Proposed Modification

	Total	2024	2027	2030	2032
ROM Coal Output Mt	27.5	0.06	0.12	4.22	0.78
Tonnes of GHG (Mt)^		0.00	0.00	0.05	0.01
Price Path ($ per tonne CO2-e abated^)		16.94	77.99	82.40	88.29
Global Impact (NPV*, $ million^)	17.9	0.00	0.00	0.05	0.01
NSW (NPV*, $ million^)	0.019	8.3E-04	9.1E-03	5.3E-03	1.1E-03

Source: EY estimates based on Umwelt (2021).
^ Real 2021 Australian dollars.
^^ Includes both Scope 1 & 2 emissions

---

[31] Interagency Working Group, 2021, Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide

Appendix D   Worker and Supplier Benefits

D.1   Introduction

In this Appendix, additional supporting evidence is presented to substantiate the addition of worker and supplier benefits as part of the economic cost-benefit-analysis (CBA) undertaken for the extension of the life of the UCC. In this case, we have considered the relevant New South Wales (NSW) planning guidelines, including:

1. NSW Government (2015) Guideline (the "Guidelines") for the economic assessment of mining and coal seam gas proposals.

2. NSW Government (2018) Technical Notes supporting the Guidelines for Economic Assessment of Mining and Coal Seam Gas Proposals.

Mining approvals in NSW require a CBA to be undertaken based on the above Guidelines published by the NSW Government.[32] At the outset, we believe that it is important to recognize the relatively unique role that the economic CBA plays in the approvals process. Whilst it is common for governments to undertake CBA when considering public expenditures such as large infrastructure developments or programs, it is much less common for governments to undertake CBA for private sector investments.

The Guidelines explicitly recognise that there are a range of potential beneficiaries from a mining project, along with the direct and indirect costs. These beneficiaries are appropriate to consider when assessing private investment and include the NSW government through tax and royalty collection, workers at a mine and suppliers to the mine. Furthermore, the Guidelines explicitly recognise that the "benefits to workers can be one of the major economic benefits from a project".

What we have observed in the approvals process broadly, is that much of the commentary around the merits of CBA analysis calls for the exclusion of key benefits, such as those that accrue to workers and suppliers at a new mine. The exclusion of these benefits are often based on highly theoretical arguments, with little supporting evidence provided, and are only justifiable under the most restrictive of circumstances. Further, the commentary overlooks the fact that the assessment considers net benefits, that is, the benefits of the Proposed Modification proceeding versus there being no modification (and therefore no additional demand for suppliers nor additional employment).

In this appendix we set out to address some of the common (often unsubstantiated) claims that are used to justify the exclusion key benefits, such as those related to worker and supplier benefits.

In addition, a further set of sensitivity analysis is presented with the impact on the overall benefits and costs of the Proposed Modification on a range of benefits to workers and suppliers. This Appendix is additional to the analysis undertaken in the main report.

D.2   Benefits to workers

The Guidelines are explicit in their allowance of positive worker benefits and recognise that such benefits can represent a major proportion of the overall benefits of a project, provided there is sufficient evidence to support it. The basis for estimating the benefits that accrue to workers in a mine is based on the following principles, as highlighted in the Guidelines:

► Wages earned in the mine

---

[32] NSW Government (2015) Guideline for the economic assessment of mining and coal seam gas proposals.

► Minus the opportunity costs of labour for working in the mining sector, compared to working in non-mining sectors (or being unemployed)

► Minus the wage difference due to skills and the disutility of working in the mining industry

To measure the opportunity cost compared to the non-mining sector, the wages earned by the Mine workers are compared to an estimated reservation wage, which is constructed as a weighted average of the wages paid to occupations not in the mining sector. The weights are given by the occupational distribution of those found working in the coal mining sector. Furthermore, the reservation wage is adjusted upwards to account for the differential in hours worked between those in the coal mining sector and those employed in the wider economy. This implies that should the Proposed Modification not go ahead, those who would have been employed by Ulan would find alternative work at the average wage paid for their occupation in NSW. The reservation wage across NSW is estimated at $93,141.2 per annum, based on 2016 Census data (updated to 2021 dollars using ABS cat. No. 6401.0 and ABS cat. No. 6345.0).

However, the inclusion of worker benefits is a key area of disagreement in the assessment process for many mine applications, as the Guidelines are not explicitly prescriptive in their treatment of these benefits. For example, in the Independent Planning Commission's (the "IPC") statements[33] regarding the Mangoola Coal Continued Operations Project, which was approved in April 2021[34], it is noted that worker benefits were overstated and were not prepared in accordance with the Guidelines. It was in part, because that "should mining cease at the site, workers would likely gain employment elsewhere in the mining industry".

Further general criticisms on the inclusion of worker benefits for mining projects in NSW tend to follow three common approaches, that:

► Projects will generally not employ people locally, and rather source employees through drive-in-drive out and fly-in-fly-out arrangements from broader areas and interstate

► That any calculation of worker benefits should include an adjustment for the disutility of working in the mines and the extra skills needed to work in the mining industry

► By measuring the mining wage against the average wage in NSW implies that workers will find alternative work at an average wage paid in NSW, which implies that there are no significant differences in skills between miners and the average worker.

Each of these arguments are addressed in commentary below.

D.2.1 Worker locations and jobs

Mining Jobs

Standing in contrast to the assertion that coal miners will simply find employment in alternative mines, Figure 15 details the forecasted coal mining employment in NSW.[35] These projections of employment also operate as a proxy for coal production. Under all scenarios, there is an overall decline in projected employment within the coal sector in NSW over the expected life of the project with only the high demand scenario showing a potential increase in employment over the short term. In contrast to the 2016 NSW Intergenerational Report (IGR), the 2021 IGR highlights a quick and significant shift in the outlook for the coal mining industry, with Australia's top three thermal coal export countries (Japan, South Korea and China) committing to achieving net zero emissions by the middle of the century.

---

[33] New South Wales Government Independent Planning Commission, Mangoola Coal Continued Operations Project – Statement of Reasons for Decision

[34] Notice of State Significant Development Determination – Mangoola Coal Continued Operations Project – SSD 8642

[35] NSW Treasury (2021) TTRP21-07 The sensitivity of the NSW economic and fiscal outlook to global coal demand and the broader energy transition for the 2021 NSW Intergenerational Report

In 2021 IGR, *The sensitivity of the NSW economic and fiscal outlook to global coal demand and the broader energy transition for the 2021 NSW Intergenerational Report,* the NSW treasury writes that a "declining global demand for NSW coal will impact employment in coal mining. Under the reference case, employment in coal mining is projected to decline by an average of 600 per year for the next two decades".

As global demand for coal is forecast to plateau, NSW plans to slowly unwind investing in coal mining projects, as countries transition to a clean energy framework.[36] Those currently employed in the sector are going to face increasing challenges in finding alternative employment within the mining sector. Those that do will displace a person already in the workforce, who may either retire from the workforce or seek employment in some other profession. Therefore, the continued operations related to the Proposed Modification would give the employees at the UCC an opportunity to have access to stable employment in an environment where global factors mean that alternative opportunities in coal mining in NSW are becoming increasingly scarce.

Figure 15: Forecasted Coal Mining Employment
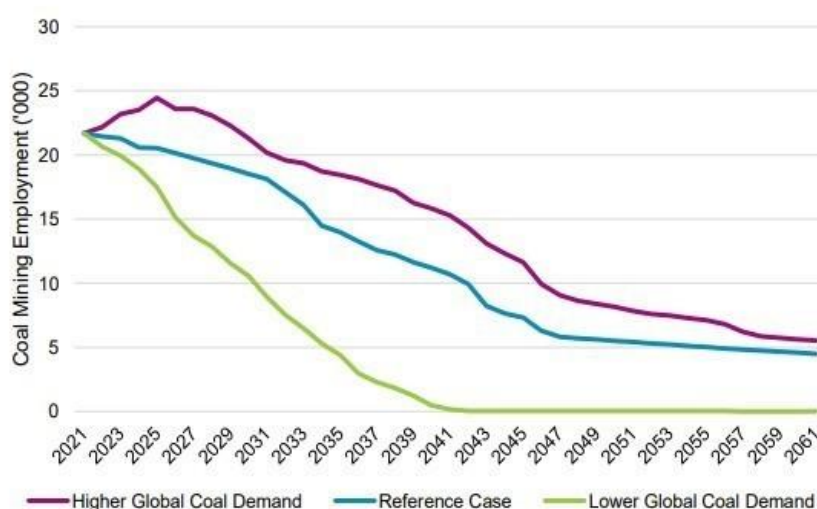
Source: NSW Treasury and VURM

In the establishment of a base case to compare the Proposed Modification against, one of the key assumptions in the Guidelines is that alternative project and land uses should continue on in a business-as-usual fashion, unless there is a significant and material impact that a new project would have.

In this respect, we also assume that alternative mines would be operating in a business-as-usual manner, irrespective of whether a project is approved. That is, they would also be attempting to maximise their production though the minimisation of vacancies, which would result in minimal lateral transitions between operations. Taking this assumption in conjunction with the estimates shown in Figure 15, it becomes increasingly difficult to argue that, should the Proposed Modification not proceed, that the existing workforce would find alternative employment in the coal mining industry in NSW. While these employees may find employment in other jurisdictions, this would result in a net loss of benefits to NSW relative to the Project Case (and assumed base case).

Worker locations

Relatedly, it is also commonly argued that many workers would not be sourced locally, and that workers would alternatively be resourced through Fly-In-Fly-Out (FIFO) programs. As such, many of the employment benefits would accrue to workers that may not be from the state. However, since this is a modification of a currently operating mine, it is expected that many of the workers

---

[36] https://resourcesandgeoscience.nsw.gov.au/__data/assets/pdf_file/0004/1236973/Strategic-Statement-on-Coal-Exploration-and-Mining-in-NSW.pdf

currently employed will remain working at the UCC. To the extent that increased workforce numbers associated with this project would dislodge workers from alternative mines, the subsequent filling of that vacancy would eventually result in workers being sourced either from other sectors or the unemployment queue. According to residential information provided by UCMPL, all of the workforce resides within NSW, therefore it is reasonable to expect that the vast majority of wage benefits that accrue to employees in the project case would be attributable to NSW.

D.2.2 The skills argument

The second major criticism usually put against worker benefit estimations is the fact that miners will possess specialised and unique skillsets, which would mean that, should approvals for a project not be granted, workers would simply end up employed elsewhere in the mining industry. Alternatively, that a project will generally source most of its employees from within the mining sector. Therefore, the reservation wage that should be utilised in the estimation of worker benefits is the average mining wage. However, as noted in the previous subsection, it is unlikely that any workers at the UCC that are to lose a prospective employment opportunity by this project not proceeding can assume they would gain employment in the NSW mining industry. Accordingly, the assumption that the use of the average mining wage as a reservation wage cannot be justified unless there is evidence of additional demand for mining employment in NSW that would enable the displaced workers to be employed in the mining sector. In the following section we aim to show that using the average mining wage as a reservation wage is not appropriate, based on an examination of inter-industry movements and the average age and education level of occupations that are found in the mining industry, and of comparable industries.

D.2.2.1 Inter-industry movement

One of the major arguments levied on the estimation of worker benefits are that jobs in the mining sector require a very specialised and niche set of skills. Such an implication would mean that there would be a significantly lower level of transitions from other industries into the mining sector, whether individuals work in the same occupation (for example, technicians) or not.

Figure 16 outlines the proportion of workers that reported changing industries between 2011 and 2016 from Census data. Longitudinal census analysis can represent a reasonable proxy on estimating the level of difficulty, or levels of qualifications required, to enter certain industries, as these can be compared on a like-for-like basis across a range of sectors in the Australian economy. For example, the industries which showed the lowest proportions of lateral transfers (i.e. staying in the same occupation but switching sectors) were the financial services, health care, and education and training. These industries generally require significant qualifications and educational levels to enter, which explains the lower level of lateral transfers into these industries.

Alternatively, the industries which saw the highest lateral transfers were the accommodation and food services, administration and support services and arts and recreation services. These industries are characterised as having lower barriers to entry for jobs (in terms of educational or required qualifications), as well as generally providing short term employment.

From 2011 to 2016 (at the time of the census), roughly half of the employees in the mining sector had transferred from alternative industries, placing it roughly between the construction and professional, scientific and technical services sectors in terms of ease of entry. In this respect, there doesn't appear to be any significant differences in the level of accessibility for employees of this industry relative to the rest of Australia. Figure 17 demonstrates that the construction, manufacturing and professional services sectors are the main sectors supplying skilled workers to mining between 2011 and 2016.

Moreover, this implies that there doesn't appear to be any significant differences in the level of qualification, or education needed to secure entry into the mining, with that of the general employment landscape in Australia, which we show in more detail below.

Figure 16: Proportion of workers that transferred laterally into select industries from 2011 - 2016[37]

Source: Australian Bureau of Statistics (2016)

Figure 17: Longitudinal movements into the mining sector from 2011 - 2016 at the occupational level
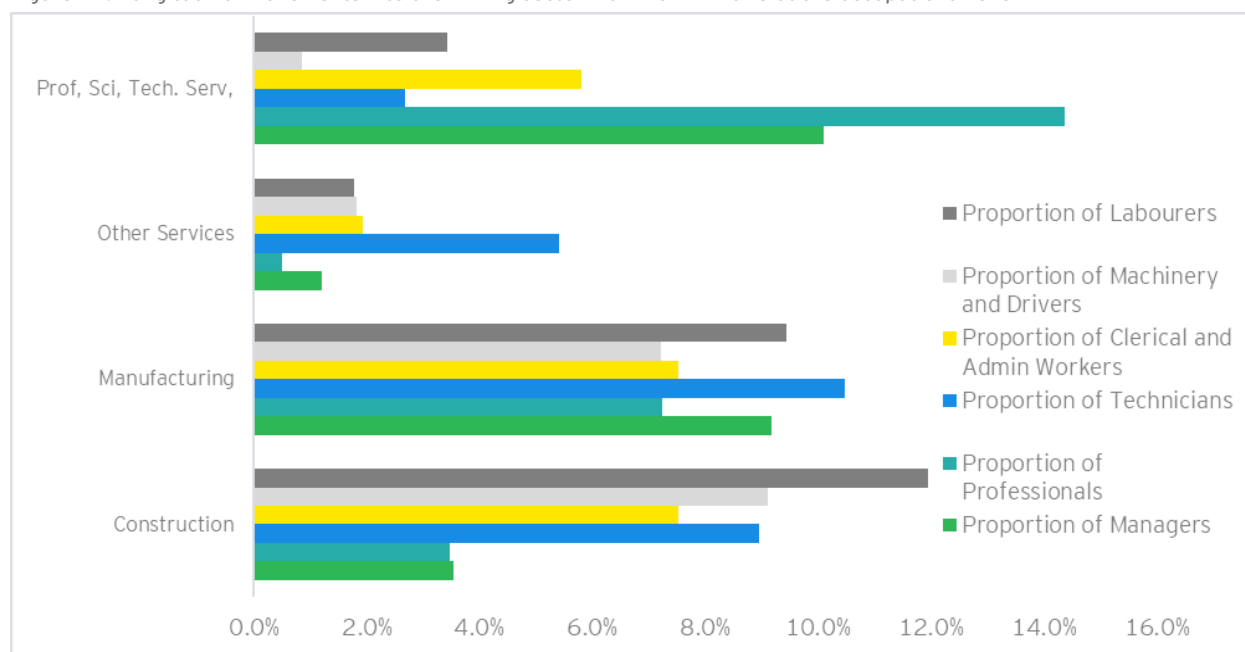
Source: Australian Bureau of Statistics (2016)

D.2.2.2 Average age of the workforce

Measuring the unique skillsets of a workforce also presents challenges, however some reasonable proxies can be utilised to examine whether occupations in the mining sector are different relative to these comparable industries. These can be, for example, examining demographics such as the

---

[37] From 2011 and 2016 the ABS changed their method of collecting industry of employment data. The changes were aimed at reducing the amount of responses which provided an industry but failed to provide sufficient information to code the information at the Australia New Zealand Industry Classification (ANZIC) 2-Digit level or higher. As such, we've limited the longitudinal analysis to only consider ANZIC 1-Digit industry codes, as we believe this change would not have a material effect on these results

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

Figure 18 details the average age of workers by occupation across the mining sector in comparison to the sectors that supplied the most workers to mining between 2011 and 2016. Broadly speaking it appears that there are no significant differences in the age of workers at the occupational level between mining and the three comparable industries. For example, the occupation which sees the largest representation in the mining workforce, machinery operators and drivers, has an average age of its workforce at around 43 years old, which is consistent with machinery operators and drivers in other sectors. This shows that there may be no significant differences in the level of experience between those employed in the mining sector, and those that are employed in comparable industries.

Figure 18: Average age of employees at the occupation level
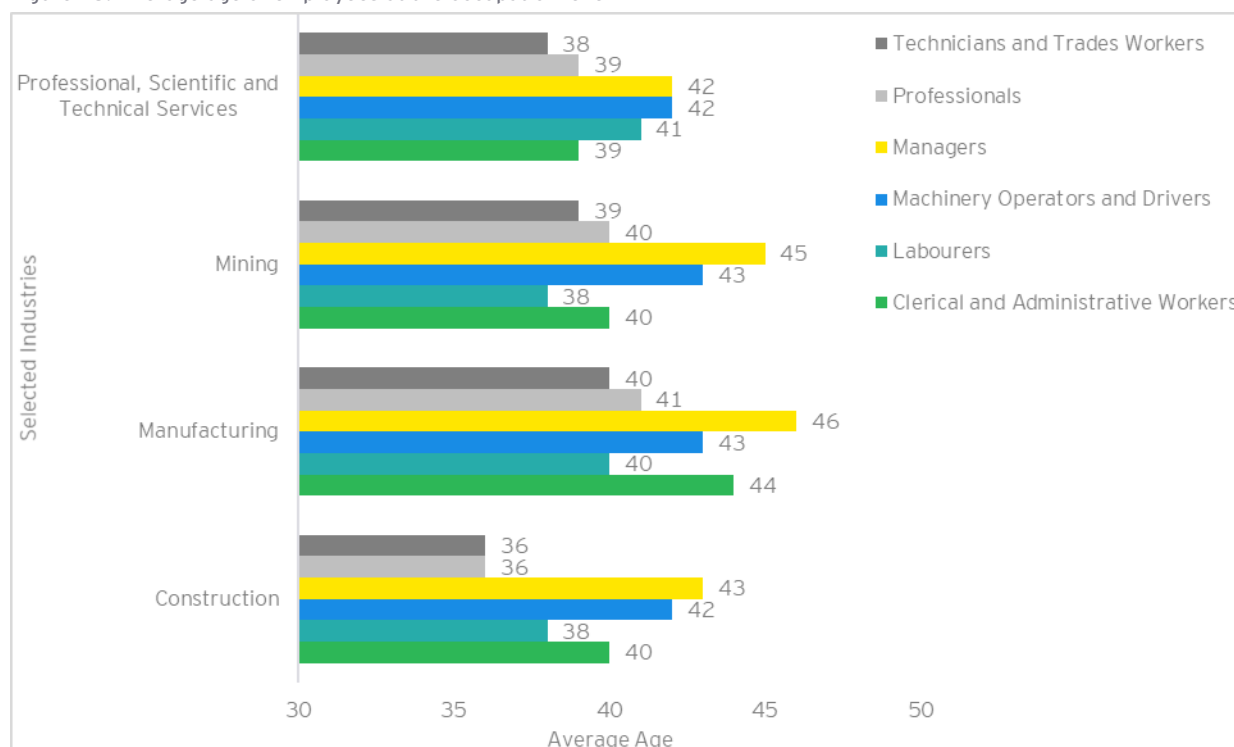
Source: Australian Bureau of Statistics (2016)

D.2.2.3 Skills and qualifications

A suitable proxy for examining the skill and qualification levels of employees in occupations is to look at the amount of time each employee has spent in schooling. Figure 19 details the average number of years of schooling that employees have by each occupation and industry.

In mining, professionals and managers have the highest levels of schooling, at 14 years on average. This in contrast to the Professional Scientific and Technical Services industry, where, on average, managers and professionals undertake and extra year of schooling. Overall, education levels in each occupation is similar across mining and other sectors. This implies that there are no significant differences in the amount of schooling that employees undertake in the mining sector relative to some of the comparable industries.

Figure 19: Estimated^ average number of years of schooling
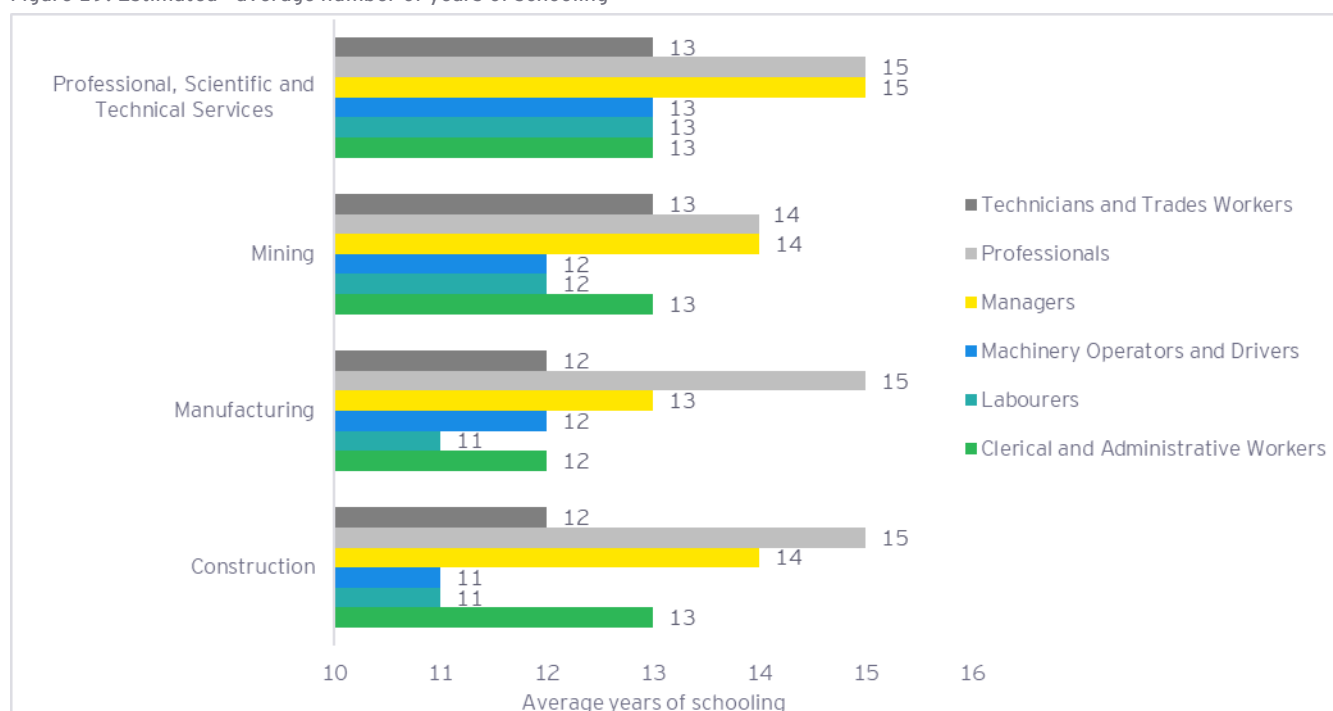
Source: Australian Bureau of Statistics (2016) ^Based on reported highest levels of education achieved.

D.2.3 Disutility argument

General criticisms against worker benefits tend to argue that the high reservation wage is due to the disutility of working at the mine face, and therefore any wage premium should be adjusted due to the challenges of working in the mining sector. The application of any premium to account for these externalities will be specific to the mine site and type of commodity being mined.

Any metrics around the disutility of working in mining are very difficult to ascertain in both an absolute (mining specific) or relative (compared with other industries) way. As noted in the Report, regarding the mining specific measures of disutility, one source of information considered in this analysis was any documented 'hardship' allowances recognized in mining awards. However, these allowances appear to be relatively minor. For example, the Black Coal Mining Industry Award 2010 does provide for the payment of an Underground allowance (Electrical/ Mechanical) of 0.23 per cent per day or shift (above the standard rate/ reimbursement) to an adult employee who works underground on any shift. In addition, there is a Confined space allowance of 0.08 per cent and a Dirty work allowance of 0.23 per cent, that may apply to underground workers. These are not significant uplift rates relative to allowances for other functions in coal mining (for example, the First Aid Officer Allowance is 0.76 per cent per day or shift above the standard rate).

On the other hand, one possible way to measure the relative disutility of working in mining, would be through published work health and safety statistics, which examine various fatality and injury statistics, nation-wide, for all industries.

The mining sector has focused on providing a safe working environment for all its workers. The table below outlines the incidence rates by sector per million hours worked from 2000 to 2019. During the period of analysis, the Australian mining sector has reduced their average number of claims per million hours worked by 57 per cent, which represented the largest decline in incidence rates, from 2000 to 2019, of any sector, except for financial services.

Comparable industries, such as agriculture, forestry and fishing, construction and manufacturing reduced their rates (defined as claims per million hours worked) from between 35 and 42 per cent over the same period.

Based on a 5-year moving average, on a claims per million hours worked basis, the mining industry also ranks well below these comparable industries and delivered incidence rates below the national average.

Table 26: Work health and safety statistics for Australia

Industry	Average claims per million hours worked (2013 – 2019)	Change from 2000 to 2019	Ranking
Agriculture, forestry, and fishing	9.2	-35%	19
Manufacturing	8.5	-39%	18
Transport, postal and warehousing	8.4	-44%	17
Construction	8.1	-33%	16
Retail trade	5.1	-42%	9
Mining	4.6	-57%	7
Information media and telecommunications	1.5	-51%	3
Financial and insurance services	0.9	-58%	1

Source: Safe work Australia (2020)[38]

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

D.2.4 Concluding remarks

The evidence presented here supports the argument for the inclusion of worker benefits in the CBA. For example, by utilising census data, we have shown that, not only does the industry not appear to be any more difficult to transfer into related industries such as construction manufacturing, but that a significant proportion of those working in the mining sector, as of 2016, had previously been drawn from said industries – noting also that the total number of years of schooling remains consistent between these industries, as shown in Figure 19. Moreover, the level of educational attainment and estimated level of experience (proxied by age) support the argument that the characteristics of workers in the mining industry are not significantly different to those in comparable industries.

Secondly, on the concept of disutility, evidence suggests that there are minor additional negative externalities incurred by workers,[39] especially given that a sizeable portion of the workforce would not be working at the mine face. Relative to comparable industries, the mining sector appears not only have implemented significant safety measures over the last two decades, which has resulted in a consistently lower claims rate. Lastly, given the UCC's proximity to the township of Mudgee, the mine can be considered hardly remote, with the majority of the current Ulan workforce residing in the local region, it is therefore unlikely that there would be any significant disutility arising due to the location of the mine.

In this respect, we believe that, not only would the majority of worker benefits accrue to NSW, but that employees in this Proposed Modification would be paid a significant wage premium driven primarily by the highly capital-intensive nature of the mining sector which results in a higher

---

[38] Safe Work Australia National Data Set for Compensation-based Statistics (NDS)

[39] That is, would be subject to any negative externalities over and above those incurred from alternative employment

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

D.3   Benefits to suppliers

One of the key benefits of private sector investment is through the establishment of supply chain networks that act to disperse economic benefits to a myriad of businesses.

The Guidelines are clear in their allowance for the use of supplier benefits as part of the CBA. Consistent with the Guidelines, we have made an estimate of the producer surplus associated with the additional demand for inputs into production.

D.3.1 Methodology for the estimation of supplier benefits

The economic benefit to suppliers is estimated as a producer surplus generated from goods and services provided from NSW-based firms to the Proposed Modification. As summarised in the Main Report, based on the input cost data provided by UCMPL, the Proposed Modification is estimated to use $778.3 million in intermediate inputs supplied from NSW over its life-cycle in NPV terms. Currently, 84 per cent of the UCC's inputs used are supplied from NSW-based businesses and it is assumed this would also be the case with the Proposed Modification.

The producer surplus is not readily observable through this spend that is allocated to local suppliers by the UCC. However, aligning with the assumptions in setting up the CBA, this spend represents a net increase in demand for the production of goods and services in the NSW economy.

To proxy for producer surplus, we have used the gross operating surplus allocated to suppliers from the spend by the UCC in the region, for the Proposed Modification. Gross operating surplus is a measure of the profits earned by firms in the economy. According to the ABS, gross operating surplus is "the surplus accruing from processes of production before deducting any explicit or implicit interest charges, land rent or other property incomes payable on the financial assets, land or other tangible non-produced assets required to carry on the production".[40] In using an average gross operating surplus ratio for suppliers of around 20 per cent, derived from an in-house regional input-output model, the total benefits to suppliers are estimated at $131.9 million in NPV terms.

D.3.2 Current criticisms and responses

In its reasons for approving the Mangoola Coal Continued Operations project, the IPC noted: "[The IPC] is of the view that local suppliers will earn similar margins relative to what they receive under the base case, such that there are no additional benefits to suppliers in NSW".[41] Recent studies, such as the United Wambo Open Cut Coal Mine Economic impact assessment[42] have chosen to, conservatively, not quantify the extent of which the mine would provide benefits to suppliers, citing the fact that supplier outcomes in the base case may not be readily observable. The study notes, though, that such a Project could deliver an additional benefit to suppliers, relative to a base case. Given that UCMPL has provided an estimate of the location of the suppliers for the Proposed modification, and the expected level of spending on these suppliers, an estimation of the level of additional gross operating surplus could be estimated based on EY inhouse regional CGE modelling. These figures are meant to serve as a proxy for the additional benefits that arise due to the operation of the Proposed Modification.

---

[40]https://www.abs.gov.au/AUSSTATS/ABS@.NSF/2f762f95845417aeca25706c00834efa/ac6c11a0f11910fbca2569a40006164b!OpenDocument

[41] Mangoola Coal Continued Operations Project (SSD 8642) – Statement of Reasons for Decision

[42] Deloitte Access Economics, 2016, Economic impact assessment of the United Wambo Open Cut Coal Mine Project

However, the base case that would result in the UCC's operations not being extended is a direct and significant reduction in demand for goods and services in the region which may not necessarily be replaced by other projects or alternative sectors. The supply curve for goods and services in this instance can be considered as "horizontal" meaning that there are strong levels of competition in the region for goods and services to be supplied to mines. An increase in demand from a mine is unlikely to result in a change in prices from suppliers, especially when we consider the long run nature of the operations of a mine. In the long run, we can expect relatively low barriers to entry for firms to fill changes in demand, and equally, there is likely to be some form of spare capacity in the economy (as is evidenced with the low levels of inflation in the region and discussed below). Mining companies are likely to have access to a variety of firms to supply products, who are competing and reducing their overall margins.

However, this does mean that the change in demand that is directly a result of the Proposed Modification must result, at a minimum, in a linear increase in overall gross operating surplus (which again, is the profits that firms receive from supplying their goods into the mining sector). This can be considered as a relatively conservative estimate of the change in producer surplus, as we could see a more inelastic supply curve for some goods and services, and this would result in an increase in the gross operating surplus relative to the base case.

Put another way, the Proposed Modification is unlikely to increase the margin that suppliers receive, however the extended life of the mine and the associated required capital and operational expenditure of the mine is expected to increase the demand for services and supplies relative to the base case of the Proposed Modification not proceeding. The effect of this is that the same margin is applied to increased turnover which can be considered as a supplier benefit associated with the Proposed Modification that should be considered as part of the benefits indirectly accruing to NSW.

Lastly, in contrast to the IPCs view, in their review of the Tahmoor South Coal Mine[43] BIS Oxford Economics (2020) writes that such an approach appears to be broadly consistent with the specifications in the Guidelines. Whilst the use of gross operating surplus is not quite equivalent to a strict definition of Producer Surplus, the approach is said to be reasonable, given data limitations.

D.3.3 The relationship between spare capacity, inflation and, unemployment

An important consideration that the Reserve Bank of Australia (RBA) considers in their monetary policy actions is the level of spare capacity in the economy. Spare capacity relates to the balance of demand for goods and services, relative to the economy's potential to produce them.

At an aggregate level, inflationary pressure is likely to be greater in an economy operating at a higher level of capacity utilisation than if it is operating at a lower level[44]. For example, firms that have a greater degree of pricing power should be able to expand their mark-ups in an economy experiencing strong growth in demand relative to available supply.

A second indicator of spare capacity in the economy is the unemployment rate and underemployment rate. A high unemployment rate implies that there is a large pool of workers willing to work, but are not engaged in production, which suggests that the economy is operating below its potential. Whilst the unemployment rate has been relatively consistent, if trending slightly downwards, as shown in below, over the past four decades the underemployment rate has trended upwards, and has been higher than the unemployment rate since the early 2000s.

---

[43] Oxford Economics (2020) Peer Review of Economic Impact Assessment Tahmoor South Coal Project

[44] RBA (2015), Firm-level Capacity Utilisation and the Implications for Investment, Labour and Prices
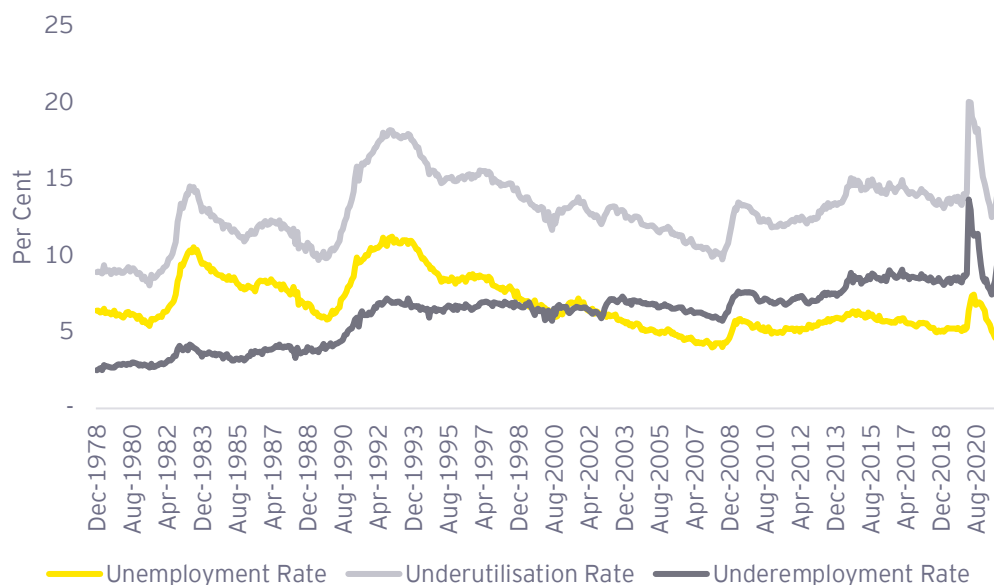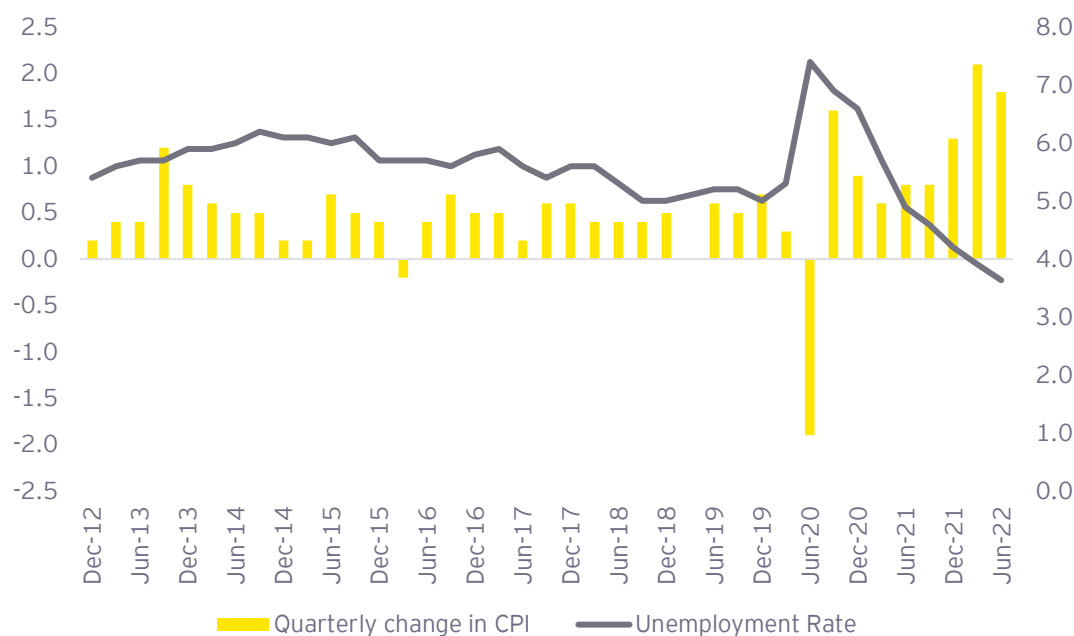
Source: ABS Cat. No. 6202.0.

What we've observed more broadly, in Figure 21, is that inflation has been benign and dropped into negative territory in July-2020, due to the large spike in unemployment related to the COVID-19 pandemic. However as of recently, there has been a significant uptick in inflation, which has coincided with a decrease in unemployment and underemployment throughout Australia, suggesting that currently the Australian economy may be operating with less spare capacity than previously observed.

The subsequent recovery from COVID-19, lack of employment immigration related to labour shortages in specific sectors such as agriculture, in addition to supply shocks as a result of geopolitical tensions translating to higher energy prices, have both contributed to a tighter labour market and has resulted in upwards pressure in inflation. It is arguable that these recent developments are potentially transient in nature and will likely subside once supply-side pressures ease up, and the national labour market is able to again import labour. It could be argued that the economy, over a longer time horizon, could return to operating with some level of slack in its capacity, especially considering that the commencement of the Proposed Development is estimated to start in 2025.

---

[45] Treasury Working Paper, 2021, Estimating the NAIRU in Australia

Figure 21: Quarterly Change in CPI (LHS) and the Unemployment Rate (RHS)

Source: ABS Cat. No. 6202.0. and Cat. No. 6401.0.

D.4 Sensitivity Analysis

In addition to the arguments put forward in this Appendix, we extend the sensitivity analysis presented in the Report to include a full range in both worker and supplier benefits. These results are presented in Table 27, below. Table 27: Worker and supplier benefits scenario analysis ($million**)

Proposed Modification	Worker Benefits			Supplier Benefits		
Scenario	25% Worker Benefits	50% Worker Benefits	75% Worker Benefits	25% Supplier Benefits	50% Supplier Benefits	75% Supplier Benefits
Direct Benefits	144.9	144.9	144.9	144.9	144.9	144.9
1. Net producer surplus	0.0	0.0	0.0	0.0	0.0	0.0
2. Royalties, payroll tax and Council rates	102.1	102.1	102.1	102.1	102.1	102.1
3. Company income tax apportioned	42.8	42.8	42.8	42.8	42.8	42.8
Indirect Benefits	135.9	139.8	143.7	48.7	81.7	114.7
1. Net economic benefit to existing landholders	0.0	0.0	0.0	0.0	0.0	0.0
2. Net economic benefit to Local workers	3.9	7.9	11.8	15.8	15.8	15.8
3. Net economic benefit to Local suppliers	131.9	131.9	131.9	33.0	66.0	99.0
Indirect (Environmental costs)	0.0	0.0	0.0	0.0	0.0	0.0
Potential Net Benefits	280.8	284.7	288.6	193.6	226.6	259.6

Source: EY estimates based on information from various sources. * Estimated as the benefits of the Proposed Modification case less the Baseline case. ** NPV in 2021 dollars based on a 7 percent real discount rate.

Appendix E   References

Australian Bureau of Statistics (2016), Census General Community Profile, Lithgow-Mudgee SA3, New South Wales and Australia

Australian Bureau of Statistics (2018B), ABS Maps, Accessed at stat.abs.gov.au/itt/r.jsp?ABSMaps

Australian Bureau of Statistics (2021), Regional Population Growth, Australia, 2019-20 Financial Year, Accessed at https://www.abs.gov.au/statistics/people/population/regional-population/2019-20

Australian Government Clean Energy Regulator (2022), Action October 20211, Accessed at http://www.cleanenergyregulator.gov.au/ERF/auctions-results/october-2021

Department of Jobs and Small Business Small Area Labour Markets (SALM) – June quarter 2021

KPMG (2022), *Coal Price and FX consensus forecasts March/April22*, accessed at https://assets.kpmg/content/dam/kpmg/au/pdf/2022/coal-price-fx-market-forecast-march-april-2022.pdf

Layman (2004) *CGE modelling as a tool for evaluating proposals for project assistance: a view from the trenches,* WA Department of Treasury and Finance, Staff Paper

NSW Government Department of Planning and Environment (2018), 2016 NSW population and household projections, Accessed at https://www.planning.nsw.gov.au/Research-and-Demography/Demography/Population-projections.

NSW Government Department of Planning and Environment (2018), *Technical Notes supporting the guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals*.

NSW Government, Department of Planning and Environment (2015), *Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals,* Available at http://www.planning.nsw.gov.au/Policy-and-Legislation/Mining-and-Resources/~/media/C34250AF72674275836541CD48CBEC49.ashx, Accessed September 2021

NSW Treasury (2009), 'Guidelines for estimating employment supported by the actions, programs and policies of the NSW Government', Accessed at https://www.treasury.nsw.gov.au/sites/default/files/pdf/TPP09-7_Guidelines_for_estimating_employment_supported_by_the_actions%2C_programs_and_policies_of_the_NSW_Government.pdf.

Office of the Chief Economist, Department of Industry, Innovation and Science (December 2021), *Resources and Energy Quarterly*

Pant, Brown, Buetre and Tulpulé (2000) *Measurement and decomposition of welfare changes in GTEM,* paper presented to the Third Annual Conference on Global Economic Analysis, Monash University, Melbourne, 27-30 June 2000 http://www.copsmodels.com/2000gtapconf.htm

EY | Building a better working world

EY exists to build a better working world, helping to create long-term value for clients, people and society and build trust in the capital markets.

Enabled by data and technology, diverse EY teams in over 150 countries provide trust through assurance and help clients grow, transform and operate.

Working across assurance, consulting, law, strategy, tax and transactions, EY teams ask better questions to find new answers for the complex issues facing our world today.

ey.com