



Economic Impact Assessment for Revised Mine Plan

Bylong Coal Project

Revision to Project Mine Plan
Economic Impact Assessment

Prepared for

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EXECUTIVE SUMMARY

KEPCO Bylong Australia Pty Limited (KEPCO) is seeking approval for the Bylong Coal Project (the Project). The Project entails the construction and operation of an open cut and underground coal mine for a period of approximately 25 years. The Project is located to the south of the Bylong Village, approximately 55 km to the north east of Mudgee in Central West Region of NSW.

In light of the concerns raised by the Planning Assessment Commission (PAC) (now referred to as the Independent Planning Commission (IPC)) and the Heritage Council in relation to the impacts on the Tarwyn Park property, the NSW Department of Planning and Environment (DPE) has requested information on the effects of contracting the open cut mine plan for the Project (the revised Project) to remain outside of the Tarwyn Park property and other considerations.

Gillespie Economics has prepared a brief Economic Impact Assessment of the revised Project. It uses the same primary methods referred to in the Economic Impact Assessment provided for the Environmental Impact Statement (EIS) and subsequent approval documents (including Response to Submissions (RTS) and Response to PAC Review Report). That is, the Economic Impact Assessment provides a Cost Benefit Analysis (CBA), Input-Output (IO) Analysis and Computable General Equilibrium (CGE) Analysis, based on financial and technical advice provided by KEPCO and its specialist consultants.

This report focuses on the biophysical differences between the Project and revised Project and the impact of these differences on the Economic Impact Assessment results. Consequently, all other assumptions underpinning the original Economic Impact Assessment have remained constant.

The revised Project will result in a reduction in production in the early years of mining, from a contraction to the proposed open cut mining areas.

This results in reduced operating costs and revenues which subsequently leads to reduced net production benefits from the Project of \$13M present value (\$15M including revised company tax estimates), mainly comprising a reduction in NSW government royalties. This represents a 4% reduction in net production benefits of the Project.

It will also result in a reduction in the environmental, social and cultural impacts of the Project, most of which are immaterial from an aggregate CBA perspective, but important at a local scale.

Consequently, the revised Project will result in a minor (4%) reduction in the net social benefits of the Project to NSW, from \$314M (\$395M including revised company tax estimates) to \$301M (\$380M including revised company tax estimates). Importantly, the aggregate benefits of the revised Project to NSW still exceed the aggregate costs to NSW and hence the revised Project continues to be desirable and justified from an economic efficiency perspective.

The revised Project will also contribute to economic activity in the regional and NSW economies, during both construction and operation. These impacts have been estimated using two methods, IO and CGE analysis, that differ in their underlying assumptions. However, whichever approach is used, it is clear that the revised Project will provide significant economic activity (output, value-added, regional income, and employment) to the regional economy, as well as more broadly across NSW.

The CGE analysis estimates that the revised Project would increase gross regional income (Cadence Economics' preferred measure of economic welfare i.e. whether the region as a whole is better off or

worse off) to the region by around \$4.9 Billion (B) present value (using a 7% discount rate) and between \$6.4B and \$6.8B present value to the NSW economy. This represents a reduction of 7% to 8% in economic activity compared to the Project.

1.0 INTRODUCTION

KEPCO Bylong Australia Pty Limited (KEPCO) is seeking State Significant Development (SSD) approval for the Bylong Coal Project (the Project) under the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Project entails the construction and operation of an open cut and underground coal mine for a period of approximately 25 years. The Project is located to the south of the Bylong Village, approximately 55 km to the north east of Mudgee in Central West Region of NSW.

In light of the concerns raised by the Planning Assessment Commission (PAC) (now referred to as the Independent Planning Commission (IPC)) and the Heritage Council in relation to the impacts on the Tarwyn Park property, the NSW Department of Planning and Environment (DPE) has requested information on the effects of contracting the open cut mine plan for the Project (the revised Project) to remain outside of the Tarwyn Park property and other considerations. DPE has specifically requested the following concessions to the open cut mine plan in correspondence to KEPCO dated 28 May 2018, including:

1. No open cut mining or overburden emplacement should be permitted on the Tarwyn Park property; and
2. Overburden emplacement areas should be redesigned to minimise the visual impacts and maximise the integration of the proposed final landform with the surrounding topography.

Gillespie Economics has prepared a brief Economic Impact Assessment of the revised Project. It uses the same primary methods referred to in the Economic Impact Assessment provided for the Environmental Impact Statement (EIS) and subsequent approvals documents (including response to submissions (RTS) and Response to PAC Review Report). That is, the Economic Impact Assessment provides a Cost Benefit Analysis (CBA), Input-Output (IO) Analysis and Computable General Equilibrium (CGE) Analysis, based on financial and technical advice provided by KEPCO and its specialist consultants. The Economic Impact Assessment provided in the EIS and subsequent approvals documents should be referred to for technical information on the methods, as well as the assumptions underpinning the analysis.

This report focuses on the revised production rates and biophysical differences between the Project and revised Project and the impact of these differences on the Economic Impact Assessment results. Consequently, all other assumptions underpinning the original Economic Impact Assessment have remained constant.

For the CBA analysis, the focus is on the costs and benefits to NSW - reflecting the NSW Government (2015) *Guidelines for economic assessment of mining and coal seam gas proposals*, which post dated the original Economic Impact Assessment.

2.0 COST BENEFIT ANALYSIS

2.1 Introduction

The revised mine plan has consequences for the estimated net production benefits of the Project as well as the environmental, social and cultural impacts.

2.2 Net Production Benefits

The main impact of the revised Project is a reduction in product coal (approximately 2.5 million tonnes (Mt)) in the early years of mining from a contraction in the open cut mining area - Refer to Figure 1. This is associated with a reduction in operating costs and revenues associated with the mining, processing and transport of less product coal. Capital costs remain unchanged. The overall effect is a reduction in royalties and company tax to NSW i.e. a reduction in net production benefits of 4%.

Figure 1 - Comparison of Product Coal

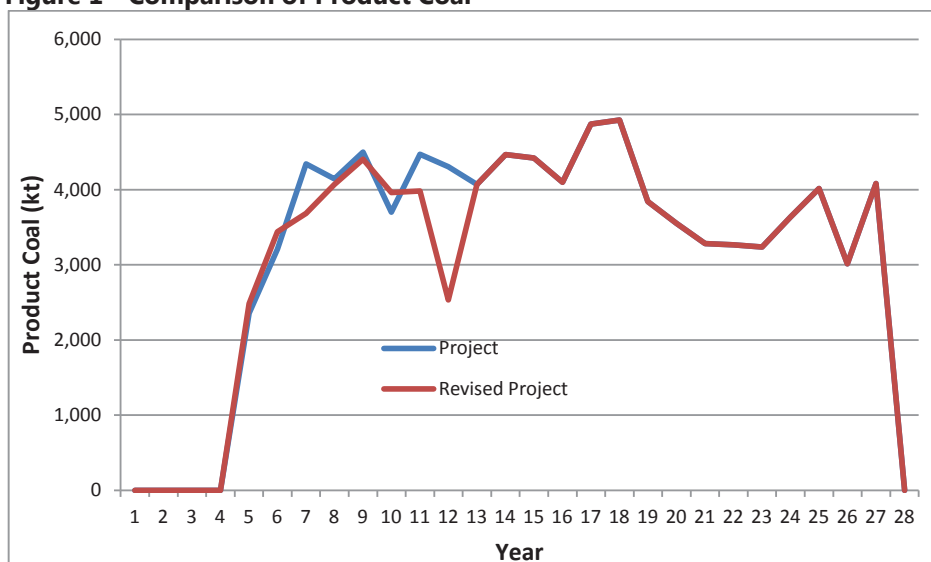


Table 1 - Comparison of Net Production Benefits to NSW (NPV, \$M at 7% Discount Rate)

BENEFITS	Project	Revised Project	Difference
Net direct production benefits			
Net production benefits to KEPCO ¹	\$0	\$0	\$0
Net production benefits to Commonwealth Government – Company tax ²	\$21 (\$102)	\$21 (\$99)	\$0 (-\$3)
Net production benefits to NSW Government – Royalties	\$290	\$278	-\$12
Net production benefits to local and regional community in the form of voluntary contributions ³	\$4	\$4	\$0
Secondary net production benefits	\$0	\$0	\$0
Total direct production benefits	\$315 (\$396)	\$302 (\$381)	-\$13 (-\$15)

¹KEPCO is 100% foreign owned and hence these benefits accrue outside of NSW

²The Project analysis assumed 28.5% company tax (a proposal by Government at the time) and 7% accruing to NSW. The NSW Guidelines (2015) suggest using 32% of company tax as accruing to NSW. The figure in brackets updates the company tax to 30% (in line with the current company tax rate) of taxable income with 32% accruing to NSW.

³VPA payments are not linked to impacts and hence are part of the producer surplus that is redistributed to local government.

2.3 Indirect Benefits

The only indirect benefits identified in the Economic Impact Assessment of the Project were the nonmarket values for employment, estimated at \$165M. These proved contentious throughout the approvals process to date, despite theoretical and empirical evidence as to their existence and magnitude. They have therefore been omitted from this analysis, but are estimated at \$163M for the Revised Project.

Wage benefits, landholder benefits and net economic benefits to suppliers, as identified in the NSW Guidelines (2015) were not estimated for the NSW analysis in the Economic Impact Assessment of the Project and remain unquantified here. Consequently, *ceteris paribus*, the net benefits of the Project and revised Project are understated.

2.4 Environmental, Social and Cultural Costs of the Revised Project

An analysis of the environmental social and cultural impacts of the revised Project is provided in Attachment 1. A summary of these impacts compared to the Project is provided in Table 2. The revised Project will result in minor reductions in most biophysical impacts of the Project.

Table 2 - Summary of Environmental, Social and Cultural Impacts of the Revised Project

Impact Category	Project	Revised Project	Difference
Project Disturbance Boundary	1,160 ha	1,047 ha	-113 ha
Subsidence	1,714 ha	1,714 ha	No change
Greenhouse gas emissions	2,228,023 (t CO ₂ -e)	2,141,081 (t CO ₂ -e)	3.9% reduction in Scope 1 emissions
Agricultural impacts on land owned by KEPCO			Minor reduction
- Extensive grazing land	694 ha	639 ha	-55 ha (7.9%)
- Arable land	451 ha	395.25 ha	-55.75 ha (12.4%)
- Biophysical Strategic Agricultural Land (BSAL)	423.1ha	400.4 ha	--22.7 ha (5.4%)
- Equine Critical Industry Cluster (CIC)	700 ha	587.2 ha	-112.8 ha (16.1%)
Noise			
Significantly impacted receivers	3	1 (this has since been acquired by KEPCO)	-2
Moderately impacted receivers	6	8 (2 previously significantly impacted receptors now moderately impacted - 1 of these has since been acquired by KEPCO, the 6 previously moderately impacted receivers remain moderately impacted with 5 acquired or reached agreement with KEPCO)	+2
Negligibly impacted receivers	3	3	No change

Impact Category	Project	Revised Project	Difference
Blasting	Impacts below relevant criteria	Impacts further below relevant criteria	Reduced blast impacts for receivers to the north of the Project Reduced impacts to sensitive heritage items including Tarwyn Park Homestead and Stables
Air quality impacts	No private receptor impacted by criteria exceedances	Reduction of particulate emissions	Approximate 40% reduction in annual Total Suspended Particulate emissions
Groundwater	Complies with NSW Aquifer Interference Policy and relevant guidelines	Complies with NSW Aquifer Interference Policy and relevant guidelines	30% reduction in groundwater inflow to open cut mining areas No change to groundwater inflow to underground mine No change to peak required WALs
Surface water	Complies with relevant guidelines and policies	Complies with relevant guidelines and policies	No significant changes. Sufficient WALs held by KEPCO
Ecology	243 ha of impacted Critically Endangered Environmental Communities (CEEC)	238.5 ha of impacted CEEC	Reduction in 4.5 ha of CEECs
Biodiversity offsets	4,100 ha	4,100 ha	No change to Project offsets
Road transport impacts	Minimal road network impacts. Intersection and road upgrades required and included in capital costs of the Project	Reduction in traffic associated with marginally smaller workforce, reduced open cut mine life (by one year) and production levels.	Reduction
Aboriginal heritage	102 sites with direct impact 42 sites potentially indirectly impacted by blasting	98 sites with direct impact 46 sites potentially indirectly impacted by blasting (addition of four previously directly impacted sites)	Reduction in level of impact to 4 sites of low archaeological significance on Tarwyn Park
Historic heritage	7 sites with direct impacts	5 sites with direct impact	Reduced impacts to Tarwyn Park Farm Complex (Horse Burials and Natural Sequence Farming areas), former Catholic Church and Cemetery, and Bylong Landscape Conservation area
Visual & Landscape impacts	No significant visual impacts to private receivers	Reduced visual impacts to KEPCO land	Reduced impacts via reduced open cut mining area and improvements to the landform size and design

However, in terms of the CBA of the Project, in accordance with government policy many of the initial impacts are internalised into KEPCO's capital and operating costs or were assessed as being immaterial to the CBA and hence reductions have no material impact to the CBA of the revised Project. For example:

- greenhouse gas emission costs to the people of NSW were assessed at less than \$0.5M, so reductions associated with the revised Project are immaterial to the CBA outcome of the revised Project.
- agricultural impacts are borne by KEPCO since they have purchased the impacted land. Including the acquisition cost in the CBA essentially assumes no agricultural production from any of this land during

the Project life. This is a highly conservative approach, but it means that changes to the agricultural land area affect do not affect the outcome of the CBA. Adjusting this assumption for areas of land that can be farmed during the Project life would increase the net benefits of the Project to NSW marginally via increased company tax payments on profits from farming. But this is likely to be immaterial to the CBA outcome of the Project or revised Project.

- air quality impacts associated with the Project meet amenity and health criteria and hence economic impacts were assessed as immaterial to the CBA. Consequently, reductions in particulate emissions associated with the revised Project are immaterial to the CBA outcome of the revised Project.
- noise impacts associated with the Project are borne by KEPCO via government policy and practice requiring acquisition of significantly affected properties and management and mitigation actions for moderately impacted receivers. With the revised Project, a reduction in the number of properties assessed as requiring acquisition reduces the capital costs of the Project and would increase the profitability and hence company tax accruing to NSW. However, it is not likely to be material to the CBA of the revised Project.
- the revised Project will result in reduced groundwater inflows to the open cut mining areas and hence the licence requirements for the open cut operation. However, the peak requirement for the underground mine will not change from the Project, and hence the maximum quantum of licence required for the revised Project does not change. Costs of acquiring/holding licences is allowed for CBA of the Project and this will not change with the revised Project.
- the revised Project will not result in any significant changes in surface water impacts. At the time of the Economic Impact Assessment, KEPCO held sufficient licences to account for the Projects predicted water take and the opportunity cost of this was included in the CBA. There is no change to the level of water access licence that is needed, although it is noted that KEPCO now hold additional water access licences due to property acquisitions.
- road network impacts of the Project were assessed as minimal, while intersection and road upgrades required as a direct result of the Project were included in the capital costs of the Project. The revised Project will result in a reduction in road network traffic associated with a marginally smaller workforce and production levels. There is no change to intersection upgrades required although KEPCO has now agreed to contribute toward some additional regional road upgrades. This will increase the costs of both the Project or the revised Project, decrease the profits and hence company tax accruing to NSW. However, the cost of these works is such that it is unlikely to be material to the CBA.
- the revised Project will result in a reduction in the area of vegetation clearing and hence reduced direct biodiversity impacts. However, the biodiversity offsets to compensate the impacts of the Project will remain unchanged. Hence, if the proposed biodiversity offsets previously resulted in no net loss of biodiversity, it must now result in some net gain in biodiversity, adding a benefit to the revised Project. However, this remains unquantified in the analysis.
- the revised Project will result in a reduction in disturbance to four Aboriginal heritage sites on the Tarwyn Park that are of low archaeological significance. With the Project these sites would be directly disturbed. However, with the revised Project they would only be potentially indirectly impacted by blasting. These impacts were previously unquantified in the CBA. However, they are unlikely to materially impact the CBA.
- the revised Project will result in a reduction in heritage impacts on Tarwyn Park Farm Complex (e.g. horse burial site), the former Catholic Church and Cemetery, and the Bylong Landscape Conservation Area. The CBA for the Project valued the direct impact on seven heritage items using benefit transfer from Allens Consulting Pty Ltd (2005) *Valuing the Priceless: The Value of Historic Heritage in Australia*, prepared for the Heritage Chairs and Officials of Australia and New Zealand. The Centre for

International Economics, in its peer review, stated that this is a "reasonable approach". At an estimated value to NSW households of \$170,000 per heritage site, a reduction in heritage impacts of the revised Project will not be material to the CBA results.

- the revised Project will also result in a reduction in localised (generally from land owned by KEPCO) visual impacts associated with the reduced areas of open cut mining and final landform changes. Visual impacts remained unquantified in the Project CBA but were considered immaterial to the CBA, based on the Visual Impact Assessment conclusions. A reduction in visual impacts from the revised Project will therefore not materially impact the CBA results.

Notwithstanding, the lack of materiality of the residual impacts (after compensation, offset and mitigation) of the Project from an aggregate CBA perspective, the revised Project will result in reductions in most biophysical impacts of the Project.

2.4 Net Social Benefits to NSW of the Revised Project

Based on the above analysis, the net social impacts of the Project and Revised Project, and difference between them is summarised in Table 3. The revised Project is still estimated to have net social benefits to NSW of in the order of \$301M (\$380M with company tax estimated in accordance with the latest guidelines). The revised Project is therefore justifiable from an economic efficiency perspective.

The main consequence of the revised Project will be a:

- reduction in net production benefits to NSW of \$13M (\$15M with company tax estimated in accordance with the latest guidelines), mainly comprising a reduction in royalties of \$12M. This represents a 4% reduction in net production benefits; and
- a reduction in environmental, social and cultural impacts, most of which are immaterial from an aggregate CBA perspective but important at a local scale.

Table 3 - NSW Cost Benefit Analysis Results (Present Value at 7% discount rate)

Value (\$M)	Project	Revised Project	Difference
Net Production Benefits			
Net production benefits to Commonwealth Government – Company tax	\$21 (\$102)	\$21 (\$99)	\$0 (-\$3)
Net production benefits to NSW Government – Royalties	\$290	\$278	-\$12
Net production benefits to local and regional community in the form of voluntary contributions	\$4	\$4	\$0
Secondary net production benefits	\$0	\$0	\$0
Total	\$315 (\$396)	\$302 (\$381)	-\$13 (-\$15)
Residual Costs After Mitigation, Compensation and Offset			
Greenhouse gas emissions	\$0	\$0	Reduction
Agricultural impacts - included in capital and opportunity costs of project	\$0	\$0	Reduction
Noise impacts -significant impacts included via land opportunity costs and capital costs.	\$0	\$0	Reduction
Moderate impacts included via mitigation costs included in operating costs	Immaterial*	Immaterial*	Reduction
Blasting - Impacts below amenity criteria	\$0	\$0	Reduction
Air quality impacts - No property significantly impacted	\$0	\$0	No change
Water - Sufficient water entitlements held. Cost included in opportunity costs of land and water	\$0	\$0	No change
Ecology - Some loss of values but offset. Cost of biodiversity offset included in opportunity cost of land, capital costs and operating costs	\$0	\$0	Reduction
Road transport impacts - Minimal road network impacts. Intersection and road upgrades required and included in capital costs of the Project	\$0	\$0	Reduction in network and road impacts
Aboriginal heritage	Unquantified	Unquantified	Reduction
Historic heritage - Demolition of 7 heritage items	\$1	\$1	Reduction
Historic heritage impacts - Costs of protecting and restoration of 12 heritage items included in capital costs	Immaterial*	Immaterial*	No change
Visual impacts - Cost of mitigation measures included in capital and operating costs	Immaterial*	Immaterial*	Reduction
Total	\$1	\$1	
NET SOCIAL BENEFITS – excluding employment benefits	\$314 (\$395)	\$301 (\$380)	-\$13 (-\$15)

* "Immaterial" does not mean that there will be no impacts, but impacts are not likely to amount to more than 5% of the quantified net production benefits of the Revised Project.

**\$0M impacts refers to residual impacts after compensation, offset and mitigation. Hence most residual impacts estimated to be valued at \$0M have already been accounted for elsewhere e.g. in Project costs.

3.0 REGIONAL AND STATE ECONOMIC IMPACTS - INPUT OUTPUT ANALYSIS

3.1 Introduction

Economic activity impacts arise from the spending of mining projects on inputs to production and the expenditure of employees. Because mining projects involve large expenditures and high salaries they can contribute significantly to regional economic activity at the regional and State level.

The New South Wales Minerals Council (NSWMC)¹ analysed the expenditure patterns of 26 NSW exploration and mining companies to determine the economic contribution of the industry throughout NSW in 2016/17. The spending data, which included business purchases, employee salaries and wages, community contributions and local and state government payments, was collected by postcode where it was spent to allow local, regional and state-wide economic benefits to be assessed.

The study found that in the Central West, the 26 companies surveyed contributed \$573M in direct spending through:

- \$393M in wages and salaries to 3,549 direct full-time employees (including contractors);
- \$169M in purchases of goods and services from 872 local businesses (including contractors);
- \$1.7M in contributions to 252 community organisations; and
- \$8.3M in local government payments.

This \$573M in direct spending was modelled using IO analyses of the Central West economy and estimated to generate a total of:

- \$880M in supplying business purchases;
- \$717M in total wages and salaries paid to workers;
- \$1.3Billion (B) in value added, or 8.5% of total value-added in the Central West (\$14.8B); and
- 12,101 full-time equivalent (FTE) jobs, or 12.3% of the entire workforce in the Central West.

At the NSW level the study found that expenditure from the surveyed companies contributed the following direct and indirect economic activity to the New South Wales economy

- \$25.5B in output/turnover (or purchases from supplying businesses);
- \$22.8B in value added (contribution to gross state product);
- \$9.8B in income (wages and salaries); and
- 130,167 full-time equivalent jobs.

¹ Lawrence Consulting (2018) *NSW Mining Industry Expenditure Impact Survey 2016/17*, prepared for the NSW Minerals Council.

The Economic Impact Assessment of the Project used the same method, IO analysis, to estimate the economic activity impacts of the Bylong Coal Project on the Mid Western Regional Local Government Area (the region).

The revenue, expenditure and employment associated with the construction and operation of the revised Project would also stimulate economic activity for the regional economy.

3.2 Construction

Construction for the revised Project would be the same as for the Project. The regional economic impact of the average annual construction expenditure in the main year of construction (Project Year 2) was estimated at up to:

- \$297M in annual direct and indirect regional output or business turnover;
- \$104M in annual direct and indirect regional value added;
- \$55M in annual direct and indirect household income; and
- 863 direct and indirect jobs.

This assessment included the construction of the Worker Accommodation Facility, which is no longer proposed. However, as identified in the Response to Submissions, this was a minor part of the construction costs of the Project and would therefore only result in a slight reduction in economic activity during the construction phase of the Project.

3.2 Operation

The average annual production, expenditure and employment profile of the revised Project is slightly less than the Project due to the reduced production from the open cut mining operations. The regional and NSW economic impacts of the revised Project will therefore be slightly less than estimated for the Project. Table 4 compares average annual regional and NSW economic impacts of the Project and revised Project.

Table 4 - Annual Economic Impacts of Operation of the Project on the Regional Economy

Economic Indicator	Region			NSW		
	Project	Revised Project	Difference	Project	Revised Project	Difference
Output (\$000)						
<i>Direct</i>	468,691	453,768	-14,923	468,691	453,768	-14,923
<i>Production-induced</i>	106,155	100,925	-5,230	217,784	207,050	-10,734
<i>Consumption-induced</i>	48,836	47,571	-1,265	168,768	163,055	-5,713
Total impacts	623,682	602,265	-21,417	855,243	823,873	-31,370
Value-added (\$000)						
<i>Direct</i>	305,426	298,550	-6,876	305,423	298,550	-6,873
<i>Production-induced</i>	45,469	43,230	-2,240	96,017	91,283	-4,734
<i>Consumption-induced</i>	27,078	26,377	-702	90,433	87,372	-3,061
Total impacts	377,973	368,156	-9,817	491,873	477,204	-14,670
Income (\$000)						
<i>Direct</i>	40,600	40,040	-560	40,600	40,040	-560
<i>Production-induced</i>	21,051	20,014	-1,037	52,707	50,108	-2,598
<i>Consumption-induced</i>	10,758	10,479	-279	41,876	40,459	-1,418
Total impacts	72,409	70,533	-1,875	135,183	130,607	-4,576
Employment (no.)						
<i>Direct</i>	290	286	-4	290	286	-4
<i>Production-induced</i>	309	294	-15	588	559	-29
<i>Consumption-induced</i>	231	225	-6	618	597	-21
Total impacts	830	805	-25	1,496	1,442	-54

The revised Project is estimated to make up to the following average annual contribution to the regional economy for 23 years:

- \$602M in annual direct and indirect regional output or business turnover;
- \$368M in annual direct and indirect regional value added;
- \$71M in annual direct and indirect household income; and
- 805 direct and indirect jobs.

This represents a 3% reduction in total regional economic impacts compared to the Project.

The revised Project is estimated to make up to the following total contribution to the NSW economy for 23 years:

- \$824M in annual direct and indirect output or business turnover;
- \$477M in annual direct and indirect value-added;
- \$131M in annual direct and indirect household income; and
- 1,442 direct and indirect jobs.

This represents a 3% to 4% reduction in total NSW economic impacts compared to the Project.

These assessments include the operation of the Worker Accommodation Facility which was part of the original Project but is no longer proposed. However, as identified in the Response to Submissions, assuming no accommodation capacity shortfalls, the provision of workers accommodation by existing accommodation providers would result in a redistribution of direct economic activity during the operations phase of the Project from the Workers Accommodation Facility to existing accommodation providers i.e. a shift of economic activity from direct effects to flow-on effects. It will not result in any substantial changes to the overall level of economic activity arising from the Project.

4.0 REGIONAL AND STATE ECONOMIC IMPACTS - COMPUTABLE GENERAL EQUILIBRIUM ANALYSIS

A CGE analysis of the revised Project is provided in Attachment 2. A comparison of the results to the CGE analysis of the Project, which was included in the Response to the PAC Review Report, is provided in Table 5.

Table 5 - CGE Analysis Results for the Region and NSW

	Region			NSW		
	Project	Revised Project	Difference	Project	Revised Project	Difference
Annual Gross Regional Product \$M (NPV @ 7%)						
- Inelastic labour supply	4,638	4,413	-225	4,915	4,673	-242
- 0.15 labour supply elasticity	4,917	4,674	-243	5,281	5,013	-268
- 0.30 labour supply elasticity	5,131	4,876	-255	5,578	5,290	-288
Annual Gross Regional Income \$M (NPV @7%)						
- Inelastic labour supply	5,156	4,756	-400	6,910	6,386	-524
- 0.15 labour supply elasticity	5,259	4,866	-393	7,109	6,589	-520
- 0.30 labour supply elasticity	5,338	4,949	-389	7,275	6,756	-519
Average Annual Operational Employment - FTE						
- Inelastic labour supply	-			-		
- 0.15 labour supply elasticity	272 (153 to 365)	260 (166 to 349)	-12	356 (211 to 527)	333 (200 to 495)	-23
- 0.30 labour supply elasticity	483 (272 to 648)	462 (294 to 620)	-21	645 (382 to 956)	605 (367 to 898)	-40

This indicates that the regional and State impacts of the revised Project will be slightly (4% to 8%) less than those of the Project, but still substantial.

The gross regional income² provided by the revised Project to the regional economy is estimated at \$4.9B present value (using a 7% discount rate), compared to \$5.3M for the Project i.e. 7% less. The gross regional income provided by the revised Project to the NSW economy is estimated at \$6.4B to \$6.8B present value (using a 7% discount rate), compared to \$6.9M to \$7.3M for the Project i.e. 7% to 8% less. The welfare impact was not very sensitive to different labour supply assumptions.

With regard to employment during the operation of the revised Project, the CGE analysis indicates incremental annual full-time equivalent (FTE) employment in the regional economy of between 166 and 349 when the labour supply elasticity is assumed to be 0.15 and between 294 and 620 annual FTE when

² Cadence Economics' preferred measure of economic welfare i.e. whether the region as a whole is better off or worse off.

the labour supply elasticity is assumed to be 0.30. The average annual labour supply is 4% less than for the Project. If the economy is assumed to be at full employment, then there are no additional labour impacts, but significant benefits in terms of wage increases across the economy.

Labour impacts to the NSW economy during the operation of the Project are greater than for the regional economy i.e. 210 to 495 FTE when the labour supply elasticity is assumed to be 0.15 and between 367 and 898 annual FTE when the labour supply elasticity is assumed to be 0.30. The average annual labour supply is 6% less than for the Project.

5.0 CONCLUSION

The revised Project will result in a reduction in production in the early years of mining, resulting from a contraction to the open cut mining areas.

This is associated with a reduction in operating costs and revenues and overall results in a reduction in net production benefits from the Project of \$13M (present value) (\$15M including revised company tax estimates), mainly comprising a reduction in royalties. This represents a 4% reduction in net production benefits.

It will also result in a reduction in the environmental, social and cultural impacts of the Project, most of which are immaterial from an aggregate CBA perspective, but important at a local scale.

Consequently, the revised Project will result in a minor (4%) reduction in the net social benefits of the Project to NSW, from \$314M (\$395M including revised company tax estimates) to \$301M (\$380M including revised company tax estimates). Importantly, the aggregate benefits of the revised Project to NSW still exceed the aggregate costs to NSW and hence the revised Project is desirable and justified from an economic efficiency perspective.

The revised Project will also contribute to economic activity in the regional and NSW economy, during both construction and operation. These impacts have been estimated using two methods, IO and CGE analysis, that differ in their underlying assumptions. However, whichever approach is used, it is clear that the revised Project will provide significant economic activity (output, value-added, regional income, and employment) to the regional economy, as well as more broadly across NSW.

ATTACHMENT 1 - ENVIRONMENTAL, SOCIAL AND CULTURAL IMPACTS OF THE REVISED PROJECT

Project Disturbance Area

The revised Project Disturbance Boundary for the Revised Mine Plan will be reduced by approximately 113 ha (to 1,047 ha) when compared to the EIS assessments (1,160 ha). Further, the open cut mining activities for the Revised Mine Plan will occur for one year less and at reduced rates when compared to the EIS. The underground mine remains entirely consistent with that assessed as part of the EIS, which maintains the maximum Run of Mine (ROM) coal production for the Project at 6.5 million tonnes per annum (Mtpa). The environmental, social and cultural impacts of the Revised Mine Plan are summarised in below.

Subsidence

No change is proposed to the Underground Mine for the Revised Mine Plan. The subsidence impacts would remain consistent with those predicted in the EIS subsidence assessment. As stated in Section 4.4.2 of Bylong Coal Project Economic Impact Assessment (Gillespie, 2015) *'As identified in Section 2.2, no privately owned residences occur within the Subsidence Study Area, although a number of infrastructure and natural areas may be impacted. An allowance has been included in the operating costs of the Project for the management and remediation of subsidence impacts on the land surface and infrastructure.'*

Agricultural Production

The reduced footprint within the Western Open Cut will avoid impacts to approximately 1.02 ha of land classified as arable land and 18.80 ha classified as extensive grazing land. It will also avoid impacts to 2.61 ha of heavily timbered land. The reduced footprint within the Eastern Open Cut will avoid impacts to approximately 54.73 ha of land classified as arable land and 36.20 ha of extensive grazing land. These reduced impacts will result in some reductions to the assessed impacts to agriculture when compared to the EIS.

The reduced footprints within the Eastern and the Western Open Cut mining areas reduces the total area of BSAL to be directly impacted from 423.1 ha (as per the Response to Submissions (RTS)) to 400.4 ha. Similarly, the direct impacts to Equine CIC has been reduced from 700 ha to 587.2 ha.

Whilst the impacts to biodiversity values will be reduced as part of the Revised Mine Plan, the Biodiversity Offset Strategy (BOS) for the Project remains unchanged from that assessed within the approvals documentation provided to date. Therefore, the BOS will continue to impact 407.4 ha of BSAL (although 119.6 ha of this will continue to be retained for agriculture). Further, the BOS will continue to impact approximately 584 ha of mapped Equine CIC (with approximately 69 ha within previously cultivated areas and will therefore be retained for agriculture).

Operational Noise

The EIS identified three properties which were predicted to be significantly impacted by noise from the Project. A further six receivers were predicted to be moderately impacted by noise from the Project. Three private receivers were predicted to experience negligible noise impacts as a result of the Project. Since the finalisation of the EIS, KEPCO has acquired two of the three significantly impacted properties and has

either reached agreement with or acquired five of the six receivers predicted to be moderately impacted by noise from the Project. The three receivers predicted to experience negligible noise impacts remain. The noise modelling undertaken for the Revised Mine Plan has demonstrated that as a result of the reduced production rates within the open cut mining operations and the relocation of initial operations within the Eastern Open Cut further south, the predicted noise impacts for the Revised Project Layout will reduce. When comparing overall predicted noise for PY5 (worst case scenario), noise levels at impacted receivers have reduced on average by one dB. One private receiver (receiver 60) previously predicted to be significantly impacted by noise will now experience moderate noise impacts as a result of the Project. The remaining receiver previously predicted to experience moderate noise impacts will continue to receive moderate noise impacts during the early years of the Project for the Revised Mine Plan. The three receivers (located on one property) will continue to experience negligible noise impacts throughout the early stages of the open cut mine life.

Blasting

As a result of the reduced footprints for the Revised Mine Plan, Tarwyn Park Homestead and Stables would now be located more than approximately 1.4 kilometres from the nearest source of blasting. The EIS blasting assessment assumed that blasting activities would be undertaken within 190 and 107 metres of the Homestead and Stables respectively. The vibration impacts to these items of historic heritage value will be considerably lower for the Revised Mine Plan.

The Revised Mine Plan results in the former Bylong Catholic Church and associated Cemetery to remain. Blasting activities will be located more than 900 m from the former Bylong Catholic Church. Whilst blasting activities will be able to comply with the relevant criteria set for the avoidance of structural damage, a blast management strategy will be developed to ensure that blasting activities are appropriately designed to manage blast impacts to the former Bylong Catholic Church.

The EIS did not predict vibrational impacts resulting from blasting to be in excess of the guideline limits at any sensitive receptor. This finding remains for the Revised Mine Plan.

Air Quality

The EIS assessment of air quality impacts for the Project to nearby private receivers indicated that no private receivers will be impacted by exceedances of the relevant air quality criteria (PEL, 2015). The reduced footprint of the open cut mining operations for the Revised Mine Plan further reduces the potential for air quality impacts to neighbouring private receivers. The Revised Mine Plan reduced open cut mining operations by approximately one year, the footprint for open cut mining operations has been contracted and the materials handled throughout the open cut operations also reduces. Further to this, KEPCOs land acquisition of surrounding sensitive receptors has occurred since the preparation of the EIS. The Revised Mine Plan results in a reduction of total suspended particulate emissions by approximately 40% from those predicated for the EIS assessment.

Greenhouse Gases

The Revised Mine Plan reduces the total coal resource recovered utilising open cut mining methods from approximately 33 Mt of ROM coal to approximately 28 Mt of ROM coal. This reduced coal recovery results in the operational life of the open cut to reduce from eight to seven years as marginally reducing annual production rates (less handling of overburden and ROM coal). The Revised Mine Plan also reduces the amount of product coal to be transported to the Port of Newcastle.

These reductions in open cut mining operations will result in a proportionate reduction to Greenhouse Gas emissions resulting from the Project. The revised mine will also result in lower Greenhouse Gas emissions due to the following:

- Less haulage, reduced open cut mining activities and a slight reduction in major equipment resulting in approximately 5.1% less diesel consumption when compared to the EIS;
- Reduced intensity and duration of open cut mining activities resulting in an approximate 1.3% decrease in electricity consumption compared to that assessed within the EIS;
- A 3.3% reduction in fugitive emissions due to the contracted footprint of open cut mining activities compared with those assessed within the EIS; and
- A 2.7% reduction of scope 3 emissions from the burning of product coal and coal transportation compared with the EIS.

Water

Surface water and groundwater impact assessments have been completed for the Revised Mine Plan.

The Groundwater Impact Assessment has identified that as a result of the reduced open cut mining footprint which is now located further from the Bylong River alluvial aquifer, the Revised Mine Plan results in an approximate 30% reduction in groundwater inflow to open cut mining areas and has also marginally reduced the drawdown to the Bylong River alluvial aquifer. Whilst the groundwater inflows to the open cut mining areas is predicted to reduce, the peak groundwater inflows to the underground mine (4,099 ML in PY 18) does not change (as expected) for the Revised Mine Plan.

The Surface Water Impact Assessment (including water balance) for the Revised Mine Plan identified similar impacts to those reported in the EIS and associated approvals documentation. Borefield make-up water demands will slightly increase from that previously assessed as part of the water balance completed for the Supplementary RTS (primarily the result of reduced groundwater inflows to open cut mining areas). However, the existing water access licenses significantly exceed the requirement for external water supply to satisfy all site demands or all years of mining operation. KEPCO currently holds 3,045 units of water allocation from the Bylong River Water Source under the Hunter Unregulated WSP, which is greater than the 2,535 units reported within the EIS (additional obtained through additional land acquisitions).

The water balance modelling for the Revised Mine Plan has indicated the mine water management system will be capable of achieving nil discharge from the mine-affected water system, consistent with the assessments undertaken for the Project as presented in the EIS.

Ecology

The 113 ha reduction in Project disturbance as a result of the Revised Mine Plan will reduce impacts to vegetation communities which were previously assessed to be impacted. There will be no new disturbance as a result of the Revised Mine Plan. Vegetation communities located within the previous Eastern Open Cut (on Tarwyn Park) are predominantly cleared cultivated land, Derived Native Grassland with a patch of Central Hunter Greybox Woodland which will no longer require direct disturbance. There is also some reduced disturbance to woodland and grassland communities as a result of the reduced footprint within the Western Open Cut mining area. This contraction to the Western Open Cut results in approximately 4.5 ha of Critically Endangered Ecological Community (CEEC) being avoided.

Despite the above, there are no changes proposed to the Biodiversity Offsets Strategy (BOS) for the Revised Mine Plan. Ecological impacts are therefore consistent with those stated within the EIS and supporting documentation and the impacts for the Revised Mine Plan will be conservatively compensated through the BOS previously developed for the Project.

Road Transport

The Revised Mine Plan will require a marginally smaller open cut mining workforce and for one year less than that assessed within the EIS and associated approvals documents. Further to this, the quantity of materials handled throughout the open cut operations will be less than those assessed for the EIS. Accordingly, the traffic movements associated within the delivery of mining consumables (diesel, lubricants, blasting consumables, etc) will be reduced from those assessed within the EIS and associated approvals documents. These implications of the Revised Mine Plan effectively result in reduced (or similar) traffic and transport impacts on the local and regional road and rail networks to those assessed as part of the EIS and associated approvals documents.

Notwithstanding, it is important to note that the upgrades to the Wollar Road by Mid-Western Regional Council (MWRC) (in accordance with Resources for Regions funding) is now well advanced and is unlikely to result in impacts to the Project. Further, KEPCO has agreed to contribute to upgrades to the road travelling through the Munghorn Nature Reserve and upgrades to a section of the Bylong Valley Way, between Wollar Road and Upper Bylong Road. These upgrades to the regional road network will only be made should the Project be approved and proceeds.

Aboriginal Heritage

The Revised Mine Plan will remove direct disturbance to four archaeological sites located on the Tarwyn Park property, including three artefact scatters and one isolated find. Whilst these sites will no longer be subjected to salvage, the sites will be indirectly subject to vibration impacts from blasting activities. These will be managed in accordance with the Aboriginal Heritage Management Plan to be developed for the Project.

Historic Heritage

The Revised Mine Plan reduces direct impacts to the Tarwyn Park Farm Complex for the open cut mining components of the Project. This subsequently avoids the direct disturbance to the horse burial location and land located on the upper slopes of the Bylong River catchment which has been utilised for Natural Sequence Farming (NSF) activities. The Revised Mine Plan will also enable the former Bylong Catholic Church and associated Cemetery to be retained in situ. The impacts to Non-Statutory National Trust (NSW) listed Bylong Landscape Conservation Area (BLCA) will also be reduced as a result of the reduced open cut mining footprints and associated landform designs.

As Tarwyn Park Farm Complex would remain undisturbed from open cut mining, the land utilised for NSF would remain intact and access will be permitted for continued study of the technique on the site of its development. The indirect vibration impacts on Tarwyn Park Homestead and Stables would also be materially reduced as the closest mining operations would now be more than approximately 1.4 km from the structures.

The former Bylong Catholic Church and associated Cemetery would remain undisturbed, and therefore the exhumation of the cemetery would not be progressed as part of the Project. The Church building would remain in situ.

The reduced open cut mining areas would reduce the landscape impacts to the BLCA. Similarly, the retention of the former Our Lady of the Sacred Heart Catholic Church is also likely to reduce the impacts to the BLCA, as it allows for the retention of an element of the Upper Bylong Village. The revised final landform has significantly reduced impacts to the shape of the Upper Bylong and Lee Creek Valleys.

Visual Impacts

The Revised Mine Plan is considered to comprise significantly improved landscape character and visual amenity outcomes over those provided for within the EIS. The reduced footprint for open cut mining operations results in the landform changes occurring further south on the lower slopes of Tal Tal Mountain as opposed to these landform changes extending further north adjacent to the Tarwyn Park Homestead. Accordingly, the visual amenity from Tarwyn Park Farm Complex has been significantly improved.

KEPCO has also provided an example of a more detailed final landform which is typically prepared at the Rehabilitation Management Plan/Mining Operations Plan phase and in accordance with the previously committed landform management and mitigation measures. This example incorporates macro relief into the conceptual final landform design which demonstrates how the landform may be developed for the Project.

ATTACHMENT 2 - CGE ANALYSIS OF THE REVISED PROJECT



ECONOMIC IMPACT ASSESSMENT OF THE BYLONG COAL PROJECT

STATE SIGNIFICANT DEVELOPMENT APPLICATION

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General reliance restriction

This report is prepared for KEPCO Bylong Australia Pty Ltd. The purpose of this report is to provide an economic impact assessment of the Bylong Coal Project to NSW and to the local economy. You should not use the advice for any other purpose. This report should not be used or relied upon by anyone else and we accept no duty of care to any other person or entity. Due to the uncertain nature of economic data, Cadence Economics does not warrant the completeness or accuracy of the analysis or estimates provided in this report.

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Executive Summary

Cadence Economics was engaged to update its Computable General Equilibrium (CGE) analysis of the economic impacts of the Bylong Coal Project (the Project) which was previously completed for the Response to the Bylong Coal Project SSD 6367 Review Report (2017). The updated analysis is required to confirm the potential effects of contracting the open cut mine plan from the Tarwyn Park property as has been requested by Department of Planning and Environment.

Consistent with the previous CGE analysis, three different labour supply assumptions were utilised to assess the revised impacts to the Mid-Western Regional Council Local Government Area (MWRC LGA) and New South Wales (NSW) economies:

- the NSW and regional economy is at full employment and hence no new employment is generated. Workers for the Project would be drawn from their existing jobs via higher wages;
- a labour supply elasticity of 0.15, adopted by Treasury at the National Level which indicates a relatively 'inelastic' response from workers i.e. workers are slow to respond to changes in wages because it is assumed that the economy is close to full employment or the project under consideration requires highly skilled workers; and
- a labour supply elasticity of 0.30 which is still relatively 'inelastic' but more elastic than the above assumption, meaning that workers respond more readily to marginal changes in the wage rate.

The revised CGE analysis found that the Project would have significant positive economic impacts on the MWRC LGA and the NSW economies. In particular, the analysis found that the Project would increase gross regional income (the preferred measure of economic welfare i.e. whether the region as a whole is better off or worse off) to the MWRC LGA by around \$4,866 million present value (using a 7% discount rate) and between \$6,386 million and \$6,756 million present value to the NSW economy. The welfare impact was not very sensitive to different labour supply assumptions.

With regard to employment, the CGE analysis indicates peak incremental annual full-time equivalent (FTE) employment in the MWRC LGA of 350 when the labour supply elasticity is assumed to be 0.15 and 620 annual FTEs when the labour supply elasticity is assumed to be 0.30. Average wages in the MWRC LGA are projected to increase by 12.5% over the Project life when the labour supply elasticity is 0.15 and 11.1% when the labour supply elasticity is 0.30. If the economy is assumed to be at full employment, then there are no additional labour impacts, but significant benefits in terms of wage increases across the economy.

Labour impacts to the NSW economy during the operation of the Project are greater than for the regional economy i.e. a peak of 495 FTEs when the labour supply elasticity is assumed to be 0.15 and a peak of 898 annual FTEs when the labour supply elasticity is assumed to be 0.30.

1. Introduction

Cadence Economics was commissioned by Gillespie Economics on behalf of KEPCO Bylong Australia Pty Ltd (KEPCO) to undertake an economic impact assessment (EIA) of the Bylong Coal Project (the Project). KEPCO is a wholly owned subsidiary of Korea Electric Power Corporation. The Project is a greenfield development within the Mid Western Regional Council (MWRC) Local Government Area (LGA) in New South Wales.

This report was prepared as a revision to the previous analysis completed by Cadence Economics in response to the Planning Assessment Commission (PAC) Review Report. To understand a detailed economy-wide impact of the Project, this report should be read in conjunction with the *Bylong Coal Project Economic Impact Assessment* undertaken by Gillespie Economics (June 2015). The Gillespie Economics report provides a detailed cost benefit analysis of the Project setting out the regional and state-wide net benefits of the Project taking into account the financial benefits and the externalities. The Gillespie report also includes the economic impacts of the Project's capital and operational expenditure using input-output table or multiplier analysis.

During the Governments assessment process for the Project, the PAC (now known as the Independent Planning Commission (IPC)) suggested that the assessment of the economy-wide impacts of the Project, using computable general equilibrium (CGE) modelling, would help to calibrate the expected welfare gain to the community. The Response to PAC Review Report (Hansen Bailey, 2018) included the previous CGE modelling analysis completed by Cadence Economics.

The revised economic analysis in this report provides an estimation of the economy-wide impacts of the Revised Project on the MWRC LGA and NSW in total. This analysis is based on an application of a CGE model. The Cadence Economics General Equilibrium Model (CEGEM) is a large scale, dynamic, multi-region, multi-sector model of the global economy, with an explicit representation of the MWRC LGA and the rest of the NSW economy. CEGEM is based on a substantial body of accepted microeconomic theory. More information on CEGEM is outlined in Chapter 2.

This report has been prepared to be read in conjunction with the CBA and input-output analysis as set out in the Gillespie report (2015). As a result, all figures in this report are expressed in 2014 dollars and all net present value calculations are discounted to 2014.¹ Table 1 provides a summary overview of the Revised Project, a more detailed description can be found in the Gillespie report.

¹ The use of 2017 values would not have substantially changed the findings.

Table 1: Summary of operations under the Revised Project

Description of operations	
Run-of-Mine	119.8 Mt
Product Coal	87.3 Mt of Product Coal, 84% low ash coal and 16% high ash thermal coal
Sales Revenue	Based on WoodMcKenzie forecasts and an AUD:USD exchange rate of 0.84, consistent with the Gillespie Economics 2015 report
Capital Expenditure	Capital requirement is \$855.5 million (in net present value terms using a real 7% discount rate) or \$1,331 million undiscounted
Mining Methods	Underground longwall mining and open cut operations
Mining Rate	Up to 6.5 Mt of ROM coal per annum
Life of Mine	2 years preconstruction, then LOM of 25 years - 2 years construction and 23 years operation
Workforce	Approximately 470 FTE employees during the construction phase and 290 FTE during the operational phase

Source: Based on information provided by Gillespie Economics

2. CGE modelling framework

The ultimate aim of this economic impact study based on applied CGE modelling is to estimate the net benefit of the Project on economic activity and the living standard of those residing within the MWRC region and in NSW.

CGE modelling is a recognised method for assessing the impacts of large projects on the economy. It is based on detailed representation of the economy, including the complex interactions between different sectors of the economy.² A CGE model is able to analyse the impacts of the Project in a comprehensive, economy-wide framework meaning the modelling captures:

- **Direct increases in demand** associated with the Project, including short term construction activity as well as the assumed increases in 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 mine to overseas interests, in this case, the Bylong Coal Project which is owned by KEPCO; and,
 - construction worker wages.

About Cadence Economics' CGE model

CEGEM is a large scale, dynamic, multi-region, multi-sector model of the global economy, with an explicit representation of the MWRC LGA and the NSW economies.

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 can also be 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) shows how the change in real GSI is a good approximation to the **equivalent variation** welfare measure in global CGE models, such as CEGEM. This measure is widely used by practitioners and can also be decomposed into various components to assist

² See for example the Policy & Guidelines Paper produced by the NSW Treasury (2009).

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).

As noted by Pant et al (2000), in considering welfare results in global CGE models such as CEGEM, the main components are the change in: output (measured by real GSP); terms of trade; and payments to foreigners. Of particular relevance in the discussion around estimating the net benefits of the Project 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 CEGEM

CEGEM is a multi-commodity, multi-region, dynamic model of the world economy. Like all economic models, CEGEM 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 Global Trade Analysis Project (GTAP) and Global Trade and Environment Model (GTEM), with state and regional modelling frameworks such as Monash Multi-Regional Forecasting (MMRF) and The Enormous Regional Model (TERM) models.

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 CEGEM, 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.

CEGEM 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.

That noted, real GSI does not capture some non-market effects that can impact on the living standards of NSW residents. These could include the, noise impacts for residents or pollution as considered in the detailed CBA of the Project prepared by Gillespie Economics.

CEGEM 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 Project investment or coal output. Set against this scenario is the policy scenario (or the Project case) under consideration.

Overview of scenarios

All scenarios outlined in the modelling below use the scenario as specified in the Gillespie Economics report, and summarised in Table 1.

In addition, we have also factored into our scenarios the benefits that flow from the Project outside of the MWRC LGA and the NSW economies. This includes, the repatriation of profits out of the LGA to foreign shareholders, along with the payments out of the LGA for royalties to the NSW Government and corporations tax to the Australian Government. We have assumed these royalty payments accrue to the Rest of NSW. In addition, as construction workers reside outside of the LGA, we have assumed this income migrates out of the LGA.

The central consideration across the scenarios relates to the responsiveness of the NSW labour market to the increase in expenditure (the labour supply response³) and to test the responsiveness we have incorporated into our modelling three labour market assumptions, as discussed below.

Conceptually, if the NSW economy is operating at full employment and, therefore, no new workers were available to service the increase in expenditure (demand) associated either with the construction of the Project or the associated increase in coal output, the Project would not create a single additional job. That is, workers would be drawn from their existing jobs via the new Project offering higher wages. Similarly, if a new project required very specific highly trained and skilled workers and there were none readily available, the Project would not create a single additional job. We replicate this type of world by assuming an 'inelastic' – or Zero -labour supply elasticity.

On the other hand, in a world where the economy is operating at below capacity, as evidenced for example by higher unemployment and slower growth, it is more realistic to assume a relatively more 'elastic' labour supply whereby potential workers are encouraged into the workforce, again through increased wages. In terms of specifying the elasticity of labour supply, we follow the lead of the Australian Treasury and use a labour supply elasticity assumption of 0.15 under 'Medium' settings, which indicates a relatively 'inelastic' response from workers. This means workers are slow to respond to changes in wages because (it is assumed that) the economy is close to full employment or the project under consideration requires highly skilled workers.

To further test the results to the responsiveness of the NSW labour market, under the 'High' scenario, a labour supply elasticity of 0.3 is assumed, which is relatively more 'elastic' and means that workers respond more readily to marginal changes in the wage rate.

³ In economic jargon, the assumed labour supply elasticity.

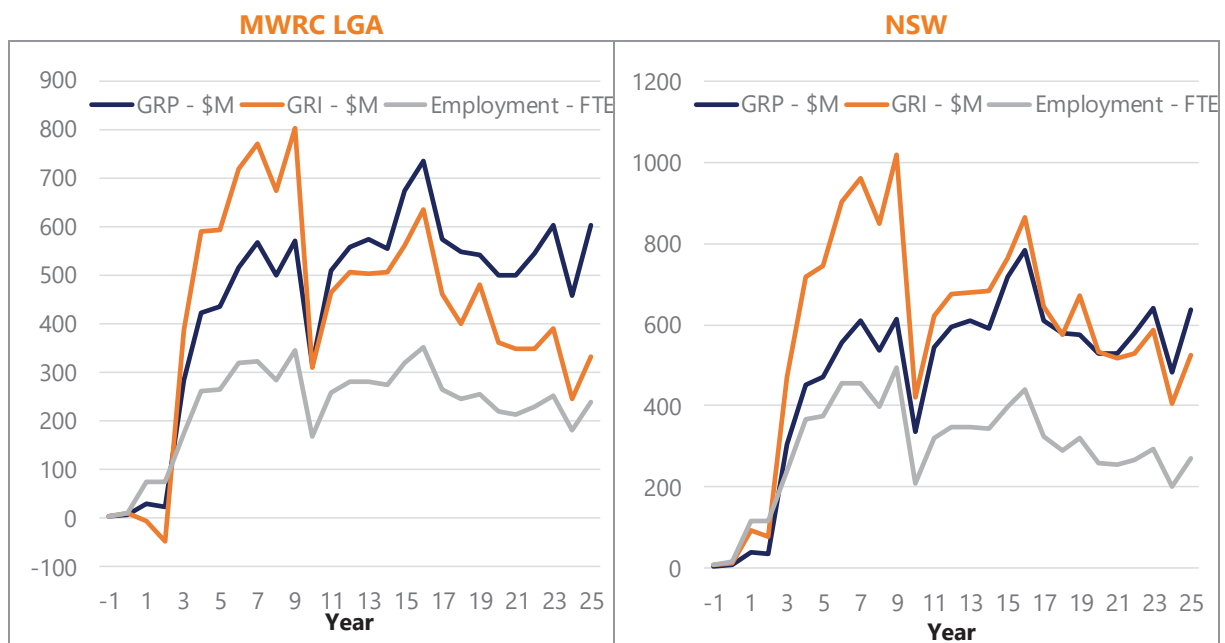
3. Economy-wide modelling of the Project

Given the number of possible scenarios under consideration, this section focusses on annual impacts of the medium labour supply scenario that is based on the Project using a labour supply elasticity of 0.15.

A summary of the key macroeconomic variables projected under the core scenario is shown in Figure 1. The results are reported as deviations from the reference case and represent the change in a particular variable as a result of investing in and operating under the Project assumptions. The results for the MWRC LGA are outlined on the left hand side of the figure and NSW on the right (NSW includes the MWRC LGA).

The annual results from the CGE model generally move in-line with the Project capital expenditure and production activity. Real GRP for the MWRC LGA is projected to peak at \$733 million higher than the reference case in Year 16 of the Project, coinciding with peak coal output. This increase in real GRP is a function of the higher levels of activity within the LGA associated with output at the mine and the flow-on benefits of purchasing inputs to operate the mine. Real GRI is also projected to peak in Year 9 of the Project at \$802 million, which coincides with peak capital expenditure associated with underground construction and relatively high levels of coal output. The increase in GRI is driven by the twin factors of higher wages for local workers and the repatriation of profits out of the LGA to the foreign owners of the mine, the company tax outflows and the royalty payments to the Rest of NSW.

Figure 1: Projected economy-wide impacts of the Project, 0.15 Labour Supply Elasticity



Source: Cadence Economics estimates

Employment in the MWRC LGA is expected to peak at 350 FTE, also in Year 16 of the Project. These results are driven by the direct employment within the MWRC LGA, the flow-on impacts from local inputs and any of the crowding out of employment in other sectors. Given the increase in economic activity

and a migration of workers into higher paying sectors, average wages in the MWRC LGA are projected to increase by 12.5% over the Project life.

Moving to the state-wide results, real GSP for NSW is projected to peak at \$783 million higher than the reference case in Year 16 of the Project, coinciding with peak saleable output from the Project. In Year 9 of the Project real GSI will peak at \$1,017 million and employment of 495 FTE. State-wide average wage increases by a modest 0.048%.

High Labour Market Assumption

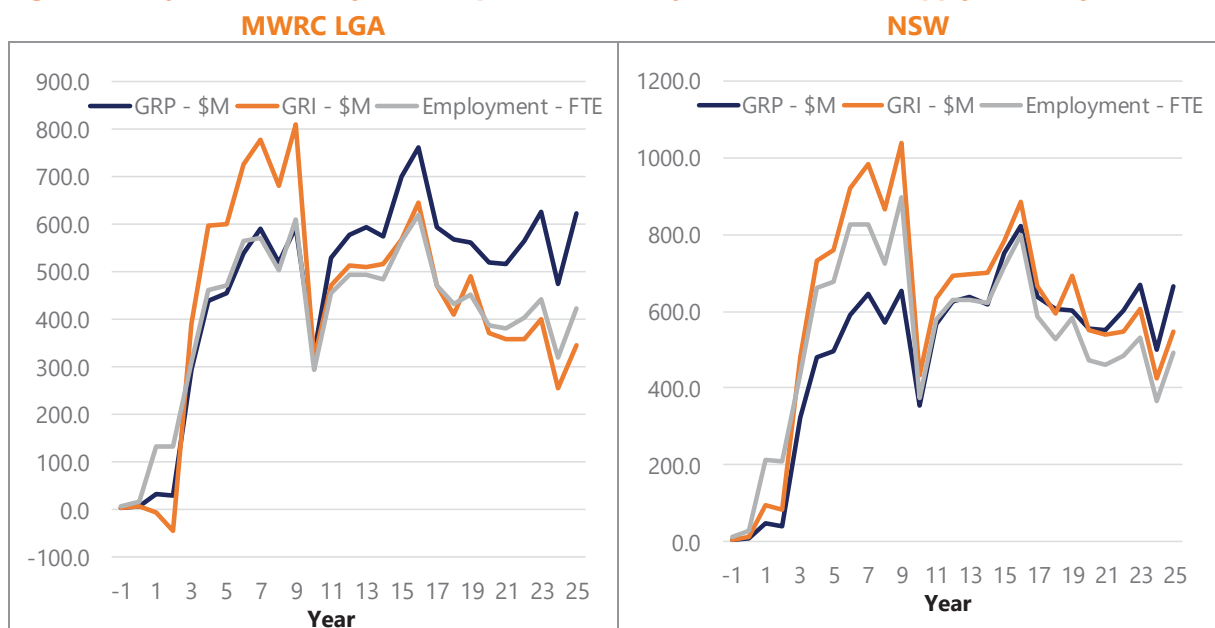
This section provides an overview of the economic impacts, where the labour market responds more readily to marginal changes to the wage rate, under the High labour market assumptions outlined above.

The results indicate that the labour market assumptions have a relatively large impact to employment compared to the economy-wide impacts to GRP and GRI.

Real GRP for the MWRC LGA is projected to peak at \$762 million higher than the reference case in Year 16 of the Project, where real GRI is projected to peak in Year 9 of the Project at \$811 million, under the High labour market assumptions, see Figure 2. Both are modest increases to impacts reported for the Medium labour market scenario.

The employment impacts are more pronounced, employment in the MWRC LGA is expected to peak at 620 FTE in Year 16 of the Project. These results are driven by the direct employment within the MWRC LGA, the flow-on impacts from local inputs. It will also include any of the crowding out of employment in other sectors, although given the greater availability of workers, these impacts are lower than in the Medium scenario. Average wages in the MWRC LGA are projected to increase by 11.1% over the Project life, slightly lower than the Medium case assumptions.

Figure 2: Projected economy-wide impacts of the Project, 0.30 Labour Supply Elasticity



Source: Cadence Economics estimates

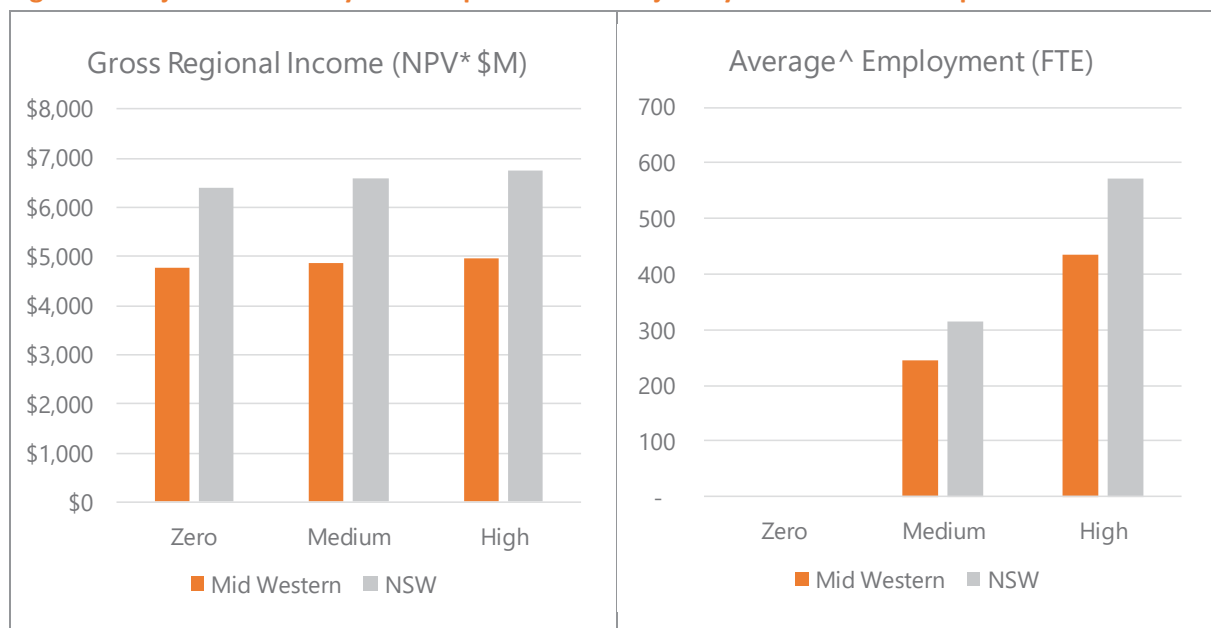
Moving to the state-wide results, real GSP for NSW is projected to peak at \$821 million higher than the reference case in Year 16 of the Project, coinciding with peak saleable output from the Project. In Year 9 of the Project, real GSI will peak at \$1,038.7 million and employment of 898 FTE. State-wide average wages increase by a modest 0.043%.

Overall summary

A summary of the projected economy-wide impacts of the Project generated by the CGE model are summarised in Figure 3 under three separate labour market response assumptions, including the Zero response labour market assumption.

Under each scenario, the Project is projected to increase GRI, which is a measure of economic welfare, in both the MWRC LGA and NSW more broadly. In NPV terms, the projected increase in GRI in the MWRC LGA ranges from \$4,756 million under the Zero labour supply response to \$4,949 million under the High labour response assumption. The increase in projected economic welfare is related to the projected employment which averages 436 FTE under the High labour response assumption (245 FTE under the Medium assumption).

Figure 3: Projected economy-wide impacts of the Project by labour market response



* Net Present Value in 2014 Australian dollars calculated over the period 2014 to 2040 using a 7 per cent real discount rate.

^ For the years 2016 to 2040 i.e. the 25 year Project life excluding two years preconstruction.

Source: Cadence Economics estimates based on information provided by Gillespie Economics.

The economic benefits of the Project also accrue to the broader NSW economy. In NPV terms, the projected increase in GRI in NSW ranges from \$6,386 million under the Zero labour supply response to \$6,756 million under the High labour response assumption. The associated employment effects are 573 FTE under the High labour response assumption (316 FTE under the Medium assumption).

The Zero response assumption is equivalent to assuming that the MWRC LGA and NSW economies are operating at full employment and, therefore, no new workers are available to service the Project. That is, workers are drawn from their existing jobs through the offer of higher wages.

Under the other scenarios, the MWRC LGA and NSW economies are operating at below capacity, as evidenced for example by higher unemployment or underemployment, and it is more realistic to assume a relatively more 'elastic' labour supply whereby potential workers are encouraged into the workforce, again through increased wages.

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