Review of the Key Economic Interactions between the Dendrobium Mine and Related Entities in the Wollongong Region

Prepared for the NSW Department of Planning, Industry and Environment

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Table of contents

1 Introduction

BAEconomics Pty Ltd was commissioned by the Planning & Assessment Group of the NSW Department of Planning, Industry and Environment (the Department) to prepare a detailed and expert assessment of the key economic interactions between the Dendrobium Coal Mine and the Appin Mine, BlueScope's steel-making operations at Port Kembla and Port Kembla Coal Terminal. In particular the assessment 'must assess the risks and uncertainties associated with disruption to these interactions, should the current approval for the Dendrobium Coal Mine (which expires in December 2030) not be extended through approval of the Project (proposed to finish coal extraction in December 2048).' The assessment should make use of publicly available information including that from company annual reports. In addition, contact should be made with South 32, BlueScope Steel and the Port Kembla Coal Terminal (PKCT) to obtain relevant additional information.

Telephone contact (together with a representative of the Department) was made with the key stakeholders on 25 March 2020. Follow up by telephone and email was made after the initial calls. No face-to-face meetings were conducted due to the restrictions in place following the COVID19 outbreak. Significant delays in completing this report have resulted from problems in interacting with key stakeholders due to the COVID19 crisis. Further, some of the affected companies have only been prepared to provide limited data about their operations and interactions with each other.

2 Background

2.1 The characteristics of the Southern Coalfield mines and coal terminal

The Southern Coalfield of NSW is known for its premium hard coking coals. The productive parts of the Southern Coalfield extend from Picton and Menangle southwest of Sydney to the Illawarra Escarpment to the northwest, west and southwest of Wollongong. The medium-ash low-volatile hard coking coals produced in this area are currently mined only from the Bulli and Wongawilli Seams using underground longwall mining methods. Typically, the mines are deep (in excess of 400 m below the surface) which tends to push these mines into the high end of the global cost curve. The estimated coal reserves and resources by coalfield and the typical coal characteristics in each are set out in NSW Government (2017).

The key operating mines in the Southern Coalfield are the Appin and Dendrobium Mines (owned and operated by Illawarra Metallurgical Coal, a subsidiary of South 32), Metropolitan Mine located at Helensburgh (Peabody Energy) and Tahmoor Mine (Simec Group, part of the Gupta Family Group Alliance). The Russell Vale and Wongawilli Collieries (Wollongong Coal) are both under care and maintenance at this time. Coal from these mines (and some coal from Centennial Coal's mines in the Western Coalfield) is transported by either road or rail to Port Kembla for domestic use or for shipping to other domestic or export markets.

The Port Kembla Coal Terminal (PKCT) is a coal shipping terminal operated by Illawarra Metallurgical Coal on behalf of a consortium consisting of Illawarra Metallurgical Coal, Centennial Coal Company Ltd, Tahmoor Coal Pty Ltd, Metropolitan Collieries, Oakbridge Coal (not currently shipping coal to PKCT) and Wollongong Coal. The terminal is a full cost reimbursable port and the average cost per tonne of throughput is highly dependent on the level of throughput itself.

The terminal has an annual capacity of 16Mt. The throughput of the terminal for the past ten financial years is shown in Table 2.1.

Table 2.1 PKCT historical throughput by financial year, 2008-09 to 2018-19

Financial Year	Coking Coal Mt	Energy Coal Mt	Total Throughput Mt
FY2009	6.301	6.920	13.221
FY2010	6.865	6.884	13.749
FY2011	6.329	7.678	14.007
FY2012	8.286	6.206	14.492
FY2013	8.153	4.958	13.110
FY2014	6.898	5.473	12.370
FY2015	8.659	4.466	13.125
FY2016	8.013	2.833	10.846
FY2017	6.311	1.747	8.058
FY2018	3.258	1.459	4.717[a]
FY2019	5.913	1.377	7.290

Source: David Richards, General Manager PKCT, pers comm. 27 April 2020.

[a] Mine output at Illawarra metallurgical Coal was reduced in 2017-18 following a mine safety gas prohibition.

As can be seen from Table 2.1 the terminal throughput is variable but has trended down over the past five years, with the average throughput over the past two financial years 44 per cent less than the average throughput over the period 2014-15 to 2016-17.

The current loading charge at PKCT is $6.50/t[1] compared to the charge at Port Waratah Coal Terminal (PWCT) in Newcastle of about $2.40/t and that for Dalrymple Bay Coal Terminal in Mackay of about $5.70/t (David Richards, pers comm. 27 April 2020). The highly competitive loading charge at PWCT compared with that at PKCT, together with more complicated rail transport logistics in western Sydney, limits any future growth in output from the Western Coalfield being directed toward the PKCT. It is likely therefore that PKCT will remain highly dependent on the supply of coal from the Southern Coalfield for its future viability.

Illawarra Metallurgical Coal supplies around 70 per cent of the throughput at PKCT.

2.2 The domestic use of coal from the Southern Coalfield

The high-quality coking coal produced from the Southern Coalfield is either exported or used domestically in the iron and steel manufacturing industry. The largest domestic user of coking coal is BlueScope Steel's plant at Port Kembla. The BlueScope blast furnace produces around 2.6Mt of liquid iron per year, which when

[1] All dollar amounts in this report are Australian dollars, unless otherwise labelled as US dollars. Note that the PKCT loading charge quoted here excludes the capital access fee while the loading charges for PWCT and DBCT include such a fee.

combined with scrap steel, results in the production of around 3Mt of steel per year from the plant.[2]

The production of 3Mt of steel from the Port Kembla plant requires the use of around 2.9Mt of coal which comprises 2.5Mt of hard coking coal and 0.4Mt of PCI coal (PCI coal or pulverised coal injection coal is finely ground coal that is injected directly into a blast furnace). Of the total coal use, 2.4Mt is sourced locally from the Southern Coalfield while the remainder is supplied from Queensland. Of the total from local sources, 2.2Mt is hard coking coal and 0.2Mt is PCI coal. Of the 2.2Mt of hard coking coal around 1.5Mt (68 per cent) is sourced from Illawarra Metallurgical Coal, 0.6Mt (27 per cent) from Metropolitan and 0.1Mt (5 per cent) from Tahmoor. Metropolitan also supplies the 0.2Mt of locally produced PCI coal. Illawarra Metallurgical Coal supplies a blended hard coking coal product to BlueScope which comprises coals from both the Wongawilli Seam (Dendrobium Mine) and the Bulli Seam (Appin Mine).

Because BlueScope Steel and Illawarra Metallurgical Coal were historically part of BHP's steel making operations at Port Kembla there remains strong physical and commercial links between these now separate legal entities. For example, the coal preparation plant (CPP) for Dendrobium Mine's coal is located within the BlueScope yard at Port Kembla and a contract for coking coal supply with an end date of 2032 exists between the two entities.

[2] Production and coal use statistics supplied by Lawrence McDonald, Manager, Finance Commercial, BlueScope Steel Limited, pers comm. 25 March 2020 and 3 June 2020.

3 Likely consequences of the non-approval of the Dendrobium extension project

3.1 Illawarra Metallurgical Coal production

Illawarra Metallurgical Coal operates two underground coking coal mines in the Southern Coalfield. The Dendrobium Mine is currently approved to extract up to 5.2Mt of ROM coal per year and the Appin Mine and related facilities are approved to extract up to 10.5Mt of ROM coal from the Bulli Seam per year. The Bulli Seam coal is washed at the West Cliff CPP while the Wongawilli Seam coal from the Dendrobium Mine is washed at the Dendrobium CPP located at the BlueScope complex.

Currently Area 3B is being mined at Dendrobium and Areas 7 and 9 are being mined at Appin. The projected combined production from the two mines is 7Mt in 2019-20 and 8Mt in 2020-21 (South 32 2019a). Actual production in 2018-19 was 5.35Mt of metallurgical coal and 1.3Mt of energy coal (South 32 2019b, p.32).

Illawarra Metallurgical Coal sells a blended coking coal product consisting of a blend of Bulli and Wongawilli Seam coals.

3.2 Illawarra Metallurgical Coal cost structure

The cash cost for the combined mines in 2018-19 was $US94/t of coal sold (Miningdataonline, No date) which converts to $A130/t at the average exchange rate for the financial year.

The Appin Mine has the largest historical and approved footprint of any underground coal mine in Australia but is a high cost producer. Structurally, the mine is not particularly efficient. It has three separate pit tops, two sets of longwall equipment and 50km of underground conveyors as well as being a relatively deep mine. The seam height is 3.0 to 3.3m compared with a 3.9m of the Wongawilli seam currently being extracted at the Dendrobium Mine. During the last quarter, the cash cost at the Appin Mine was about $A130/t ROM coal compared with a cost of $A54/t ROM coal at Dendrobium. The Appin operation was not profitable to operate over the period.[3] The operating cost at Appin places the mine in the 4th quartile of the global metallurgical mine cost curve. It follows that the Appin Mine is only likely to be economically viable in the longer term under one or more of the following circumstances:

- Average global coking coal prices remain high in the long term; and/or
- Production continues at the design level at the Dendrobium Mine thus allowing their owner to average the cash costs of the two mines and

[3] Andy Hyslop, General Manager Mine Services, Illawarra Metallurgical Coal, pers com. 25 March 2020.

continue to produce the blended coking coal product that is sought after by BlueScope Steel and is an accepted product on export markets.

3.3 Cost structure of the Port Kembla Coal Terminal with reduced throughput

PKCT's cost base consists of approximately 80 per cent fixed costs and 20 per cent variable costs.[4] Given the very high proportion of fixed costs in the overall cost structure of the terminal it follows that any significant fall in terminal throughput will have a detrimental impact on the average cost per tonne of coal exported.

PKCT has estimated that a total loss of Dendrobium coal exports through the terminal would result in a 75 per cent increase in the loadout costs per tonne (see Table 3.1). It is considered likely that an increase in charges of this level would make exports through the terminal economically marginal under average conditions in the global coal market.

The total loss of Illawarra Metallurgical Coal product to the terminal is likely to lead to the closure of the terminal itself given the dependence of the terminal on coal from that company's two mines. Such an outcome may well then lead to the other mines in the Southern Coalfield becoming unviable, except in the case where an existing mine could profitably operate without exports and enter into a new contract to supply hard coking coal to BlueScope's primary steelmaking facility at Port Kembla. It should also be noted that the Russell Vale Colliery (currently on care and maintenance) has no rail spur. Consequently, should PKCT close, it would be inevitable that Russell Vale would also close permanently.

Table 3.1 PKCT loading charges

	UOM	Amount	% Increase
Current Loading Charge	$/t	6.50	
Loading Charge - no Dendrobium Next Domain	$/t	11.40	75%
Loading Charge - no Illawarra Metallurgical Coal	$/t	27.80	328%

Source: David Richards, General Manager PKCT, pers comm. 27 April 2020.

3.4 Importance of Illawarra Metallurgical Coal's product to BlueScope Steel

As outlined in Section 2.2, BlueScope Steel currently sources 68 per cent of its hard coking coal needs from Illawarra Metallurgical Coal. BlueScope's blast furnace is currently optimised to use coke with characteristics the same or very similar to that produced from the coking coal blend delivered from that company's mines. However, BlueScope does and could use other sources of coking coal including coal shipped

[4] David Richards, General Manager PKCT, pers com. 27 April 2020.

from Queensland's coking coal mines. The main impediment to substituting large quantities of Queensland coal for coal currently sourced from Illawarra Metallurgical Coal is the limited import capacity at Port Kembla and the transport costs involved.

BlueScope Steel estimates that upgrading the port infrastructure to significantly increase coal imports would require expenditure of approximately $A200m. Freight costs from Queensland have been estimated to be around $A20/t. BlueScope estimates that, after taking account of the freight and unloading costs together with the price differential on Queensland coal purchased at the fob price, to replace current local supplies would add an additional cost of around $A40/t or around $A100m per year to the cost of its blast furnace operation.[5]

BlueScope's domestic primary steel making operation at Port Kembla is not low cost from a global perspective. BlueScope considers its blast furnace operation to lie somewhere in the 3rd quartile on the global cost curve (that is, it is on the higher end of global costs).

BlueScope will face a critical decision regarding the continuance of primary steel making in Australia from around 2025 when it will be necessary to decide whether to invest in excess of $A500m on relining the blast furnace at Port Kembla. Further, this decision will need to be made at around the same time as there is a potential reduction in the availability of Wongawilli Seam coal due to the proposed staging of operations at the Dendrobium Mine. That is, the Dendrobium Extension Project is based on ceasing extraction from the Wongawilli Seam sometime around 2024, when production would move to Area 5, which would extract coal solely from the Bulli Seam. Mining from the Wongawilli Seam is not projected to recommence until around 2033. BlueScope has a strong desire to maintain continued supply of Wongawilli Seam coal as part of its coking coal blend due to the favourable characteristics of this coal, which enables suitable coke to be made for iron and steel making. The change in available coals from the Southern Coalfield (Dendrobium Mine is the only mine which extracts from the Wongawilli Seam which provides a currently essential component of BlueScope's coking coal blend) may have a significant impact on the cost of BlueScope's steel making operations and viability of the necessary blast furnace reline.

Given the projected cost of the reline, coupled with the uncertainties and issues associated with the availability and coking characteristics of local coal and the additional cost of imports from Queensland, there is a risk that primary steelmaking will be discontinued at Port Kembla by the end of this decade. The decision will also depend on many other factors including the state of existing steelmaking technology at the time, Australia's climate policy and whether there is a shift back to more

[5] Lawrence McDonald, Manager, Finance Commercial, BlueScope Steel Limited, pers comm. 25 March 2020.

reliance on domestic manufacturing following recent international trade tensions and the experience of the COVID 19 pandemic.

While steel businesses face significant risks associated with climate change policy, the global transition away from primary steelmaking based on reduction of iron oxides using carbon sourced from coking coal is likely to be much slower than the transition away from the use of energy coal because of the lack of availability of an economically viable alternative smelting technology in the near term.

Regardless of how these factors play out, the availability of a reliable long-term supply of local premium coking coal will remain of critical importance to the decision.

3.5 Overall impact of reduced economic activity in the iron and steel and coal sectors

The Australian Bureau of Statistics regularly publishes Input-Output Tables which provide data on production, consumption and total economic multipliers for 114 separate industries across Australia. The most recent of these Tables (ABS 2020a) reports total output multipliers for the coal and the iron and steel industries as 2.01 and 3.21 respectively (see Table 3.2).[6] That is, for one additional dollar of output from the coal industry (designated as the 'initial effect'), about two dollars of output would be created in the whole economy. The additional output is created by the material requirements of the coal industry and its suppliers in all the related production processes, plus the consumption effect driven by the extra labour income earned by workers as a result of the initial extra dollar of output.

For iron and steel, an extra dollar of output from the industry would create about three dollars and twenty cents of output in the domestic economy. Note that the total multipliers presented in Table 3.2 have excluded imported goods purchased in Australia.

The coal industry has a lower output multiplier largely because it is one of the most upstream industries in the economic supply chain. Multipliers from input-output analysis consider only the flow-on effects in relation to their suppliers and their directly-employed labour. Impacts on the downstream industries are not considered.

Table 3.3 shows the total labour income multipliers for key sectors and their components derived from the output multipliers presented in Table 3.2. The labour income multiplier for an industry is the total value of wages, salaries and supplements paid to achieve a dollar's worth of output of that industry. To achieve an additional dollar of output from the coal industry, labour income in the industry would initially increase by about 9 cents. This low initial effect on labour income is largely because mining and manufacturing industries use relatively more plant and equipment in their

[6] For an explanation of the various multipliers and how they are constructed see McLennan (No Date).

production and thus a smaller share is spent on labour.

Table 3.2: Total output multipliers for selected sectors

	Initial effect	Production induced effect	Consumption induced effect	Total multiplier
Coal Mining	1.00	0.55	0.46	2.01
Oil & Gas Extraction	1.00	0.53	0.38	1.91
Iron Ore Mining	1.00	0.43	0.36	1.79
Non-Metallic Mineral mining	1.00	0.81	0.78	2.60
Exploration and mining support services	1.00	0.85	1.08	2.93
Iron and steel manufacturing	1.00	1.28	0.93	3.21
Basic non-ferrous metal manufacturing	1.00	1.53	0.69	3.22
Retail trade	1.00	0.69	1.15	2.83
Accommodation	1.00	0.85	0.96	2.81
Food and Beverage Services	1.00	0.91	1.11	3.01

Source: BAEconomics' calculation from ABS (2020a). Note that for the purposes of computation the initial effects are set to unity by assumption.

After the production and consumption flow-on effects are factored in, the total labour income generated in the whole economy would be around 34 cents for an additional dollar of output from the coal industry. Dividing the total effect of 34 cents by the initial effect of 9 cents (that is, setting the initial effect to be equivalent to one), gives a total labour income multiplier of 3.75.

The larger total labour income multiplier in comparison with the total output multiplier reflects two attributes in the coal industry: a relatively low initial effect for labour income; and a relatively high average salary (Table 3.4).

For iron and steel, an additional dollar of output from the industry would create about 68 cents of labour income in the whole economy. In comparison with the initial 20 cents of labour income required to generate an additional dollar of output, this is equivalent to a multiplier of 3.48.

The output and income multipliers for both the coal and iron and steel sectors indicate that both sectors result in substantial flow on effects to the rest of the NSW economy. This is consistent with the findings in the economic impact assessment report for the Dendrobium Mine extension proposal (Cadence Economics 2019, pp.61-5).

Table 3.4 highlights that jobs created in the coal and the iron and steel industries are

high-paying jobs on average. The average salary earned in 2017-18 by each employed person in the coal industry, including superannuation, was $116,100. This was about 63 per cent higher than the average salary of all industries or 3.6 times the average salary earned in the food and beverage services industry.

Table 3.3: Total labour income multipliers for selected sectors

	Initial effect	Production induced effect	Consumption induced effect	Total effect	Total multiplier
Coal Mining	0.09	0.14	0.11	0.34	3.75
Oil & Gas Extraction	0.08	0.11	0.09	0.28	3.58
Iron Ore Mining	0.08	0.09	0.09	0.26	3.21
Non-Metallic Mineral mining	0.19	0.19	0.19	0.57	2.99
Exploration and mining support services	0.29	0.25	0.26	0.79	2.76
Iron and steel manufacturing	0.20	0.26	0.22	0.68	3.48
Basic non-ferrous metal manufacturing	0.05	0.29	0.17	0.50	9.71
Retail trade	0.39	0.17	0.28	0.84	2.15
Accommodation	0.27	0.20	0.23	0.70	2.61
Food and Beverage Services	0.34	0.20	0.27	0.81	2.36

Source: BAEconomics' calculation from ABS (2020a)

The average salary earned by each employed person in the iron and steel industry was $87,024 a year in 2017-18. This is about 22 per cent higher than the average salary of all industries or 2.7 times the average salary earned in the food and beverage services industry. Creation of high-paying jobs is key to raising living standards and boosting the well-being of NSW society.

Table 3.5 shows the total employment multipliers for the coal mining and iron and steel manufacturing sectors corresponding to the output multiplier components presented in Table 3.2. For an additional million dollars of output from the coal industry, 0.78 jobs would be created initially within the industry. If the production and the consumption flow-on effects are considered, the total number of jobs created in the whole economy would increase to about four. Dividing the total effect of about four jobs by the initial effect of 0.78 job, gives an employment multiplier of 5.17.

For iron and steel, an additional million dollars of output in the industry would create 7.83 jobs in the whole economy. In comparison with the initial 2.26 jobs created within in the industry, this is equivalent to a multiplier of 3.47.

Table3.4: Employment and average salary per person, 2017-18

	Employment (persons)	Compensation per person* ($)
Coal Mining	51,912	116,100
Oil & Gas Extraction	27,540	158,316
Iron Ore Mining	31,969	158,777
Non-Metallic Mineral mining	14,084	80,661
Exploration and mining support services	54,025	83,035
Iron and steel manufacturing	23,936	87,024
Basic non-ferrous metal manufacturing	25,935	87,024
Retail trade	1,286,679	39,091
Accommodation	110,043	43,410
Food and Beverage Services	780,378	32,243
Whole economy	12,449,961	71,259

Source: BAEconomics' calculation from ABS (2020a), ABS (2020b) and ABS (2019)
*Note: Including superannuation guarantee

Table 3.5: Employment multipliers for key sectors, employment per $1m of output

	Initial effect	Production induced effect	Consumption induced effect	Total effect
Coal Mining	0.78	1.56	1.68	4.02
Iron and steel manufacturing	2.26	2.78	2.79	7.83

Source: BAEconomics' calculation from ABS (2020a)

4 Industry linkages in the Southern Coalfield and implications of breaking the chain

The hard coking coal mines in the Southern Coalfield of NSW and the domestic primary steelmaking industry associated with those mines have the following economic characteristics and linkages.

- The mines produce high quality premium coking coal which is in strong demand from both the domestic steelmaking industry and from overseas buyers.
- The mines themselves are generally deep, have large historical footprints, are gassy and typically high cost. The evidence collected during this study suggests that at global coal prices experienced over the past six months at least some of these mines (other than Dendrobium Mine) have been unprofitable in the short term.
- Illawarra Metallurgical Coal sells a blended coking coal product to BlueScope Steel and for export. The blended coking coal product is currently made up of Wongawilli and Bulli Seam coals and is sourced from both the Appin and Dendrobium Mines. The Appin Mine is very high cost and Illawarra Metallurgical Coal is likely to be economically unviable as a business unit of South 32 without the ability to jointly operate both the Appin and Dendrobium Mines.
- PKCT is currently operated by Illawarra Metallurgical Coal and is also dependent on the ongoing operation and exports of Illawarra Metallurgical Coal product if it is to remain viable. In turn, a closure of PKCT may lead to the closure of all the coal exporting mines in the Southern Coalfield, due to the additional costs of railing coal to Newcastle.
- Finally, the continued operation of BlueScope's primary steel production is dependent on the supply of local coal from the Southern Coalfield. If the supply of local coal is compromised then this would lead to a significant increase in operating costs for BlueScope, which ultimately would threaten the viability of iron and steel making at Port Kembla. If BlueScope was forced to close its blast furnace operation at Port Kembla, there would be major detrimental consequential flow on effects to the NSW economy.

Using the multipliers set out in Section 3.5, it is possible to make an estimate of the likely economic consequences of a worst-case scenario described above where cascading closures lead to both the cessation of coal exports through PKCT and the production of primary steel at BlueScope.

Using the average East Asian Hard Roll Coil (HRC) price of approximately $800 per tonne in 2018-19, the annual output value of 3 million tonnes crude steel produced by BlueScope Steel's blast furnace facilities is about $2.4 billion.

In its most recent Annual Report (2019, p.23) South 32 quotes realised metallurgical and thermal coal prices of $US205/t and $US83/t respectively. Taking these prices, converting them to Australian dollars at an assumed exchange rate of 0.72 (the long run exchange rate projected by Department of Industry, Science, Energy and Resources 2020, p.25) and weighting them using the shipped weights of metallurgical and thermal coal passing through PKCT in 2018-19, gives a weighted coal price for the Southern Coalfield of $253/t. This weighted price is high compared to the long run price projected by the Department of Industry, Science, Energy and Resources (2020, p.46 and p.59) which projects prices for metallurgical coal in 2025 of $US166/t and $US67/t for thermal coal (in real 2020 dollars). Converting these prices at an exchange rate of 0.72 and using the same weighting procedure as described above leads to a weighted price for coal from the Southern Coalfield of $205/t.

Taking a conservative approach and applying the estimated average export coal price of $205/t, the annual throughput of coal at PKCT in 2018-19 of 7.29 million tonnes is valued at about $1.49 billion. Adding the two output values together, the direct annual output loss of 3 million tonnes of blast furnace steel and 7.29 million tonnes of coking coal would be $3.89 billion per year for the domestic economy.

Using the output multipliers presented in Table 3.2, the total output loss for the whole economy, including flow-on effects, would increase to around $10.7 billion per year (Table 4.1). This is the sum of $7.7 billion induced by the loss of 3 million tonnes of steel and $2.99 billion induced by the loss of coal export revenue.[7]

Note that the $10.7 billion total output loss does not include any output disruptions in the downstream industries where all domestic steel products are assumed to be replaceable by imports. Neither does it include any potential losses from losing capability to produce metal and metal products, losing capability to advance science and technology education and programs in Australia or losing the capability to provide sufficient metal supply during pandemics, wars, or border closures.

Table 4.1: Estimated annual output losses, $ billion

	Direct loss	Indirect loss	Total loss
Coal Mining	1.49	1.50	2.99
Iron and steel manufacturing	2.40	5.30	7.70
Total	**3.89**	**6.80**	**10.69**

[7] The 2.4 million tonnes of coking coal used by BlueScope Steel is included in the output multiplier calculation for the iron and steel industry. This amount is not used again in the output multiplier calculation for the coking coal industry.

Using the labour income multipliers presented in Table 3.3, the direct labour income loss is about $0.61 billion a year. This is the sum of $0.48 billion in the iron and steel industry, and $0.13 billion in the coal industry. For the economy, the total labour income loss would increase to $2.14 billion a year (Table 4.2). This is the sum of $1.63 billion induced by the output loss of 3 million tonnes of crude steel, and $0.51 billion induced by the output loss of coking coal exports.

Table 4.2: Estimated annual labour income losses, $ billion

	Direct loss	Indirect loss	Total loss
Coal Mining	0.13	0.38	0.51
Iron and steel manufacturing	0.48	1.15	1.63
Total	**0.61**	**1.53**	**2.14**

Using the employment multipliers presented in Table 3.5, the direct employment loss can be estimated as about 6,586 workers. This is the sum of 5,424 workers in the iron and steel industry, and 1,162 workers in the coal industry.

These estimates can be compared with the actual numbers employed by the various industries in the region. BlueScope Steel employs around 6100 workers in Australia with around half that number employed at the Port Kembla steelworks (BlueScope Steel Limited, No date and BlueScope Steel Limited, 2018, p.18.). Taking account of the potential flow-on effects on Liberty Steel in the worst-case scenario, the job loss estimate from the direct effect appears reasonable. However, it may over-state the likely direct job losses in NSW that would follow a closure of primary steel making at Port Kembla.

The currently operating mines in the Southern Coalfield employ around 2500 employees and contractors.[8] This number is in excess of the direct loss of employment estimated using the multiplier analysis. This under-estimate has likely arisen because the mines in the Southern Coalfield are underground mines which would generally employ higher numbers per dollar of output compared with the average Australian mine. It follows that the employment related losses in the coal industry in NSW under the worst-case scenario would be higher than estimated in the multiplier analysis.

Overall, the likely direct job loss under the worst-case scenario in both the iron and steel and coal sectors in NSW but more particularly in the Wollongong region is likely

[8] See Peabody Energy, Inc, 2020, Simec, No Date, and South 32 2019a, b for current mine employment numbers.

to be around 5,500.

For the whole economy, the total job loss would increase to just under 25,000 workers (Table 4.3). This is the sum of 18,821 job losses induced by the output loss of 3 million tonnes of crude steel, and 6,008 job losses induced by the output loss of coking coal.

Table 4.3: Estimated job losses in Australia

	Direct loss	Indirect loss	Total loss
Coal Mining	1,162	4,846	6,008
Iron and steel manufacturing	5,424	13,397	18,821
Total	**6,586**	**18,243**	**24,829**

Care needs to be taken in interpreting these multiplier-based estimates of economic loss in the sense that the total loss estimates are likely to over-state the actual long term economic losses given that subsequent price adjustments in markets will lead to changes in the structure of the economy and workers being employed elsewhere. Such long-term effects are best estimated using a computable general equilibrium (CGE) framework. Having said that, CGE models rarely if ever take account of the costs of the short-term social disruption associated with the closure of whole industries in a small region and in the present case, a large share of the costs outlined above would fall on the Wollongong region.

Burrows, Masouman and Harvie (2015, p.19) estimate that a shutdown of steelmaking at Port Kembla (valued then at $2b) would result in a loss to the regional economy of around $3.3b. For the current estimated direct loss from steelmaking of $2.4b, this implies a regional loss to the Wollongong economy of around $4b. If it is assumed conservatively that 80 per cent of the total coal mining losses under the worst case scenario fall on the local economy then the total local losses would amount to around $6.4b per year in today's dollars.

5 Conclusions

In summary, the historical linkages and dependencies between Illawarra Metallurgical Coal and the primary steelmaking operations at BlueScope mean that the failure of one will compromise the other.

While it is likely that the overall operations of Illawarra Metallurgical Coal would be economically viable without coal offtake by BlueScope Steel, it would be unlikely to be viable to keep the Appin Mine operating should the Dendrobium Mine be forced to close. Without the Dendrobium Mine, it is likely that Illawarra Metallurgical Coal would be unviable as a business unit for South32 and the Appin Mine would also be closed, or possibly sold to a smaller player. The closure of these mines would lead to the immediate loss of around 1700 high paying jobs.

Without product from Illawarra Metallurgical Coal, PKCT would become unviable. This, in turn, may well lead to the closure of the remaining mines in the Southern Coalfield and the loss of a further 740 coal mining jobs. This would provide a second pathway by which BlueScope may be forced to close its primary steelmaking operation at Port Kembla with a consequent loss of around 3000 local jobs.

Conservatively, the closure of these coal mining and steelmaking operations could cost the local Wollongong region around $6.4b per year in lost regional product. The estimated loss to the Australian economy as a whole could be as high as $10.7b per year.

In conclusion, the ongoing economic viability of the premium hard coking coal mining, iron smelting and coal transport and shipping businesses located in and around the Wollongong-Port Kembla area and elsewhere in the Southern Coalfield of NSW is critically dependent on the continuing success of both Illawarra Metallurgical Coal and BlueScope Steel. Major changes in either of these businesses would have flow on effects to the other as well as to other significant coal and iron and steel related businesses. The annual economic loss under such a scenario could approach $10.7 billion per year with a large share of this loss falling directly on the Wollongong regional economy.

Therefore, the decision on whether or not to approve the extension of the Dendrobium Mine should be taken in the context not only of the net economic contribution of the mine itself but of the net contribution to the NSW community of the complex of coal, transport and iron smelting, steelmaking and steel fabrication businesses in the local region.

References

ABS, 2020a. *Australian National Accounts: Input-Output Tables, 2017-18*. Publication 5209.0.55.001, released at 11:30am 29/05/2020.

ABS, 2020b. *Labour Force, Australia*, Detailed, Quarterly, Feb 2020, Publication 6291.0.55.003, released at 11:30am 26/03/2020.

ABS, 2019. *Australian System of National Accounts, 2018-19*. Publication 5204.0, released at 11:30am 25/10/2019.

BlueScope Steel Limited, No Date. BlueScope in the Illawarra. https://www.bluescopeillawarra.com.au/working-at-bluescope/, accessed 30 June 2020.

BlueScope Steel Limited, 2018. 2017/2018 Sustainability Report. https://s3-ap-southeast-2.amazonaws.com/bluescope-corporate-umbraco-media/media/2480/fy2018-bluescope-sustainability-report.pdf, accessed 30 June 2020.

Burrows, S., Masouman, A. and Harvie, C. 2015. Regional Economic Impacts of a Closure of BlueScope Steel Operations in Port Kembla, Report prepared for the Australian Workers Union, Port Kembla, University of Wollongong, August.

Cadence Economics, 2019. Economic Impact assessment of the Dendrobium Mine – Plan for the Future: Coal for Steelmaking, May.

Department of Industry, Science, Energy and Resources, 2020. *Resources and Energy Quarterly*, March, https://publications.industry.gov.au/publications/resourcesandenergyquarterlymarch2020/documents/Resources-and-Energy-Quarterly-March-2020.pdf, accessed on 29 June 2020.

McLennan, W. No Date. Information Paper Australian National Accounts Introduction to Input-Output Multipliers, Australian Bureau of Statistics Catalogue No. 5246.0 https://www.ausstats.abs.gov.au/Ausstats/subscriber.nsf/0/FFD0BAE851EDCB8BCA2570C9007ECE04/$File/52460+-+Information+Paper+-+Introduction+to+Input+Output+Multipliers.pdf, accessed 26 June 2020.

Miningdataonline, No date. https://miningdataonline.com/property/338/Illawarra-Mine.aspx#Costs, accessed 10 June 2020.

NSW Government, 2017. *Coking Coal: Opportunities in New South Wales*, Department of Planning & Environment, Resources & Geoscience, July, http://australiaminerals.gov.au/__data/assets/pdf_file/0020/51923/NSW-coking-coal-KO.pdf, accessed 9 June 2020.

Peabody Energy, Inc. 2020. Metropolitan Mine: Quick Facts, pdf. https://www.peabodyenergy.com/Operations/Australia-Mining/New-South-Wales-Mining/Metropolitan-Mine, Accessed 26 June 2020.

Simec, No date. Resident Information Pack: Western DomainInformation Pack, Longwall West 1 & Longwall West 2 / Information Booklet, pdf. https://www.peabodyenergy.com/Operations/Australia-Mining/New-South-Wales-Mining/Metropolitan-Mine, accessed 26 June 2020.

South 32, 2019a. Illawarra Metallurgical Coal Site Tour, pdf, 20 June.

South 32 2019b. Annual Report 2019, Perth.