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Economic assessment of the Hume Coal project

Development of an underground coal mine in NSW's Southern Highlands is not economically viable and presents risks to the environment, existing industries and landowners.

Discussion paper

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Summary

The Hume Coal Project is a proposal to build an underground mine in the Southern Highlands of New South Wales, near Berrima on the Hume Highway, southwest of Sydney. The mine would produce around 3 million tonnes of metallurgical and thermal coal each year for almost 20 years. Hume Coal is owned by South Korean steelmaker POSCO.

The project is controversial. The community, other industries and the local government are worried that the mine will consume groundwater that local residents, businesses and farms depend on. “Water not Coal” signs are common on fences, gates and businesses throughout the district.

This research has been commissioned by Coal Free Southern Highlands. Hume Coal were approached to participate, but provided only limited assistance. Key data sources are Hume Coal’s Preliminary Environmental Assessment and a groundwater study commissioned by Southern Highlands Coal Action Group. Local stakeholders were interviewed in two field trips to the Southern Highlands in April–May 2016.

This report is a cost benefit analysis prepared in line with the NSW *Guidelines for the economic assessment of mining and coal seam gas proposals*, and uses the draft Cost Benefit Analysis Workbook that accompanies the Guidelines. As this is the first full assessment to use these resources it provides a working example of how they can be further developed.

Our cost benefit analysis estimates that at a global level the project has net present value of negative A$556 million. Key assumptions in this estimate are a coal price of A$112 per tonne, operating costs of A$97 per tonne, a 7% discount rate and groundwater inflow of 9.7 gigalitres per year.

The project as proposed is almost certain to represent a large financial loss to the proponent. Under our central assumptions, producer surplus – a basic estimate of profit – is estimated at negative A$539 million. This means that, if approved, the project is unlikely to proceed as proposed unless there is a major increase in coal price.

If it did proceed despite the financial loss to the proponent, we estimate the project would be liable for royalties worth A$118 million in present value terms. While this represents a substantial benefit to the NSW community, our central estimate of the cost of groundwater impacts is A$131 million. Beyond this likely cost there are many

unquantified impacts that make it very unlikely that the project represents an improvement in economic welfare for the NSW community.

Sensitivity analysis shows that to reach a positive net present value, coal prices would need to increase by 43 percent. For the project as proposed to make a reasonable level of profit for the proponents we estimate an increase in coal price of 58 percent is necessary. Importantly, this increase would need to be maintained through the life of the project. Such high prices have only been observed for short periods in the last 30 years.

Alternatively, the project could become viable for the proponent with a 38 percent reduction in operating costs. However, part of the reason for the high operating costs of the mine is the methods adopted to reduce environmental impacts. Any move to reduce operating costs is likely to increase environmental externalities, particularly impacts on groundwater.

The project is unlikely to proceed as proposed under current conditions or prices as forecast by Commonwealth Treasury. If approved, the project is likely to remain on hold indefinitely. This imposes considerable costs on the local economy, which has been affected by the uncertainty over the project. These impacts are further considered in the local effects analysis, presented in a separate document.

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List of acronyms

BCR	Benefit Cost Ratio
CHPP	Coal Handling and Processing Plant
CO2-e	Carbon dioxide equivalent
EIS	Environmental Impact Statement
FTE	Full time equivalent
GHGs	Greenhouse gases
GL	Giga-litre – 1 billion litres
IMC	Illawarra Metallurgical Coal
MIA	Mine Infrastructure Area
ML	Mega-litre – 1 million litres
Mtpa	Mega-tonnes per annum
NSW DPE	NSW Department of Planning and Environment
PEA	Preliminary Environmental Assessment
PKCT	Port Kembla Coal Terminal
TAI	The Australia Institute

All values are in 2016 Australian dollars unless otherwise stated

Introduction

The Hume Coal Project is a proposal for an underground mine in the Southern Highlands region of New South Wales (NSW). The site is located approximately 130 kilometres southwest of Sydney and 160 kilometres northeast of Canberra, near the village of Berrima.

The mine would produce 3 million tonnes per annum (Mtpa) of mainly metallurgical coal. Thermal coal for power generation would also be produced. All coal would be railed to Port Kembla near Wollongong and exported.

The project proponent is Hume Coal, a subsidiary of Korean steelmaker POSCO. POSCO owns 100 percent of Hume Coal.

The project area is not a major coal mining area. While a colliery operated nearby for many years, the local economy is dominated by services. Being close to Sydney and Canberra, the employment profile for the area closely reflects that of NSW more broadly. Agriculture and tourism-related sectors (such as accommodation and food services and retail) are relatively large employers in the Southern Highlands. The region's tourism is linked closely to agricultural activities and scenery, as well as heritage buildings and ambiance.

As a result, the Hume Coal Project has faced considerable local opposition. The local Wingecarribee Shire Council officially opposes the project and anti-mine signs can be seen on fences and shopfronts throughout the area. Opposition is mainly focused on potential damage to groundwater resources and other local industries.

This report is an economic assessment of the Hume Coal Project, commissioned by Coal Free Southern Highlands. It is the first such assessment commissioned by a community group in NSW. It consists of a cost benefit analysis (CBA) and local effects analysis (LEA). The CBA compares the economic, environmental and social costs and benefits of a policy or project to assess whether the proposal is in the best interests of the NSW community. The LEA focuses on the local economy, particularly on employment effects.

Both the LEA and CBA adhere closely to the NSW *Guidelines for the economic assessment of mining and coal seam gas proposals* ("the Guidelines" or "2015 Guidelines"), published in December 2015. The Guidelines were developed through 2014–15 with industry and public consultation and are intended to improve the standard of economic assessment of mining projects, following serious criticism by the

NSW Land and Environment Court, the Planning Assessment Commission (PAC) and public submissions of some proponent-commissioned assessment.

The 2015 Guidelines have been finalised but supporting worksheets are still in draft form. These worksheets are intended to help standardise economic assessment and ensure assessments are comparable and consistent. The worksheets are to be further developed by Department of Planning and Environment (the Department) during 2016. This assessment uses some of these worksheets and is intended to contribute to the development process.

This is the first assessment of a new coal mine under the 2015 Guidelines and the first to use the supporting worksheets. Coal Free Southern Highlands and The Australia Institute intend to work with the Department and other stakeholders to ensure that this assessment sets the bar for compliance with the Guidelines and provides useful feedback as to how they can be updated and supporting worksheets improved.

Cost benefit analysis

REQUIREMENTS UNDER 2015 GUIDELINES

The December 2015 NSW *Guidelines for the economic assessment of mining and coal seam gas proposals* refer to "key steps", "key features" and "tasks" of CBA.

The following are identified as key steps in CBA:[1]

- Establish the base case
- Define the project
- Quantify the changes
- Estimate the monetary value of changes
- Estimate net present value
- Undertake sensitivity analysis
- Assess distribution of costs and benefits

The Guidelines also set out "key features" of a CBA:

- Scope
- Discount rate
- Timeframe
- Risk and uncertainty
- Unquantified factors

The Guidelines also set out a list of tasks:

- Estimate royalties payable
- Estimate company income tax
- Estimate net producer surplus: Identify the direct costs and benefits to the producer
- Quantify direct benefits and direct costs to the producer and estimate the total direct net benefit to the producer
- Estimate net producer surplus attributable to NSW
- Estimate indirect benefits to NSW
- Estimate indirect costs to NSW

[1] See Box 1.1 of the Guidelines, page 3.

All of these points are important and the key steps, features and tasks are not all discrete tasks or points. All are addressed in this assessment, with the initial steps and features in the following sections.

ESTABLISHING THE BASE CASE AND THE PROJECT

The benefits and costs of a project must be measured against a "base case", or how things would be in the absence of the project. This isolates the impact of the project compared to the status quo.

The Base Case

The base case for this CBA is that no mining is occurs at the proposed mining site, and that all factors of production continue to be used in their existing fashion, or at their highest non-mining utility.

Since the Hume Coal Project is a greenfield development, the base case is more straightforward than other projects, which might involve trade-offs between a ramp down of production and immediate rehabilitation, or the extension of production and delay of rehabilitation.

Under the base case, the impact of any current externalities must be considered. For example, there will be some level of greenhouse gas (GHG) emissions associated with any current livestock grazing. To the extent that this economic activity is replaced with underground coal mining, the current rate of emissions must be subtracted from emissions forecast under the project case.

The Project

According to Hume Coal's Preliminary Environmental Assessment, the proposal is to develop an underground mine which would extract up to 3.4 Mtpa of unprocessed "run of mine" (ROM) coal which would create up to 3.0 Mtpa of saleable metallurgical and thermal product coal.[2] Saleable coal will be railed to domestic markets or to Port Kembla Coal Terminal (PKCT) for shipment to domestic and international markets.

Construction of the mine will take approximately 3 years, followed by 19 years of operations and 2 years of rehabilitation.

[2] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", (2014)

The project area covers 5,043 hectares, 3,400 of which will comprise the mining area. 115 hectares will be required exclusively for surface infrastructure and operations, and the remaining land will continue under its existing use.

KEY FEATURES

Scope

The Guidelines note that CBA compares costs and benefits at a particular scope, or to a particular community. The required scope under the Guidelines is to assess costs and benefits to the NSW community. This is because the NSW community owns the coal that is to be extracted, so any proposal to exploit this resource should bring a net benefit to the people of NSW.

To arrive at an estimate of net benefit for the NSW community, it is necessary to consider costs and benefits that accrue to other stakeholders. Most clearly in this case, to the owners of Hume Coal, which are domiciled in South Korea. As an earlier version of the Guidelines stated:

> *In the first instance, it will generally be most practical to assess all major costs and benefits to whoever they accrue and then adjust to estimate the proportion of these attributable to residents of the State.*[3]

This CBA initially adopts a global scope that includes costs and benefits that accrue internationally, most importantly the capital and operating costs of the project and the revenue from coal sales. These costs and benefits are largely borne by and accrue to Hume Coal's Korean owners.

Assessing costs and benefits at both a global level and at a state level gives important insights into the project. In particular we find that the project is very likely to have negative net benefits at an international level, even before environmental and social impacts are considered. This means that the owners are unlikely to proceed with the project as planned, meaning that benefits of production at a state level such as jobs and royalties are unlikely to be realised.

An assessment of a foreign owned project that only estimated costs and benefits to the state would focus largely on royalties. But such an assessment would provide no insight into whether the royalty payments were likely to eventuate. For example, the

[3] Department of Planning and Infrastructure (2012) *Guideline for the use of Cost Benefit Analysis in mining and coal seam gas proposals*, page 5.

economic assessment of the Angus Place coal mine estimated net benefits to the NSW community of that mine's expansion at $770 million, consisting largely of $418 million of job-related benefits and $203 million of royalties. This assessment neglected to consider the costs and benefits to the mine's owners, Thai coal company Banpu. The net benefits accruing to Banpu are low or negative, as the mine has been placed in care and maintenance and two years after the economic assessment was written the proponent is yet to respond to submissions on the mine's EIS.[4]

Similarly, a 2014 CBA of the Warkworth Continuation Project assessed the benefits to NSW without considering the costs and benefits to international owners, Rio Tinto, Mitsubishi and POSCO. The estimate of net benefits to NSW came to $1,488 million, with $617 million in royalties and $612 million in job-related benefits. Without considering the benefits and costs to owners, readers have no understanding of whether these benefits to NSW will eventuate. At current coal prices it is unlikely they will, a view given support by Rio Tinto's efforts to sell its NSW coal mines.[5]

The draft Cost Benefit Analysis Workbook prepared as part of the 2015 Guidelines adopts this approach, making it easy for analysts to enter costs and benefits at a global level and make an assessment of benefits and costs to the state. Incautious use of the worksheet, however, could lead to analysts reporting a net benefit to the state, while ignoring a global negative net benefit, as seems to have occurred in the above examples.

In order to understand the likely net benefits of the Hume Coal Project to NSW, it is essential to also consider the costs and benefits at a global level.

Discount rate

As projects such as the Hume Coal Project incur costs and accrue benefits over long periods of time it is important to adjust future costs and benefits into present value terms using a discount rate. The 2015 Guidelines specify a central discount rate of 7 percent, with sensitivity testing at 4 percent and at 10 percent. All present values in

[4] AIGIS Group (2014) *Angus Place Colliery Extension Project - economic impact assessment;* *http://www.centennialcoal.com.au/News/Latest-News/Angus-Place-Springvale-Restructure-Announcement.aspx;* *http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=5602*

[5] BAEconomics (2014) *Economic Impact Assessment for Warkworth Continuation 2014 and Mount Thorley Operations 2014*; Campbell and Denniss (2015) *Submission: Warkworth and Mount Thorley Continuation Projects* available at http://tai.org.au/content/submission-warkworth-and-mount-thorley-continuation-projects

this report are based on a 7 percent discount rate, except those in the sensitivity analysis section.

Timeframe

In line with the 2015 Guidelines, this CBA uses as its timeframe the life of the project. We assume that construction would begin in 2018 and the project operate for 19 years before 2 years of rehabilitation.

We assume land acquisition costs are incurred this year, 2016. As these costs were incurred in the past, arguably they should be considered a sunk cost and not included in the CBA. However, as the project has not begun and the properties largely unchanged the proponent could sell these properties if the project is not approved. In including these costs in 2016 we assume that if the project is committed to this year by the proponent, the use of the relevant properties would change and resale would become unfeasible, thus the cost is incurred in this year. Changing this assumption does not lead to a major change in the results of the CBA.

A major concern around the project is damage to groundwater resources. There is a risk of permanent impacts on valuable aquifers. This cost would be likely to accrue over a much longer time period than the project life. This CBA may understate groundwater costs due to the timeframe adopted and the approach to its evaluation.

The draft Cost Benefit Analysis Workbook prepared as part of the 2015 Guidelines does not include a cost line for groundwater impacts, perhaps assuming these costs will be included in operating costs or loss of surplus to other industries. This should be considered in the further development of the worksheets.

Risk and uncertainty

The process of valuing a project involving costs and benefits occurring up to 20 years in the future requires assumptions to be taken on the magnitude and timing all costs and benefits. Estimating future market prices and expenditures is an inherently uncertain pursuit; actual results could be significantly higher or lower. Nonetheless, all project decisions are made with some level of uncertainty, and valuations must still be calculated so that alternative investments can compared and be traded off.

This report has endeavoured to calculate a ‘P50’ valuation of the Hume Coal project, meaning there is an equal chance the actual result of each assumption could be higher or lower than the estimate, and by implication, there is an equal chance that the realised value of the project is higher or lower than our estimate.

Furthermore, many environmental and social impacts of the project are uncertain. They are largely considered qualitatively and the risks associated with them should be considered by decision makers alongside quantified costs and benefits.

In line with the 2015 Guidelines, sensitivity testing includes consideration of a range of costs and benefits, notably groundwater impact estimates.

Global CBA

Before assessing the costs and benefits associated with Hume Coal's proposed underground coal mine from the perspective of the state of NSW and the Southern Highlands region, it is necessary to first understand the project at a global level as many of the important financial costs and benefits will accrue to overseas interests.

In May 2013, POSCO Australia Pty Ltd (POSA) acquired Cockatoo Coal Limited's 30% stake in Hume Coal Pty Ltd, making it the sole shareholder of the project[6]. POSA is the Australian subsidiary of South Korean steelmaker POSCO, and is the ultimate and sole shareholder of the Hume Coal project.

Under central valuation assumptions, the Hume Coal project represents a net present value of approximately negative half a billion dollars to POSCO. For Hume Coal to generate a commercial 10% internal rate of return, POSCO would have to believe that coal prices will increase by 58% from current prices, and remain at that level for the life of the project.

GLOBAL BENEFITS – REVENUE

Coal volume

How much and when coal is to be mined and sold is a key driver of total project value, since it dictates both when revenue is received and when expenses are incurred.

At peak production rates, Hume Coal plans to extract 3.4 Mtpa of run-of-mine (ROM) coal, 3.0 million tonnes of which will end up as saleable product (Exhibit 1).

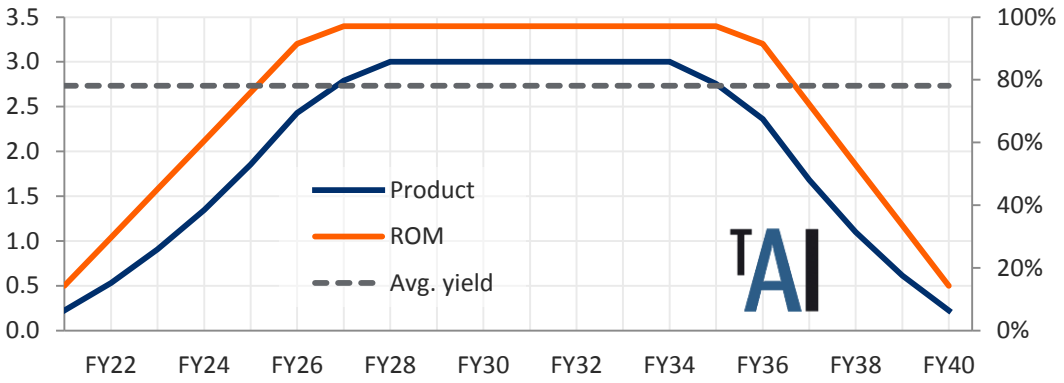
The mining yield is the proportion of ROM coal which is ultimately sold to market, and is particularly important in project valuation, since costs are predominantly driven by ROM volumes, whereas revenue is related to volume sold (product coal). The expected yield was not published in the Hume Coal's 2014 Preliminary Environmental Assessment (PEA), but the proponents included a figure of 78% in their 2013 pre-feasibility study[7].

[6] Southern Highland News, "POSCO acquires 100 per cent of Hume Coal", (2015)

[7] Reported in Pells, P., Pells, S. "Groundwater Study: Background and Synopsis", p.3, (Pells Consulting, 2014)

Exhibit 1 ROM and product coal volume over project life

Mega tonnes per annum (Mtpa)



Source: EMGA Mitchell Mclennan, "Hume Coal Project – Preliminary Environmental Assessment", p. 15, (2014); profile assumed by TAI

Using the information provided in the PEA and pre-feasibility study, the production profile illustrated in Exhibit 1 has been estimated by The Australia Instititue (TAI)[8]. The total ROM coal produced in Exhibit 1 is 50 Mt, in line with the PEA. An average yield over the project of 78% gives total product coal of 39.8 Mt. The ROM and Product Coal functions here form part of our estimates of project revenues and operating costs.

Coal volume

How much and when coal is mined and sold is a key driver of total project value, since it dictates both when revenue is received and when expenses are incurred. What share of coal mined is actually sold is also important, since costs are mostly based on run-of-mine (ROM) volumes while revenue depends on volume sold (product coal/saleable product).

At peak production rates, Hume Coal plans to extract 3.4 Mtpa of ROM coal, 3.0 million tonnes of which will end up as saleable product (Exhibit 1). This represents a "mining yield", or proportion of ROM coal that is ultimately sold to market, of about 88%.

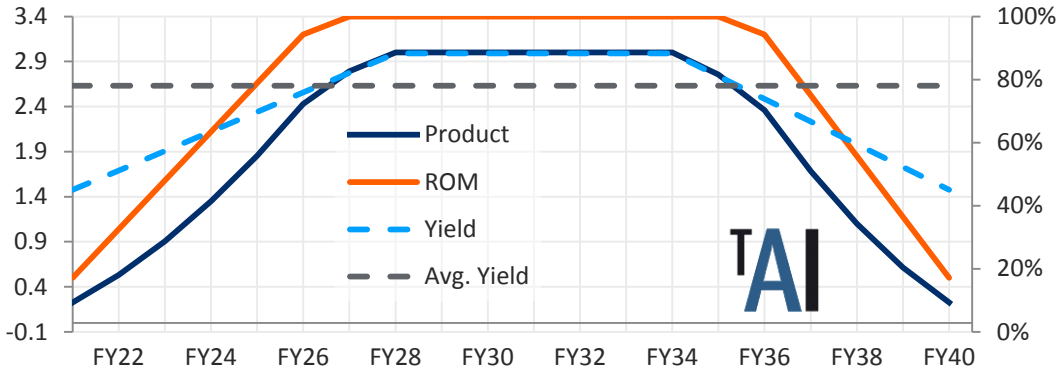
The proponents do not provide their expected overall yield in their 2014 Preliminary Environmental Assessment (PEA), but did use the figure 78% in their 2013 pre-feasibility study[9].

[8] Total ROM production approximately 50Mt, peak ROM production is 3.4Mtpa, and peak saleable production is 3.0Mtpa as per the EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", (p.50). Average yield is 78%.

[9] Reported in Pells, P., Pells, S. "Groundwater Study: Background and Synopsis", p.3, (Pells Consulting, 2014)

TAI has used the figures provided in the PEA and pre-feasibility study to assume a profile of ROM and yield, and therefore product coal, over the Hume Coal Project's life[10] (Exhibit 1).

Exhibit 2 ROM and product coal volume over project life
Mega tonnes per annum (Mtpa)



Source: EMGA Mitchell Mclennan, "Hume Coal Project – Preliminary Environmental Assessment", p. 15, (2014); profile assumed by TAI

The total ROM coal produced in Exhibit 1 is 50 Mt, in line with the PEA. An average yield over the project of 78%, in line with the pre-feasibility study, gives total product coal of 39.8 Mt. The ROM and Product Coal functions here form part of our estimates of project revenues and operating costs.

Coal price

Probably the most sensitive assumption towards the valuation of any mining project is the price buyers are willing to pay for the mine's product. Hume Coal plans to produce metallurgical and thermal coal, which will be sold into international and domestic markets[11].

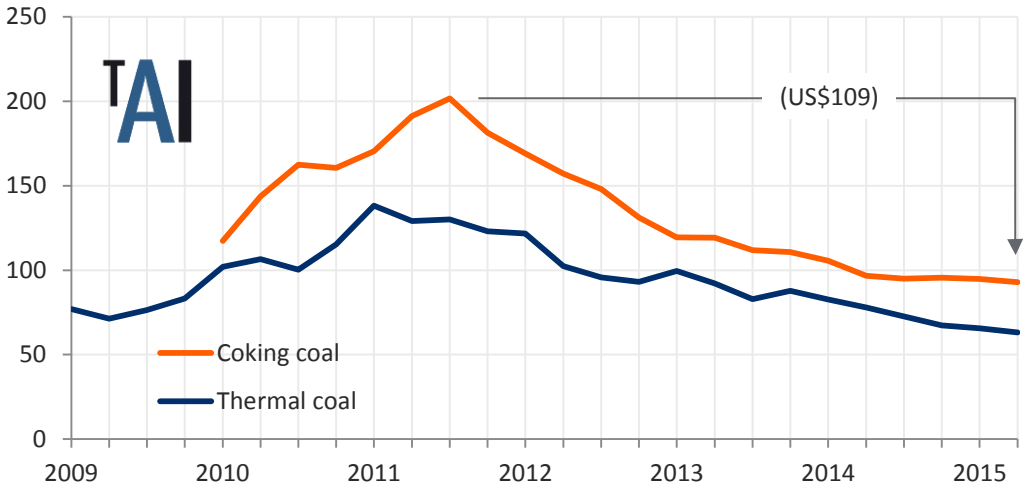
The value of metallurgical coal has fallen by over US$100 per tonne since 2011, driven by the slow-down in the Chinese construction industry, a corresponding reduction in demand for steel products and major expansions in global coal supply, with prices now closer to long term averages (Exhibit 3).

[10] Total ROM production approximately 50Mt, peak ROM production is 3.4Mtpa, and peak saleable production is 3.0Mtpa as per the EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", (p.50). Average yield is 78%.

[11] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p. E.3, (2014)

Exhibit 3 Historical coal prices

US$ per tonne FOB, nominal



Source: Steelonthenet, "Metallurgical Coal Prices", (2016); Indexmundi.com, "Coal, Australian thermal coal Monthly Price – US Dollars per tonne", (2016)

As of April 2016, the price of 'Hard Coking Coal (Premium Low Vol) FOB Australia' was US$92.75[12], and according to research released by the National Australia Bank (NAB) in March 2016, prices are expected to decline further in the second half of 2016 due to weak steel demand and falling production[13].

Note that Hume's metallurgical coal will likely trade at a lower price than Australian premium coking coal. The NSW Coal Industry Profile shows that Hume's product coal does not meet Australian hard coking coal benchmarks on several specifications:

Table 1: Coal specifications

Specification	Hume	Platts benchmark Hard Coking Coal FOB Australia
Moisture (% air dried)	2.3	N/A
Moisture (% as received)	8.0	9.5
Ash (% air dried)	11.0	9.0
Volatile Material (% air dried)	34.3	21.5
Sulphur (% air dried)	0.59	0.50
Energy content (kcal/kg)	7,337	7,800[a]
Crucible Swelling Number	7.0	8.5

[a]This is the Platts Low Vol PCI FOB Australia Benchmark rather than Hard Coking Coal FOB Australia, which does not list energy content.

Sources: Division of Resources and Energy (2013) *NSW Coal Industry Profile*; Platts Global (2016) *Methodology and Specifications Guide Metallurgical Coal*.

[12] CME Group, "Australian Coking Coal (Platts) Low Vol Futures Quotes", (2016)

[13] National Australia Bank, "NAB Minerals & Energy Commodities Outlook – March 2016", (2016)

Table 1 shows that, while Hume's coal is likely to meet standards for moisture and swelling properties, ash content, volatiles and sulphur is high. Energy content is below the benchmark for pulverised coal injection product (PCI), which itself trades at a discount to hard coking coal.

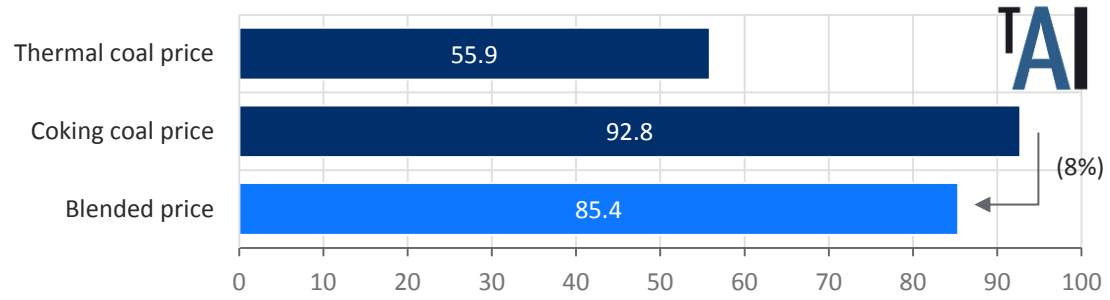
While Hume's metallurgical coal is likely to trade at a discount to Australian Hard Coking Coal benchmark prices, in our assessment we assume no discount. Hume Coal state that the raw ash content of its product is "… higher than typical Australian export metallurgical coal, but the ROM coal will be washed on-site to meet export coking coal market specifications as required, including ash content specifications". Based on this statement, the central assumptions do not penalise Hume Coal for their lower quality product; it is assumed that the impact of processing more coal to meet quality standards is reflected in the 78% yield. Regardless, our approach seems optimistic and may result in an overstatement of the value of the project.

For metallurgical and thermal coal, miners typically enter into contracts with buyers for certain quantities of their annual production. Since POSCO is a vertically integrated steel producer, it will probably be the primary customer of Hume Coal's production. The market price, however, is still very important, as it represents the price POSCO could have purchased coking coal for from another supplier.

Metallurgical coal has historically achieved around a 40% premium to thermal coal, and it is therefore important for any proposed project to understand how much of their output will be sold into each market. The proponents don't share production splits between thermal and coking (metallurgical) coal, but the nearby 'Illawarra Metallurgical Coal' operation, owned by South32, reports that 20% of its saleable production is thermal coal[14]. In estimating the value of Hume Coal's production, this report has adopted the same mix for Hume Coal, which results in an average price assumption across Hume Coal's total output being 8% lower than the benchmark coking coal price (Exhibit 4).

[14] South 32 (2015) *Making a Difference from the Ground Up-Roadshow Presentation March 2015,* sd31

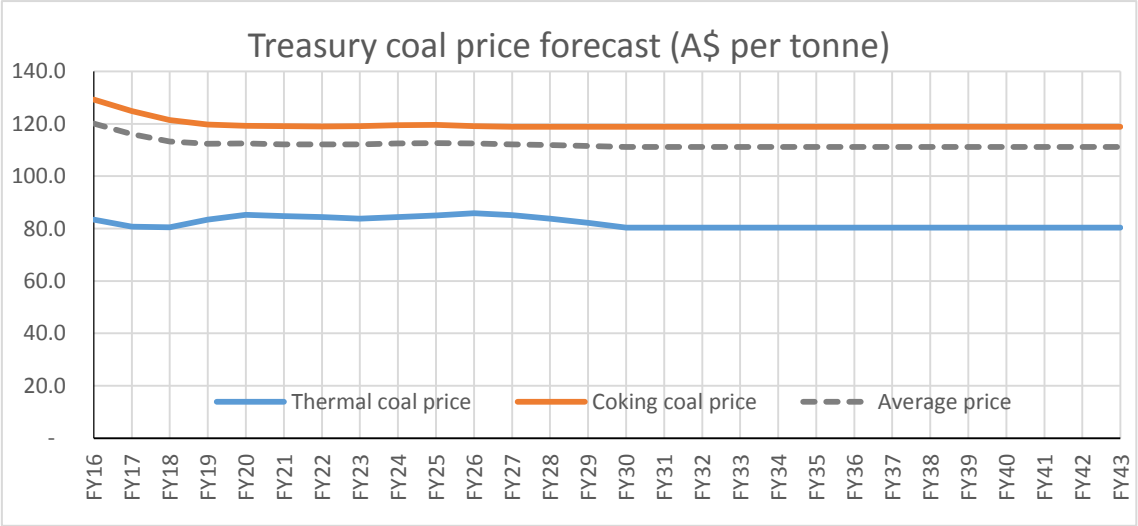
Exhibit 4 Market coal prices and Hume Coal average price (April 2016)
US$ per tonne FOB



Source: CME Group, "Australian Coking Coal (Platts) Low Vol Futures Quotes", (2016); Indexmundi.com, "Coal, Australian thermal coal Monthly Price – US Dollars per tonne", (2016)

At the current exchange rate of 0.77, this represents A$110 per tonne for the average price per tonne Hume will receive, based on the above assumptions. This is close to price estimates in the Commonwealth Treasury's Long-Run Forecasts (Exhibit 5):

Exhibit 5 Commonwealth Treasury long-term coal price forecast
A$ per tonne (2012 dollars)



Source: The Australian Government Treasury, "Long-Run Forecasts of Australia's Terms of Trade – Treasury Working Paper", p.19–21, (201

Our estimates are based Treasury's forecast and we assume that the average price Hume Coal will to receive is A$112 per tonne. **Exhibit 14** (presented further down in this chapter) shows sensitivity analysis of the NPV of the project at a global level for Hume's average received prices between US$50 and US$150.

Gross mining revenue

Under the above assumptions, gross mining revenue over the project life is almost A$4.5 billion, or A$1.7 billion in present value terms at a 7 percent discount rate. The relevant sections of the draft worksheet are presented below:

Table 2: Gross mining revenue table from Draft Worksheet (undiscounted)

1. Gross mining revenue (GMR)

		Total
Quantity of coal/mineral output	tonnes ('000)	39,820
Price (forecast) of coal/mineral	$ per tonne	
Total (quantity x price)	AU$ ('000)	4,440,995

Table 3: Discounted mining revenue from Draft Worksheet

A1. Direct economic benefits – Global

			Total
1	Gross mining revenue (GMR)	AU$ ('000)	1,709,936
2	Residual value of land	AU$ ('000)	–
3	Residual value of capital	AU$ ('000)	–
Total discounted direct economic benefits – Global		AU$ ('000)	1,709,936

GLOBAL FINANCIAL COSTS

Operating costs

The cost required to extract coal from underground, process it, and transport it to port is a key cost of the project. Many factors contribute to the operating cost for a mining project. Open cut mines are generally cheaper than underground mines on a per tonne basis, and mines which recover a high proportion of the in situ resource are generally cheaper than those which leave most in place. Since Hume Coal is an underground

mine, with a proposed recovery rate of only 35%[15], it is likely to be at the costlier end of the coking coal mining spectrum.

Hume Coal provide some detail around expected initial construction and sustaining capital costs, as well as information on mining techniques assisting comparison with other mines. As the project will adopt "environmental and social practices above and beyond the standard measures used at Australian coal mines", which they demonstrate through five design principles[16]:

1. Innovative 'non-caving' coal extraction methods
2. Underground reject coal replacement
3. Covered coal transport rail wagons
4. Advanced high performance locomotives; and
5. Apprenticeships, training, and local procurement

While this commitment to responsible practices is commendable, the reason why these particular practices are not generally employed at other Australian coal mines is because they add considerably to costs. To take the second point as an example, replacing reject coal back into the underground void would necessitate significant additional coal transport and handling per ROM tonne, which will increase costs through additional labour, fuel, and equipment maintenance expenses.

In the absence of the project-specific information required to conduct a detailed operating cost study, we have referred to two other underground operations which have published actual or expected operating costs. This approach is not uncommon. Operating cost estimates for mines submitted to the NSW planning process are often based on comparison with other mines rather than proponent estimates[17]. In one recent proposal consultants used operating cost estimates based on other mines' known costs instead of the overly optimistic data provided by the proponent[18].

The Belview Coking Coal Project is a proposal for a 3.5Mtpa ROM underground single longwall coking coal mine in Queensland's Bowen Basin. In April 2013 the proponents

[15] ABC News, "Hume Coal announces plans to build Southern Highlands mine", (2015)

[16] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p.20, (2014)

[17] Deloitte Access Economics (2013) *Cost benefit analysis and economic impact analysis of the revised Bulga Optimisation Project*; Deloitte Access Economics (2014) *Cost Benefit Analysis and economic impact analysis of the Mount Owen Continued Operations Project*.

[18] Deloitte Access Economics (2015) *Cost Benefit Analysis and Economic Impact Analysis of the Wilpinjong Extension Project*.

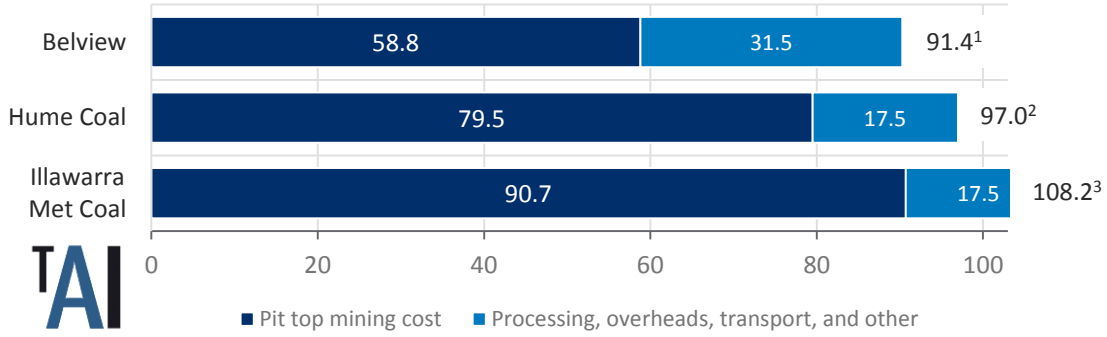
released a concept study for the mine, which estimated operating costs at A$91.4 per saleable tonne FOB Gladstone[19].

Much closer to the proposed Hume Coal site, Illawarra Metallurgical Coal (IMC) is a three-longwall underground mining operation extracting 12Mtpa of ROM coal. In March 2015, they published operating costs for FY14 of US$99 per tonne, which translates to A$108 per saleable tonne using the average FY14 exchange rate of 0.91 (Exhibit 6).

Total operating costs for Belview consist of both 'pit top mining costs', as well as processing, transport, levies and overheads. In comparison to Hume Coal, Belview will extract coal from a deeper seam than Hume (approximately 400m versus 100m), but will recover a much higher proportion of the coal (80% versus 35%). Since the operating costs are considered as a rate per saleable tonne, and given most of the effort required in underground mining is accessing the seam, leaving 65% as opposed to 20% of the coal in place adds significantly to costs. It has therefore been assumed that Hume Coal will incur around 35% more cost per saleable tonne in getting coal to the processing plant door.

On the other hand, Hume Coal is located just 80km by rail from Port Kembla, significantly shorter than the almost 300km by rail between Belview and Gladstone, which is reflected by the lower transport, processing, and overheads assumption in Exhibit 7.

Exhibit 6 Comparison of Hume Coal and other mine operating costs
A$ per product tonne; C1 cash costs (nominal)



Source: 1) Stanmore Coal, "ASX announcement – New Concept Mining Study for Belview Coking Coal Project", (2013); 2) TAI estimate; 3) South 32, "Making a Difference from the Ground Up – Roadshow Presentation March 2015", slide 30, (2015)

[19] Stanmore Coal, "ASX announcement - New Concept Mining Study for Belview Coking Coal Project", (2013)

Note: 1) Cost in FY13 dollars; 2) Estimate is in FY16 dollars; 3) Cost quoted as US$99 in FY14 and converted to A$ using FY14 average A$/US$ exchange rate 0.91

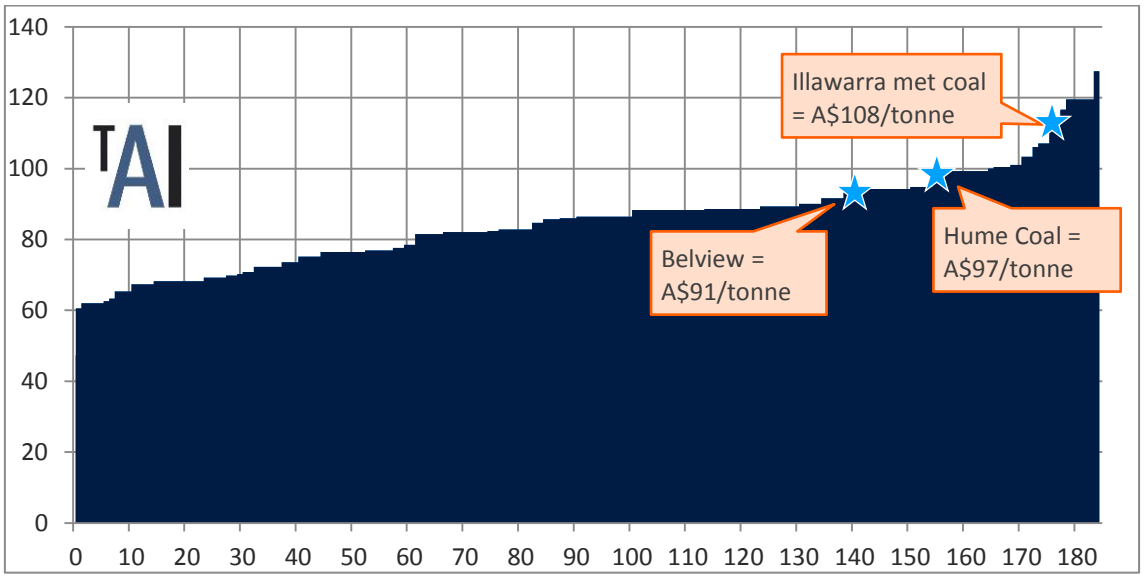
While the breakdown of operating costs for IMC was not published, since it is a similar distance to port, it is assumed that transport costs will be comparable to Hume Coal. Similar to the Belview proposal, IMC also employ longwall underground mining, which is likely to be more cost effective than the largely untested 'Pine Feather' technique proposed by Hume Coal. However, since IMC has been mining in the area for a significant amount of time, it is also likely that they are incurring legacy costs not expected to be faced by Hume Coal. This report has therefore conservatively assumed that the central operating cost assumption is lower than IMC, but higher than Belview, at A$97 per saleable tonne FOB Port Kembla.

Note that we have not included separate estimates of decommissioning costs, environmental mitigation costs, transport management costs and rehabilitation costs. We assume that these costs are factored into the operating cost estimate. Given the potential environmental impacts of the Hume project, this approach could significantly understate the costs of the mine.

Based on these assumptions of pit-top mining and other costs, averaging $97/t over the life of the project, we estimate total operating costs of $3.86 billion. Present value of operating costs at a seven percent discount rate is $1.50 billion.

Operating costs of A$97/t would place Hume Coal in the top quartile of Australian coking coal mines (Exhibit 7). As commodity prices have returned to near long term averages, this is not a good starting position for a greenfield mining development.

Exhibit 7 Australian seaborne metallurgical coal cost curve, 2012
A$ per product tonne; C1 cash costs (2016 dollars)[1,2,3]



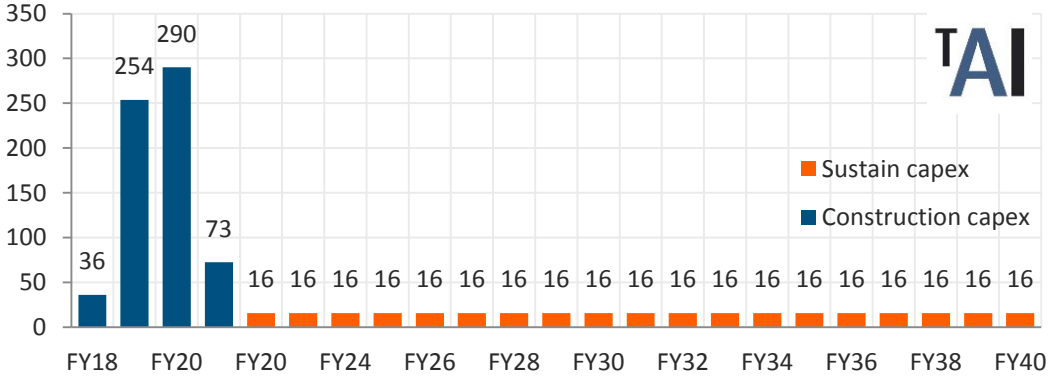
Source: Wood Mackenzie Australian seaborne metallurgical C1 cash cost curve (2012) – sourced from: Whitehaven Coal, "A Leading Independent Australian Coal Producer – Presentation to Bank of America Merrill Lynch 2012 Global Metals, Mining and Steel Conference", (2012)

Notes: 1) C1 cash costs include mining, coal preparation, transport, port and overhead costs. It does not include royalties and levies. 2) Converted to A$ using A$/US$ 1.04 exchange rate as cited by Whitehaven Coal. 3) Converted to 2016 dollars using 2.5% p.a. escalation; 4) Hard Coking Coal (Premium Low Vol) FOB Australia April (CME Group, 2016), converted to A$ at spot A$/US$ exchange rate 0.77

Capital costs

Hume Coal estimates that initial construction, including the Mine Infrastructure Area (MIA), the Coal Handling and Processing Plant (CHPP), and initial development of the mine, to cost A$720 million over a three-year period[20,21]. Ongoing capital costs for equipment and infrastructure replacements are estimated to cost a further A$300 million over the life of the project[22] (Exhibit 8).

Exhibit 8 Capital costs
A$ Millions, 2016 dollars



Source: EMGA Mitchell McLennan, "Hume Coal Project – Preliminary Environmental Assessment", p.17, (2014); Profile assumed by TAI

The present value of capital costs in Exhibit 7 is $626 million at a 7 percent discount rate.

It is worth noting that construction cost estimates published in the Hume Coal PEA in 2014 were dramatically reduced from that included in the pre-feasibility study

[20] The Australian Mining Review, "Australia's First Low Impact Coal Mine", (2015)
[21] The Hume Coal PEA gives a construction capex figure of only A$682m, but states that the associated rail infrastructure (the 'Berrima Rail Project') will be treated in a separate development application - It is assumed that the difference between the A$720m figure previously quoted by Hume Coal represents the full amount.
[22] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p.17, (2014)

completed in March 2013. The pre-feasibility study estimated that construction could cost as much as A$1,357m, with a best estimate of A$1,044 in 2012 dollars, 45% more than Hume Coal's latest estimates (and those used in this report). Without access to the pre-feasibility study it is difficult to comment on exactly how much of this decrease is warranted, but it should be noted that the figures used in this report are likely to be a 'best-case' scenario, rather than a P50 estimate.

GLOBAL FINANCIAL NET BENEFITS

At this point it is important to consider the implications of the preceding sections. The operating and capital costs of the project are greater than its revenues in both undiscounted and present value terms. Even before consideration of external costs, which are potentially large, the project has negative net financial benefits at a global level, summarised in Table 4 below:

Table 4: Financial net benefits

Item	Undiscounted (A$,000)	Present value (A$,000, r=7%)
Revenue	4,440,995	1,709,936
Capital cost	949,900	625,648
Operating cost	3,859,726	1,497,268
Global net financial benefits	**-368,631**	**-412,980**

Under the above assumptions the project has negative value of A$368 million in undiscounted terms and A$412 million in present value terms. The larger negative present value reflects that many costs are early in the project, while what profit it makes is far in the future.

Readers interested in the development of the Draft Worksheet should note that the worksheet does not have a comparable table or summary figure. The net direct economic cost calculation in the CBA tab (G150 in CBA tab) includes "Local contributions". This is incorrect from a global CBA perspective as the contribution payments represent a transfer from the proponent to the local community. The cost to the proponent is netted out by the benefit to the community, see Table 5 below:

Table 5: Draft worksheet global direct costs (undiscounted)

A. Direct economic costs – Global

			Total
1	OPEX	AU$ ('000)	3,859,726
2	CAPEX	AU$ ('000)	949,900
3	Decommissioning costs	AU$ ('000)	–
4	Environmental mitigation costs	AU$ ('000)	–
5	Transport management costs	AU$ ('000)	–
6	Rehabilitation costs	AU$ ('000)	–
7	Purchase cost of land	AU$ ('000)	2,377
8	Local contributions	AU$ ('000)	11,250
	Total direct economic costs – Global	AU$ ('000)	4,823,252

GLOBAL EXTERNAL COSTS

A global CBA includes costs and benefits to whomever they accrue, not just to overseas interests. The following costs are largely borne by the NSW community and are important to include as part of both global and NSW-level CBA.

Groundwater

The most contentious issue of the proposed Hume Coal project is the impact it could have on groundwater. There are two primary economic costs associated with depleting groundwater: firstly, the opportunity cost of water consumed or otherwise diverted by the mine which cannot be used elsewhere, and secondly, the drop in groundwater depth requires existing water users to incur expenses to increase the depths of their bores.

By consuming or diverting limited water supplies, there is less water for other users. The opportunity cost in this case would be the lost agricultural output and the loss of other uses of groundwater, such as by gardens linked to the local tourism industry and by an equestrian facility close to the mine site.

When groundwater depths are lower, existing water users will have to incur expense deepening their bores. The cost in this case is the expenses incurred by drilling deeper bores, as well as any other environmental cost associated with significantly lowering

the groundwater depth. Several groundwater users express the opinion that this may not be possible even at considerable expense.

Opportunity cost of water consumed or diverted

Mining underground creates a void in the earth, which surrounding groundwater will naturally flow into. According to the EMGA Mitchell Mclennan, "Hume Coal Project – Preliminary Environmental Assessment", (PEA), this inflow will be pumped to a 6 mega-litre (ML) underground sump, after which it may be pumped to the surface to for treatment and subsequent re-use, reinjection, supply to others or release into local creeks and estuaries[23].

Groundwater, like surface water, naturally has water flowing into the system, and all other things being equal, if the water being drawn from the system is less than or equal to that flowing into the system, then the system will not deplete.

There are currently 16.3 Giga-litres (GL) of water licences issued to the Nepean district, which the proposed Hume Coal project falls completely within. This region is said to be fully allocated[24], meaning that no more water licences are expected to be issued and, if they were, the aquifer would begin to reduce.

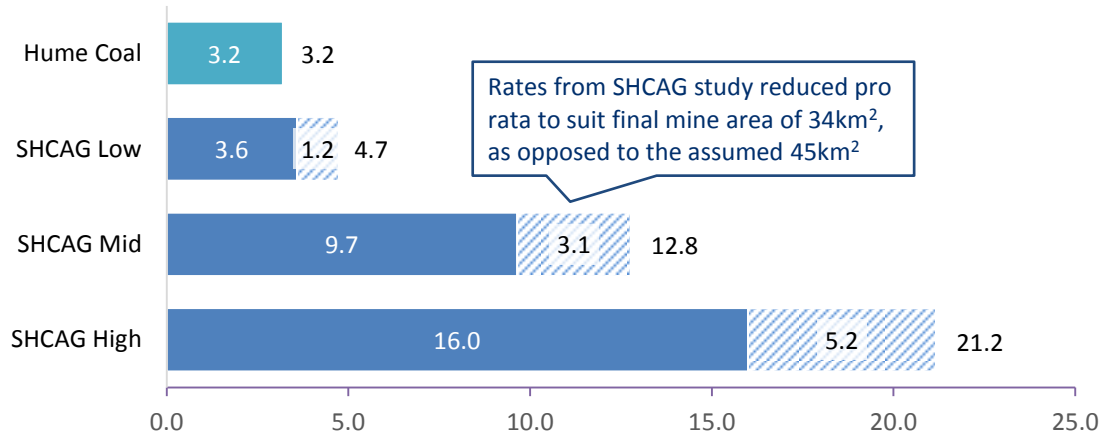
To determine how much water will be consumed by the Hume Coal project over its life, a three dimensional engineering model must be developed, which calculates annual inflow rates as the size and shape of the mine progresses.

The Southern Highlands Coal Action Group (SHCAG) commissioned a groundwater study by Pells Consulting in 2014. The central inflow estimate was for a peak of 13GL per annum, but high and low scenario modelling revealed a range of between 5 and 21GL per annum[24]. Hume Coal have developed their own numerical model which estimates a peak of 3.2GL per annum would be drained from local aquifers as a result of the project.

[23] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p.34, (2014)
[24] Pells, P., Pells, S. "Groundwater Study: Background and Synopsis", p.13, (Pells Consulting, 2014)

Exhibit 9 Water inflow rates

GL per annum



Source: EMGA Mitchell Mclennan, "Hume Coal Project – Preliminary Environmental Assessment", p.28, (2014); Pells, P., Pells, S. "Groundwater Study: Background and Synopsis", p.9, (Pells Consulting, 2014); TAI analysis

The SHCAG study was commissioned before the Hume Coal PEA was released, and in the absence of any other mine plan information from Hume Coal, it was based on an assumed mining area of 45 square kilometres. The now published Hume Coal PEA states that the mine area will in fact only cover an area of 34km^2, and so the raw inflow rates in the SHCAG study have been reduced proportionally in Exhibit 8 to reflect the new mine area[25,26].

Even after this adjustment, the central estimate from the SHCAG study is three times that of Hume Coal's own assessment. There is certainly a margin of error in conducting these studies, and inputs such as the assumed permeability of the earth can have an order of magnitude impact on the results of the model[27]. That said, since Hume Coal's own water inflow assessment is very similar to the 'best case' scenario from the SHCAG study, it may be the case that the proponents have run their model on best case assumptions, rather than a true central estimate.

While the merits of the results of varying engineering studies can be debated, the neighbouring Berrima Colliery provides a real world example of what potential impacts may occur. This underground mine is adjacent to, and shares similar geology as Hume Coal, but produced only one fifteenth of the annual coal that Hume Coal is expecting. Even at this comparatively small production rate, the Berrima Colliery drains 3 to 4ML

[25] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p. 1, (2014)

[26] This is an approximation only. A new groundwater study has been commissioned, but the results of which won't be available until after this report is published.

[27] Per phone call with Steven and Phillip Pells of Pells Consulting, authors of the groundwater study

per day of groundwater, or about 1.3 GL per year[28]. Multiplied by 15 as an approximation for what the Hume Coal project might cause, this works out to almost 19GL per annum, 4GL more than even the worst case SHCAG scenario. Simply scaling the inflow rates by production volumes is obviously a gross approximation but, at an order of magnitude level, it supports the SHCAG study rather than the Hume Coal estimate.

Cost of lowering the groundwater depth

In addition to the cost of consuming water, there are also costs associated with lowering the groundwater depth. By effectively creating a drain in the middle of the aquifer, the depth of the surrounding groundwater will decrease until it matches the depth of the drainage point, in much the same way drilling a hole in a bucket would. Hume Coal have stated that the cost associated with deepening the bores of existing water licence holders, or other compensatory arrangements, will be paid for by the company[29].

The Hume Coal PEA states that groundwater levels will be restored to within 2m of their pre-mining levels after the conclusion of mining[30], but does not provide any estimates of what the impact would be during operations. The SHCAG groundwater study, however, finds that water table draw down of 120m would likely occur in large parts of the 180 square kilometre model area (only 34km^2 of which are occupied by the mining area)[31].

In addition to the cost of simply gaining access to the deeper water, there may be serious environmental consequences associated with lowering the groundwater level. One of these is discussed in the 'Biodiversity impact' section, but there are likely other impacts that will not reveal themselves until the damage has been done.

Difficulty in compensating affected properties

Hume Coal is required by the NSW Aquifer Interference Policy to 'make good provisions' where aquifer depths drop by more than 2m, which is defined as ensuring "third parties have access to an equivalent supply of water through enhanced infrastructure or other means, for example deepening an existing bore, funding extra pumping costs or constructing a new pipeline or bore"[32].

[28] Pells, P., Pells, S. "Groundwater Study: Background and Synopsis", p.12, (Pells Consulting, 2014)
[29] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p.60, (2014)
[30] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p.57, (2014)
[31] Pells, P., Pells, S. "Groundwater Study: Background and Synopsis", p.10, (Pells Consulting, 2014)
[32] NSW Government Department of Primary Industries, "NSW Aquifer Interference Policy – Fact Sheet 4", p.5, (2013)

'Deeping an existing bore' is not likely to be a viable option for properties located above the mining area, since a bore cannot be drilled through the mine void. In these cases, building pipelines from the mine area (or other water source) to each of the affected properties is likely to be necessary. There is a large number of separate properties throughout the affected area, and the cost of connecting each of these properties would be extremely high.

Another option for Hume Coal might be truck water to every affected property. Montrose House and Berry Farm is an example of one such property, which has combined water licences for 130 ML per annum from its own bore holes. To supply this volume of water by tanker would require over 11 return semi-trailer trips per day. Cost aside, the impact of this volume of trucking for just one property will create multiple further externalities, such as accelerated road degradation, increased traffic and accident probability, as well as noise and air quality issues.

The cost of these mitigating measures have not been calculated in this report, but it is likely to be significant. There is also considerable doubt as to whether they can actually be achieved; the volume of water that must be compensated is simply too great. To borrow our trucking example again, to move the 13 GL per annum the Hume Coal project is expected to displace from the water table would require 1,179 semi-trailer water truck return trips every day.

Estimation of groundwater impact cost

The cost of groundwater impacts depends on the amount of water lost from other productive use, discussed above, and also on the value of the groundwater.

Groundwater is traded in the Southern Highlands area, however the market is small, there are not large numbers of trades with observable prices. Landholders interviewed for this report had bought licences for around $2,000 per megalitre. The same value has been used in proponent-commissioned assessments of coal mines throughout NSW[33].

While licences of several megalitres may be purchased at this price, it is unlikely that volumes of at least 3GL could be obtained at this price, if at all. As discussed above, the relevant groundwater resources are fully allocated at 16.3GL. Even at Hume's estimated inflow rate of 3 GL this represents 20 percent of the total allocation. SHCAG's upper estimate of inflow is greater than the total sustainable allocation of groundwater.

[33] See for example, Gillespie Economics (2012) *Cobbora Coal Project Economic Assessment*; Gillespie Economics (2012) *Watermark Coal Project Economic Impact Assessment*; Gillespie Economics (2012) *Drayton South Coal Project Economic Impact Assessment*.

With such large portions of the groundwater allocation in question, even if obtaining the licenses were possible, prices are unlikely to represent the marginal change in present value of earnings from a megalitre of water. Many landholders interviewed for this report claim to have invested millions of dollars into infrastructure, land improvement, crops, trees and other forms of property improvement based on their ability to access groundwater at reasonable prices. The value of such a large change in groundwater use would need to reflect these large investments. Given the value of properties and businesses involved, the potential value is likely to be in the hundreds of millions of dollars.

In Table 6 below, we apply the $2,000 per ML to the above inflow estimates. In addition we apply values of two and three times amount to reflect the likely increase in price of such a large increase in demand. At the higher levels of inflow even this represents a likely underestimate:

Table 6 Groundwater cost estimates at various inflow and water values, present value

	$2000/ML	$4000/ML	$6000/ML
Hume coal (3.2GL)	11	21	32
SHCAG mid (9.7GL)	65	131	196
SHCAG high (16.0GL)	108	216	235

Source: TAI interviews, PEA, Pell Consulting and TAI calculations

Note that the values in Table 6 are present values based on a 7% discount rate and that level of inflow assumed increases linearly through the project life to reach the inflow estimates in Exhibit 8in the final year of the project. The wide range of estimates in Table 6 reflects the uncertainty around both groundwater impacts and the value of removing or reallocating such large portions of the local groundwater allocation. Given this uncertainty a range of values are used in sensitivity testing.

Surface water

While the impact of the proposed Hume Coal project will be most pronounced on groundwater systems, the project is also located in a particularly sensitive area from a surface water perspective. There are several creeks and tributaries which run directly through the mining area, all of which feed into the Wingecarribee River, located approximately 2km north of the project area. The Wingecarribee River in turn forms part of the Warragamba Dam catchment, which supplies water to Sydney[34].

[34] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p.60, (2014)

Hume Coal has already identified a number of areas where it is likely to have an impact on surface water[35]:

1. Reducing stream baseflows by depleting groundwater, or changing surface and groundwater connectivity
2. Negatively impacting catchment and drainage through the construction of surface infrastructure, particularly for Oldbury Creek and Medway Rivulet
3. Water quality degradation during construction and operations from surface infrastructure
4. Erosion, contamination or other negative impacts on the receiving environment as a result of the discharge of treated water to nearby watercourses, or through the supply of water to others

These points all represent serious risks to the local water environment, but it is the last point which warrants further discussion and analysis. Hume Coal assert that, where possible, mine water recovered from underground workings will be recycled and reused on site for dust suppression, coal washing, belt cleaning, vehicle wash down, amenities, and fire protection systems[36].

While mining can be water intensive, the volume of water flowing into Hume Coal's mine will be orders of magnitude greater than it can ever use for the above purposes. By way of illustration, the Tasman Extension Project EIS estimates it will require 90kL/day for underground operations, 30kL/day for dust suppression, 3.5kL per day for wheel wash and 15kL / day for potable water, which is a total of 50 ML per year[37]. If the Hume Coal project uses 3 times this much (Hume Coal will operate at 3.4 ROM Mtpa versus Tasman's 1.5 Mtpa), then this still only amounts to 150 ML per year. Using Hume Coal's own conservative mine water inflow assessment of 3.2GL per year, this represents only 4.7% of the water Hume Coal must manage, and using the SHCAG central estimate of 9.7GL per year (Exhibit 8), it is only 1.5%.

Hume Coal acknowledge that they will have to manage excess water, stating it will be:

1. Returned to mined-out-voids
2. Returned to the overlying groundwater system
3. Supplied to others; or
4. Released to nearby watercourses under licence

[35] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p.63, (2014)

[36] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p.16, p.34, (2014)

[37] Donaldson Coal, "Tasman Extension Project Environmental Impact Statement - Appendix C - Surface Water Assessment", p. 62, (2012)

Returning water to mined-out-voids is a not an attractive option from a safety perspective. In 1996, four miners were killed in the Gretley Colliery near Newcastle, when water burst through the mine face from a void left by the long abandoned Young Wallsend Colliery, which over time had filled with water. Mining near water filled voids represents a considerable risk which cannot be fully mitigated (human error was the culprit in the Gretley Colliery case), and it is concerning that this is one of the leading solutions to Hume Coal's water woes.

Returning water to the overlying groundwater system only delays the water management issue, since most of this water will make its way back into the mine void in a relatively short amount of time.

Supplying water to others is challenging for the reasons already outlined, and therefore releasing water into nearby watercourses is, at least from Hume Coal's perspective, the most practical course of action. This would, however, place a significant risk on the local environment, and a potential contamination risk to Sydney's drinking water supplies.

An economic value has not been placed on the cost of Hume Coal's impact on surface water, partly because the engineering studies have not yet been completed, but also because the risk of impact is difficult to assess and there is a risk of double counting groundwater impacts.

If impacts are limited to depleting a number of dams and creeks, costs may be small. However, there is a risk of contamination of drinking water, which would bring large costs. A 2012 study into the Clarence Colliery near Lithgow, which discharges waste water into the Wollangambe River, found that pollution caused by the mine decreased macroinvertebrate family richness by 65% and abundance by 90%[38]. Valuing the magnitude and probability of this kind of environmental destruction is difficult, so these risks will instead be noted qualitatively.

Opportunity cost of land

The land earmarked for the Hume Coal project area is currently utilised for a mix of agricultural and residential purposes. Although Hume Coal has already spent approximately $50m acquiring 1,760 hectares of land within and adjacent to the proposed mining area[39,40], only 115 hectares of the total 3,400 hectare mining area will

[38] Belmer et.al., "Impact of a coal mine waste discharge on water quality and aquatic ecosystems in the Blue Mountains World Heritage area", (Proceedings of the 7th Australian Stream Management Conference, 2014)

[39] ABC News, "Plan for Hume Coal mine in NSW Southern Highlands divides local community", (2015),

have its primary use changed from farming to mining[41]. Since the mine is an underground operation, the majority of the mining area will continue to be used largely in its present form, with the exception of the disruption caused by drilling and other surface activities, as well the impact caused by changes to underground and surface water conditions (these will be covered in separate sections).

The opportunity cost of land relevant to this CBA is therefore only the 115 hectares, since it cannot continue to be used in its existing economic capacity. The opportunity cost of discontinuing its current use is equal to the present value of the revenues and costs that would have been generated over the life of the project[42]. Assuming property markets are correctly priced, however, land values should already reflect this opportunity cost.

The properties Hume Coal has already acquired provide the most recent indication of land values in the area[43]. Table 7 lists two of the major acquisitions, and their implied land value per hectare.

Table 7 Property values in Hume Coal mining area

Property	Sale price	Area	Land value
Mereworth retreat	A$ 11.1 m	500 Ha	A$ 22,200 / Ha
Evandale property	A$ 11.6 m	600 Ha	A$ 19,390 / Ha
Total / average	**A$ 22.7m**	**1,100 Ha**	**A$ 20,667 / Ha**

Source: Domain, "Southern Highlands farmers ramp up fight over mine", (2015)

At a value A$21k per hectare, the opportunity cost of the 115 hectares of land being transferred to exclusive mining use is $2.4m. This is assumed to occur in the first year of the project.

Greenhouse gas emissions

A number of the processes involved with coal mining cause or contribute to the release of greenhouse gases (GHGs) into the atmosphere. The consensus from the global scientific community is that GHG emissions are causing climate change, which if unabated will place a significant cost on the world's citizens.

[40] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p.5, (2014)
[41] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p.17, (2014)
[42] NSW Government Department of Planning and Environment, "Guidelines for the economic assessment of mining and coal seam gas proposals", p.13, (2015)
[43] "Michael Maloney, principal of Richardson & Wrench Bowral, said the sales reflect land-value only", Domain, "Southern Highlands farmers ramp up fight over mine", (2015)

Between July 2012 and June 2014 in Australia, the negative externality caused by the release of greenhouse gases from a range or large businesses and industrial facilities was internalised through the carbon pricing mechanism, at a price beginning at $23 / t CO2-e[44]. Although this legislation has since been repealed, and mining companies in Australia are no longer taxed on their emissions, the externality remains and presents a cost to the citizens of NSW and the world.

The largest cause of GHG emissions from coal mining is through fugitive emissions, where carbon dioxide (CO2) and methane (CH4) are released into the atmosphere when the seam is mined[45]. In addition, coal mining contributes to GHG emissions through the combustion of diesel in excavation and haulage equipment, the consumption of electricity onsite to power the CHPP and conveyor belts, and through the consumption of diesel by the locomotives used to take the product to port. GHG emissions will also arise from shipping product to foreign markets, and transporting it from port to the end users' facility, but these have not been included here. Ultimately, when the coal is combusted in either a steel smelter or thermal power plant, an enormous amount of GHGs will be emitted but, as is standard practice, these emissions should be counted by the party responsible for combusting the coal, not the entity which extracts it.

Estimating the quantum of GHGs released by the Hume Coal project will be the subject of a detailed engineering study to be released in the project's Environmental Impact Statement (EIS) in late 2016. In the absence of the results of this study, this report has borrowed the findings of the Tasman Extension EIS, which is a 1.5Mtpa underground mine located near the Port of Newcastle.

Emissions from the Tasman EIS have been converted into rates per ROM tonne, or per 100km of rail transport saleable tonnes for rail emissions, and are listed in Table 8 below. These assumptions were then applied to the Hume Coal ROM rates and port distances to give the total GHG emissions listed in the last column.

[44] Clean Energy Regulator, "About the mechanism", (2015)
[45] Minerals Council of Australia, "Emissions from Coal Mining", (n.d.)

Table 8 Greenhouse gas emissions assumptions and quantum

Scope	Source	Assumption	Assumption units	Hume total (Mt CO2-e)
Scope 1	Diesel	0.003	t CO2-e / ROM t	0.17
Scope 1	Fugitive Methane	0.014	t CO2-e / ROM t	0.71
Scope 2	Electricity	0.011	t CO2-e / ROM t	0.58
Scope 3	Diesel	0.000	t CO2-e / ROM t	0.01
Scope 3	Electricity	0.002	t CO2-e / ROM t	0.13
Scope 3	Bloomfield CHPP	0.001	t CO2-e / ROM t	0.05
Scope 3	Rail	0.001	t CO2-e / saleable t x 100 km	0.49
	Total			**2.14**

Source: Donaldson Coal, "Tasman Extension Project Environmental Impact Statement – Appendix J – Air Quality and Greenhouse Gas Assessment", p.56, (2012); TAI analysis

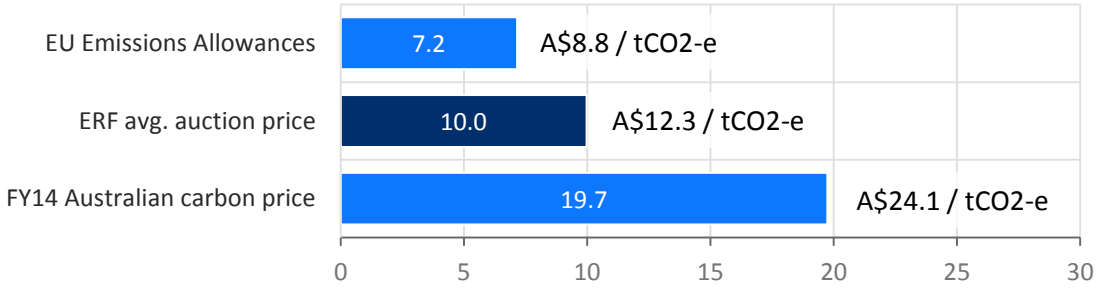
Table 8 shows that 2.14 mega tonnes of CO2 equivalent greenhouse gas emissions will be released if the Hume Coal project goes ahead. Under the base case, however, the 115 hectares of land required for exclusive mining use would continue to be used for cattle grazing. Assuming a stocking rate of 11 head per hectare, the Beef Greenhouse Accounting Framework Northern (B-GAFN) developed by the University of Melbourne[46] estimates that 1,502 t CO2-e would be emitted annually. Over the 25-year period for which grazing would not occur in this area, this sums to 0.04 Mt CO2-e (Hume State that normal activities will continue for the remainder of the mining area). The net emissions caused by the Hume Coal project is therefore slightly less at 2.10 Mt CO2-e.

Expressing these 2.10 mega tonnes of GHG emissions as an economic cost to the project requires a price to be placed on the damage done by each tonne of CO2-e. Estimating the exact cost of this externality is the subject of much international debate, and so a pragmatic approach has been taken here to use the A$12.25 / t CO2-e average price per tonne of abatement achieved in the November 2015 Emissions Reduction Fund auction[47].

[46] Eckard, R., Hegarty, R., Thomas, G., "Beef Greenhouse Accounting Framework Northern (B-GAFN)", (The University of Melbourne, 2008)

[47] Clean Energy Regulator, "Auction – November 2015", (2016)

Exhibit 10 Cost of greenhouse gas emissions under various prices
A$ millions (Present Value)



Source: Clean Energy Regulator, "Auction – November 2015", (2016); eeX, "European Emission Allowances – Global Environmental Exchange", (2016); TAI analysis

Notes: EU Emissions Allowance price EU5.89 / t CO2-e; A$/€ rate 0.67

Exhibit 10 shows the present value of Hume Coal's net GHG emissions to be A$10m. Sensitivity testing using the former Australian carbon price of A$24.15 per tonne doubles this cost to A$20m, whereas using the EU Emissions Allowance price yields a slightly lower result of A$7.2m.

Air quality and noise impacts

As an underground mine, Hume Coal's impact on local air quality will be less significant than the open cut coal mines typical of the Hunter Valley. That said, two primary dust-generating activities will still occur, namely[48]:

1. Vehicle movements on unpaved above ground surface area during construction
2. Processing, storage, handling and transporting coal and rejects

Hume Coal is commissioning air quality and noise assessments as part of the EIS, and without further detail it is difficult to determine which properties would be affected, and by how much. The primary sources of noise and dust will be from the operation of above ground equipment, such as vehicles, the CHPP, conveyor belts, load out facilities, and locomotives.

The most common method for quantifying the impact of reductions in air quality is by counting the value of any affected properties. Several landowners and businesses interviewed for this report expressed concern that noise and dust could affect them, particularly as the proposal is close to the town of Berrima. A local real estate agent interviewed for this report said that the location of project was "the first question buyers in Sutton Forest/Berrima area are asking when inquiring about property in the

[48] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p.71, (2014)

area." He was particularly concerned as he believed that winds blow south-west in the winter, from mine entrance site towards expensive residential areas.

There is no doubt that the uncertainty around the project is currently affecting property values. However, without detailed assessment of dust and noise impacts and without more certainty around groundwater impacts, these costs are difficult to quantify without double counting. These issues are not quantified in the CBA, but are discussed further in the LEA.

Heritage impact

The region surrounding the Hume Coal project is home to some of Australia's oldest and most historically important buildings. In many cases, historically important buildings in the towns of Berrima, Sutton Forest and Exeter are being maintained by the businesses that occupy them. If these businesses lost revenue or went out of business, the landlords would not be able to pay the expensive upkeep.

A prime example of this is Eschalot, a hatted restaurant located in central Berrima, a town considered to be the best preserved Georgian town on the Australian mainland[49]. The main setting of the restaurant is in a beautiful house constructed in the mid-1800s, but it also caters functions in a former brothel of the same era located across the street. Despite running on thin margins, Eschalot has funded the meticulous restoration and preservation of the buildings it occupies in partnership with the landlord, as it sees this as critical to its future success.

The proprietor estimates that 50% of its customers are drawn from out of town, mainly Sydney and Wollongong, and is acutely aware of the impact a coal mine in the area would have on tourism numbers. Without out-of-town customers, there is simply no way a business could afford the upkeep required to maintain these historic buildings.

Another example of heritage buildings being maintained by a local business is found at Bendooley Estate. Just over 8 years ago, the historic farmhouse was relatively run down. The owners wanted to restore and maintain the buildings and gardens, but could not afford the hundreds of thousands of dollars required annually without commercialising the property. Bendooley Estate now hosts a restaurant and wedding business, which has paid for the full restoration of the farmhouse, and the restoration and maintenance of heritage gardens.

[49] Weekendnotes.com, "Ten best country towns for day trips near Sydney", (2015)

Beendooley Estate's wedding business, however, is heavily dependent on water to keep its gardens at a standard high enough to attract couples form all over the state. Any changes to its ability to access water, or the gardens ability to retain it, would have serious negative impacts on the business, and ultimately on the maintenance of the co-located heritage buildings.

Similarly, the Montrose House and Berry Farm has heritage listed buildings and gardens, essential for attracting weddings and other events. If groundwater resources were affected, the owners say this would impact the viability of their business and their ability to maintain the heritage listed aspects of their property.

While the Hume Coal project deliberatively avoids mining directly under any heritage listed properties, the project could still impact many of the historic and heritage listed properties in the area. A value has not been placed on the potential impact, but will be considered qualitatively against the net benefits of the project.

Visual amenity

Most of Hume Coal's activities will be conducted deep underground, so the visual impact is largely minimised. Hume Coal acknowledges that the surface infrastructure area is likely to be visible from several adjacent areas such as Medway Road[50].

Transport impact

Road impact

The major roads and motorways within and around the Hume Coal mining area currently generally operate well with little congestion[51]. The proposed mine will require no changes to existing roads, except for minor modifications to the site access intersection.

Hume Coal is expecting 400 workers to be employed by the mine during construction, with an operational workforce of 300 thereafter. During shift changes, this is likely to add congestion to a number of local roads but, in the absence of a comprehensive road traffic study, it is difficult to value this cost.

Rail impact

Scheduling the trains which transport product coal from the rail load out to Port Kembla and back again represents a significant challenge for Hume Coal. Accessing the

[50] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p.82, (2014)
[51] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p.75, (2014)

Unanderra line from the Moss Vale siding requires locomotives to cross the Main Southern Line in both directions, which often results in extensive delays.

Furthermore, the Illawarra line, which will carry the train the remainder of the way to port, has a three-hour ban on freight movement in the morning and afternoon peak periods in order to prioritise commuter trains[52]. Details of 'The Berrima Rail Project' have not been publically released and so, depending on the scale of works proposed, some of these issues may be avoided, but likely at significant additional cost to either Hume Coal or to different levels of government.

At peak operation, Hume Coal plan to ship 3 million tonnes of coal per year[53], which would require two to three 3.3kT capacity trains making return trips to Port Kembla Coal Terminal (PKCT) each day[54,55]. While Hume Coal claim that spare rail and port capacity exists, it will present a significant scheduling challenge.

In addition to the challenges faced by Hume Coal, the additional rail traffic will pose a risk of delaying other commuter and freight movements, cause increased noise and disturbance to residents living near the rail line, and cause further road delays at every private and public level crossing on the 80km route to PKCT. These impacts will once again not be quantitatively valued in this report, but noted along with other unquantified costs to be weighed against the net benefit of the project.

Biodiversity impact

A significant portion of the proposed Hume Coal project area will mine beneath native forests and other ecosystems, including the Belanglo State Forrest on the western side of the lease.

The primary impact the project will have on biodiversity is through the effective draining of the groundwater system, and any impact that causes on surface water. In a number of sites throughout the project area, the groundwater depth is less than 10m, which is shallow enough to intersect with and potentially be relied upon by the overlying vegetation.

Hume Coal has already identified six native vegetation types which exist in areas where groundwater depths are less than 10m, and in one of these areas exists the endangered Paddy's River Box population. In addition to potential damage to

[52] Independent research by Alan Lindsay

[53] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p.15, (2014)

[54] Assuming train capacity is 3,300 tonnes

[55] Port Kembla Coal Terminal, "About", (n.d.)

endangered flora, there are a number of threatened fauna species which inhabit or utilise the vegetation as a resource where the groundwater depth is less than 10m. Species include the Glossy Black Cockatoo, Koala, Large-eared Pied Bat and Southern Myotis[56].

Hume Coal state that "…vegetation within and directly surrounding the project area is considered to be mainly dependent on rainfall", although it is uncertain where this assessment comes from. Given the evidence presented in the Groundwater section, it is almost certain that groundwater will be drained in these areas, which therefore poses a considerable risk to the overlying flora and fauna.

As with heritage impacts noted above, the Hume Coal Project could influence the financial viability of some properties and in turn the owners' ability to maintain ecological values. Several landholders contribute to the restoration and protection of native vegetation communities on their properties, particularly areas of Southern Highlands shale woodlands. These woodlands are listed as endangered ecological communities with the NSW Office of Environment and Heritage.[57] Landholders emphasise that if the financial viability of their properties were affected through groundwater impacts, their ability to continue with these conservation efforts would be reduced.

The risk placed on aquatic ecology from the release of waste water into local waterways, mentioned in the 'Surface water' section, should also be noted here. The cost of these biodiversity risks will be weighed qualitatively against the net benefits of the project.

Loss of surplus to other industries

There are many industries and businesses within and around the Hume Coal mining area which are already being negatively impacted by just the prospect of a mine operating in the area.

The cause of the losses to these industries come from several negative externalities the Hume Coal proposal will generate, the most prominent of which are:

1. Changes to groundwater and surface water conditions
2. Soil compacting, noise, and disturbance caused by drilling

[56] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p.68, (2014)

[57] http://www.environment.nsw.gov.au/determinations/SouthernHighlandsShaleWoodlandsSydneyEndComListing.htm

3. Damage to Southern Highlands' brand as a tourism destination
4. Damage to Southern Highlands' brand as a residential destination

These externalities manifest as losses to existing industries and businesses in different ways, as shown in **Table 9**.

Table 9 Impact of Hume Coal project on existing industries

Externality	Affected industries	Method of impact
1. Changes to ground and surface water	Agriculture, agri-tourism, wedding industry	- Gardens at wedding destinations cannot be maintained to the standard required to attract couples without considerable water - Reduction in output of traditional farms and agri-tourism businesses
2. Soil compacting, noise, and disturbance caused by drilling	Equestrian centres, stud farms	- Compacting of soil on show jumping and cross country courses by drilling trucks make it impossible to continue to provide world-class facilities - Disturbance caused to studs by drilling trucks would disrupt breeding
3. Damage to S.H. brand as a tourism destination	Hospitality and tourism, wedding industry, construction industry	- Reduced tourist numbers and wedding demand as perception of the region changes from 'quaint historic getaway' to 'polluted coal mining town' - Reduced investment in business expansion and associated construction as a result of lower volumes
4. Damage to S.H. brand as a residential destination	Construction industry	- Delayed and abandoned residential construction and renovation plans as a result of future uncertainty

Source: TAI interviews

Cost–benefit analysis can sometimes lead to double counting of benefits or costs. In this case, the cost of removing water from the local area has already been valued in the Groundwater section, so counting it again here as a loss to existing industry is not appropriate. It is however, useful to see how the impact of these externalities is felt by local industry, and that, considering the likely loss of surplus to these industries, the value estimated previously is probably conservative.

The other three externalities listed in **Table 9** have not been included elsewhere, so including them here is appropriate. At this stage, not enough is known about the effects of items 2 and 3 to make an accurate assessment of their impact, but anecdotal evidence can help us estimate the cost of item 4.

In interviews with various landowners, it became apparent that there could be up to 10 local properties which are delaying residential construction as a result of future uncertainty caused by Hume Coal. These construction projects would only go ahead in the absence of a mining operation, and therefore Hume Coal is causing a loss to the residential construction industry. This will be further discussed in the LEA, but has not been quantified in the CBA.

Aboriginal heritage

There are a number Aboriginal heritage sites in the project site identified in the PES, including grinding grooves, rock shelters and open artefact sites. It is unlikely these will be directly affected by the project, unless as subsidence problems arise[58].

Indirectly, the project may have more significant impacts. A number of landholders interviewed for this report say that their land also contains sites important to Aboriginal heritage. They say that they incur expense in assisting with the conservation of these sites. If the Hume Coal Project went ahead and impacted groundwater resources, the viability of their operations and these conservation efforts would be affected.

The cost of the impact the Hume Coal project will have on Aboriginal heritage has not been quantified, but is mentioned qualitatively as a potential impact of the project.

Net public infrastructure cost

As discussed above, the project would have some impact on road and rail transport.

Without more information on the proposed 'Berrima Rail Project', it is difficult to assess what infrastructure may be necessary and which party would pay for them. Upgrades to signalling equipment, level crossings, and pedestrian overpasses may be required. There is currently a proposal with council to build an overpass over a section of rail line that would benefit Hume Coal.

This report has not included any public infrastructure costs, but if new infrastructure is required it would add to the cost of the project.

[58] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p.78, (2014)

GLOBAL NET BENEFITS

Quantified benefits and costs

The main output of any CBA is net present value (NPV), the calculation of the present value of all benefits less the present value of all costs. The costs and benefits identified at a global level are summarised in the table below based on the Department's draft worksheet:

Table 10: Global CBA results summary

Net benefit – Global CBA

Net benefit of project

Benefit		**NPV total**
Net direct economic benefit	AU$ ('000)	1,709,936
Net indirect economic benefit	AU$ ('000)	–
Total net economic benefit	AU$ ('000)	1,709,936
Cost		
Net direct economic cost	AU$ ('000)	2,125,293
Net indirect economic cost	AU$ ('000)	140,524
Total net economic cost	AU$ ('000)	2,265,817
NPV of project	AU$ ('000)	-555,881.67
BCR (benefit cost ratio)		0.75

Table 8 shows that the costs of the Hume Coal Project far outweigh its benefits. The NPV of the project at a global level is negative $556 million. Table 9 below is also based on the draft Worksheet, showing some disaggregation of these costs and benefits. As discussed above, the project's direct financial costs outweigh its benefits. Indirect costs relating to environmental impacts further reduce NPV:

Table 11: Global CBA Breakdown of discounted benefits and costs

Direct Benefits		NPV total
1. Gross mining revenue	AU$ ('000)	1,709,936
2. Residual value of land	AU$ ('000)	–
3. Residual value of capital	AU$ ('000)	–
Total direct benefits	AU$ ('000)	**1,709,936**

Indirect Benefits		NPV total
1. Net economic benefit to existing landholders	AU$ ('000)	–
2. Net economic benefit to all workers		–
3. Net economic benefit to all suppliers		–
Total indirect benefits	AU$ ('000)	**–**

Direct costs		NPV total
1. OPEX & CAPEX	AU$ ('000)	2,122,916
2. Decommissioning costs	AU$ ('000)	–
3. Environmental mitigation costs	AU$ ('000)	–
4. Transport management costs	AU$ ('000)	–
5. Rehabilitation costs	AU$ ('000)	–
6. Opportunity cost of land	AU$ ('000)	2,377
7. Local contributions	AU$ ('000)	–
Total direct costs	AU$ ('000)	**2,125,293**

Indirect costs		NPV total
1. Air quality	AU$ ('000)	–
2. Greenhouse gas emissions	AU$ ('000)	9,971
3. Visual amenity	AU$ ('000)	–
4. Transport impact	AU$ ('000)	–
5. Net public infrastructure cost	AU$ ('000)	–
6. Groundwater impact	AU$ ('000)	130,553
7. Biodiversity impact	AU$ ('000)	–
8. Noise impact	AU$ ('000)	–
9. Loss of surplus to other industries	AU$ ('000)	–
Total indirect costs	AU$ ('000)	**140,524**

Readers interested in the development of the draft worksheet should note that all indirect economic benefit cells are blank, with a value of zero. There is considerable debate around whether these benefits exist at all, further discussed below. Where there is a case for their inclusion, it must be at a state level and the distributional effects closely described. At a global level, these benefits are merely a transfer between the proponent and these other stakeholders.

For example, where workers are paid a wage premium this represents an added cost to the producer equal to the benefit enjoyed by the worker. As a transfer they may be important for distributional effects, but at a global level they net out. The Draft worksheet should be amended to reflect this.

Transfers between parties in the cost benefit analysis are important to consider when adjusting the scope of the analysis from global to the NSW community. Transfers are also important to consider when calculating producer surplus.

Unquantified benefits and costs

The quantified benefits and costs above outlined above need to be considered alongside all the other costs the project causes, but which have not or could not be ascribed an economic value. Table 12 below provides a summary of the non-valued costs this report has identified.

Table 12 Impacts of the Hume Coal project not included quantitatively in the CBA

Cost	Implication and link to Hume Coal project
Degradation of heritage listed and historically important buildings and properties	• The project will cause negative impacts on the profitability of a number of existing business, many of which use their revenue to pay for the restoration and upkeep of the heritage or historical buildings they occupy.
Impacts on surface water flows	• The aquifer beneath the project area will be drained as a result of the mining activities, which may cause further reductions to creek and tributary surface flows where groundwater and surface water interact. • The project will receive enormous volumes of groundwater inflows to the mining void, well in excess of the water it could reasonably use on site. • Hume Coal will need to discharge a considerable portion of this water into local creeks and streams, and this may have serious impacts on the receiving environment and aquatic biodiversity.

Biodiversity impact	• A number of locations within the project area exist where groundwater is less than 10m below the surface, a depth which intersects with the overlying flora. • With the effective draining of the local aquifer by the project, this may have serious impacts on both the overlying vegetation, as well as the fauna which relies upon that vegetation. • Of particular concern is the endangered Paddy's River Box population, which grows within these shallow groundwater areas.
Loss of surplus to existing industries	• A variety of existing industries and local businesses could be negatively impacted by either physical or perceived effects of the Hume Coal project • Some losses to existing industries are already captured through other costed externalities, such as groundwater, but many other businesses or industries will experience sizable losses as a result of externalities not included elsewhere. • These industries include equestrian centres, stud farms, the hospitality and tourism industry, the wedding industry, and the construction industry.
Rail transport impacts	• Hume Coal will require 2–3 return train trips per day to transport its product to port at peak production. • This may cause delays to other rail commuters, cause delays for road users at level crossings, and create noise and air quality issues for residents living close to the railway.
Impacts to Aboriginal historical sites	• Possible effects from future subsidence. • Possible indirect effect of existing landholders directing fewer resources to conservation.

These impacts may be significant and our reluctance to quantify them should not be considered to reduce their importance for decision making.

PRODUCER SURPLUS

To estimate producer surplus from the global CBA results, several transfers need to be considered between the proponent and other stakeholders.

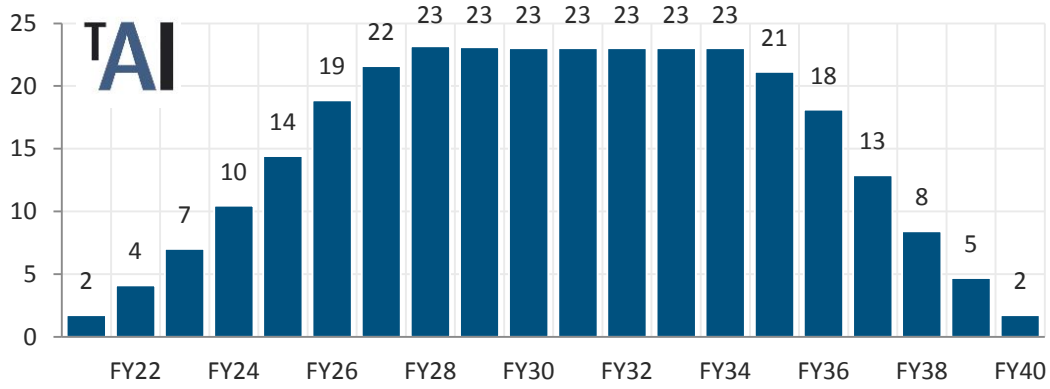
Royalties

Royalties are the price charge by the state for the transfer of the right to extract and deplete a mineral resource[59]. In NSW, royalties are charged as a percentage of the value of production (*ad valorem*) at a rate of 6.2%, 7.2% and 8.2% for deep underground, underground, and open cut mining respectively. The Hume Coal project will mine coal using underground methods from depths ranging between 70m and 180m[60], which qualifies it as underground mining (as opposed to deep underground mining) under the NSW legislation.

The royalty of 7.2% is payable on the total value of net disposals, which is the net volume of coal sold (sales less purchases) multiplied by the average sales price, less any allowable deductions[61]. The main deduction considered in our analysis is for beneficiation – costs associated with the processing of the coal.

We calculate royalty payments at the same Commonwealth Treasury long-term price discussed above, reduced by a cost of $4.60 per tonne for beneficiation. No coal levy deductions have been assumed. The resulting royalty payments from Hume Coal to the NSW government and show in in **Exhibit 11** in real 2016 dollars.

Exhibit 11 Royalties paid by Hume Coal to the NSW government
A$ Millions (2016 dollars)



Source: TAI analysis

This represents of $118m in present value terms, calculated at a 7 percent discount rate. Undiscounted the total value is $307 million.

It is important to note that royalty payments will only eventuate if the project goes ahead. The current proposal is unlikely to go ahead in current and forecast economic conditions as its direct economic costs far outweigh direct economic benefits. While

[59] NSW Department of Resources & Energy, "Paying mining royalties", (2016)
[60] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p. 13, (2014)
[61] NSW Department of Resources & Energy, "Monthly-Ad-Valorem-Coal-31122008-.xls", (2009)

this may seem obvious, unviable mines have been approved in NSW with the benefits of royalties cited as part of their benefit to the community. Obvious examples are the Cobbora Coal Project and the Angus Place Extension project.

We include these calculations here for completeness, but they are really a hypothetical exercise – if the proponent is prepared to operate a loss-making project for decades, how much royalty would they pay? It is more likely that if approved the project would not produce, at least not at the scale and timeframe of the current proposal. If the project is to produce saleable coal this would likely occur far into the future, reducing present value royalties below our calculated levels.

Readers interested in the development of the draft worksheets should note that the worksheet does not include consideration of benefaction expense, or other potential deductions from royalty calculations. A line has been added to the Benefits tab by TAI to enable the calculations above.

Company tax

In Australia large companies currently pay 30 percent company tax on taxable income. If the Hume Coal Project produced taxable income and was liable to pay company tax, this would be deducted from net revenues after royalties to estimate the surplus the project would deliver to proponents. This payment would accrue to the Australian federal government and some portion would accrue to the NSW community and be relevant for a NSW level CBA.

However, under the assumptions above the project will not have a positive cash flow until 2024 and would have accumulated losses sufficient to never have to pay company tax.

Readers interested in the development of the draft worksheet should note that the calculations in the CBA tab of Earnings before interest and tax and is flawed for several reasons. Economists can work out operating surplus estimates, but taxable income requires different data and skills. Taxable income is usually much lower, as companies are able to deduct items like depreciation and interest payments as well as losses incurred in other parts of their business.

Furthermore, tax minimisation schemes involving related party transactions are common in the Australian mining industry, particularly with vertically integrated companies such as POSCO, Hume Coal's owner. Companies set up trading hubs in low-tax countries such as Singapore. Sales are made to the Singapore entity at a low price, then the Singapore entity sells to end buyers at a higher price. This ensures minimal profit is made in Australia, so less tax is paid here. The profit is transferred to

Singapore, where it is taxed at a lower rate. The recent Senate inquiry into multinational tax avoidance included evidence of similar practices from mining companies operating in NSW such as BHP and Rio Tinto[62].

Applying the company tax rate of 30% to operating surplus less royalties is not correct from an economic or accounting perspective and will overstate the value of company tax paid and accruing to NSW. Even if estimates of company tax paid were accurate, this information may be commercially sensitive and companies may object to its disclosure.

The correct approach would be to apply a rate of tax to operating surplus. The amount of company tax paid by the mining industry is available through Australian Tax Office statistics. Estimates of the gross operating surplus of the mining industry are published by the ABS. The rate of company tax paid to operating surplus can be calculated this way and applied to the operating surplus of the project being assessed. The rate of company tax paid on gross operating surplus in the mining industry in 2008–09 was 13.9 per cent[63]. Applying this rate, or an updated estimate, would result in a more accurate estimate of tax payments accruing to NSW and also protect companies' commercially-sensitive information.

Local contributions

Money donated from the proponent to the local community is another transfer, rather than a net cost or benefit at a global level. Our modelling includes a present value expense of $11.2 million for Local Contributions, in line with the PEA claim that:

> The company is actively supporting local businesses, education facilities and other community initiatives. It currently makes substantial local investment each year, including $450,000 through its Charitable Foundation to a range of initiatives including education, indigenous programs and not-for-profit preschool providers, as well as its local apprenticeship/traineeship program.[64]

We assume Hume Coal donates $450,000 each year to the NSW community throughout the life of the project. This donation is relevant to global producer surplus as it is an expense incurred by the proponent. Within CBA however, it is a transfer from the proponent to the NSW community, which nets out at a global level with no net benefit. It is relevant again for CBA for the NSW community.

[62] http://www.abc.net.au/news/2015-05-25/tax-man-targets-the-singapore-sling/6495592

[63] Richardson D. and Denniss R. (2011) *Mining the truth: the rhetoric and reality of the mining boom*, Institute paper number 7, The Australia Institute, Canberra

[64] Preliminary Environmental Assessment, page 84

Readers interested in the development of the draft CBA Worksheet should note that Contributions made to local community (See Costs tab, rows 74 to 78) are incorrectly treated within the worksheet. While they are correctly treated as a cost to the proponent, they are not then counted as a benefit to the NSW community. This leads the global CBA summary to overstate the costs of the project at a global level and to understate direct economic benefits to NSW.

Producer surplus estimate

Based on the production, coal price, operating and capital costs outlined above, the Hume Coal project represents a negative present value of A$539 million. The Table below is taken from the draft CBA Worksheet:

Table 13: Global producer surplus

Net producer surplus and company income tax

Net producer surplus

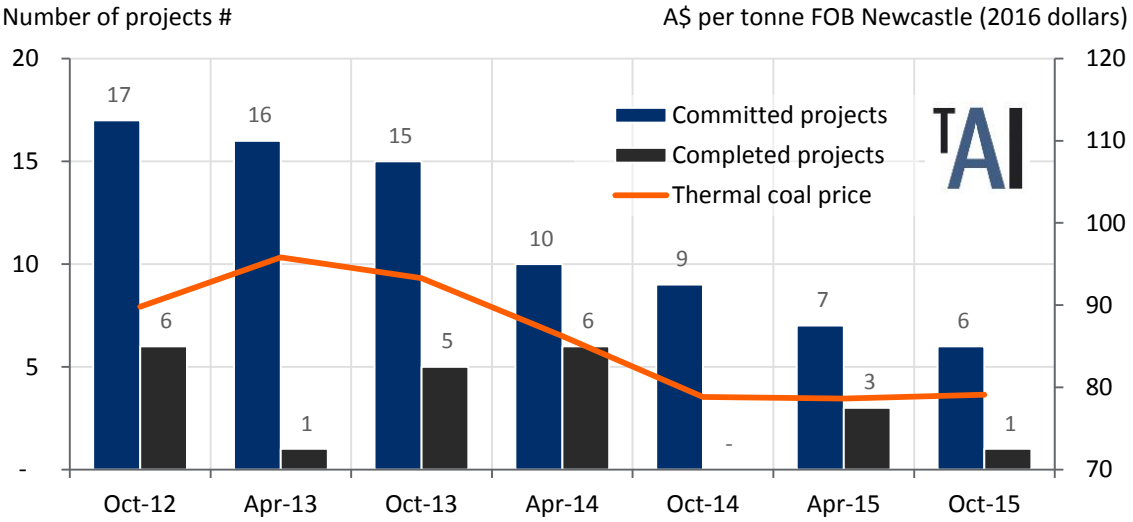
		NPV total
Earnings before interest and tax – Global	AU$ ('000)	- 538,562
Income tax expense (Australia)	AU$ ('000)	–
Net profit after tax (net producer surplus) - Global	AU$ ('000)	- 538,562
Australian share of project ownership	% of total	0%
Net profit after tax (net producer surplus) – Australia	AU$ ('000)	–
NSW population share of Australian total population	% of total	32%
Total Net producer surplus attributable to NSW	AU$ ('000)	–

Company income tax

		NPV total
Income tax expense (Australia)	AU$ ('000)	–
NSW population share of Australian total population	% of total	32%
Company income tax apportioned to NSW	AU$ ('000)	–

Hume Coal is far from alone in owning an uneconomic coal proposal. Many new coal mining projects are sub-economic, indicated by the declining number of committed projects shown in **Exhibit 12**.

Exhibit 12 Committed and completed coal mining projects in Australia



Source: Australian Government Department of Industry, Innovation and Science, "Resources and Energy Major Projects lists" (2012–2015)

Note: 'Completed' is since last period

While the number of committed projects is falling, the number of projects which are either 'Publically Announced' or at 'Feasibility' stage is relatively steady. In October 2012, committed coal projects represented 22% of total projects, but as of October 2015 they represented just 12%. Mining companies are keeping their options open to develop coal mines in the future if prices recover by progressing through the approval process, but are not in any hurry to actually develop the resource.

Implications of negative producer surplus

The analysis so far demonstrated that, under current economic conditions, there is little likelihood that the operation described in the Hume Coal PEA can create value for its shareholders. While from an economic perspective there is little logic in pursuing the project, there are several reasons why a mine owner would pursue regulatory approval of an extension project which is not profitable under current market conditions. Four reasons stand out:

- The proponent may be willing wait for an increase in coal prices to make the project profitable. Gaining approval does not force the proponent to undertake the project, so once the approval is secured the proponent can wait for better conditions without having to undertake costly investment.

- The approval provides an option to undertake the project. Having the option of immediate commencement makes the mine more valuable and means it could be sold to another company for a higher amount than would otherwise be the case. The option to develop may also be important from a corporate strategic perspective. A vertically integrated steel maker may see advantage in security of supply from a number of different sources, even if the current proposal is uneconomic.

- Not pursuing approval and abandoning the project means all prior expenditure must be written off as a loss. This would have accounting implications as what is currently considered an asset would lose all value.

- There is a perception that once project approval has been given, modifications to project conditions are easier to pursue. Hume may attempt to change the more expensive aspects of the project's planned operations, such as "pine-feather" mining and covered coal wagons, to cheaper methods such as longwall or more traditional bord and pillar mining and uncovered coal wagons.

Importantly, while there may be corporate strategic regions for Hume to pursue this project, none of these bring benefits to NSW. In fact, Hume Coal pays only a fraction of the option's real cost, with the remainder of the burden falling on the residents and existing business owners of the Southern Highlands.

The cost of having the 'black cloud' of a proposed and unknown coal mine hanging over residents and business owners in the Southern Highlands will be discussed in detail in the LEA, but in short, they constitute delayed business investment, delayed residential construction, depressed land values and reduced heritage restoration, as well as significant mental health effects on some landholders opposed to the proposal.

CBA of Hume Coal Project to NSW

Under the 2015 NSW *Guidelines for the economic assessment of mining and coal seam gas proposals*, the main scope of CBA is the NSW community. The global scope discussed in the previous sections raises significant issues for decision makers, but the key focus is the costs and benefits to residents of NSW. Through the elected government and its relevant departments, NSW residents are the ultimate decision makers of how the state's resources should be consumed or protected. Assessment of their economic welfare is therefore most important for decision making.

The implications of the global CBA in the last section are clear – the Hume Coal Project is highly unlikely to go ahead as currently proposed under current and forecast economic conditions. The company appears to be pursuing approval for corporate strategic reasons rather than intending to commence a project that will affect the economic welfare of NSW in the near future.

As a result, calculating the NPV of the project to NSW is a hypothetical exercise. These costs and benefits will only occur if the proponent is prepared to incur sustained financial losses over decades to implement the project. Because this is unlikely, the following estimates of potential costs and benefits to NSW should be considered highly uncertain.

A more likely scenario is that if the project is approved it would remain undeveloped. This would continue to have impacts on the local community and economy. This is further discussed in the LEA.

POTENTIAL BENEFITS TO NSW

Royalties

The NSW *Guidelines for the economic assessment of mining and coal seam gas proposals* lists "Task 1" of CBA for NSW as "estimate royalties payable". As discussed in the Global CBA section above, the project is unlikely to go ahead in its proposed form under current economic conditions. Hypothetically if the proposal did go ahead, we estimate royalties payable at $118 million in present value terms. More detail on this calculation is in the Producer Surplus section above.

Company tax to NSW

Task 2 in the Guidelines CBA is to estimate the company tax payments that would accrue to NSW. As discussed above, this is usually difficult for economists who lack the skills and information to make a realistic estimate of company tax payments. The draft CBA Workbook is not suitable for this calculations.

In the case of the Hume Coal Project, however, these difficulties are easily overcome. Because the project is highly unlikely to produce any taxable income as currently proposed, this figure can be estimated at zero.

Producer surplus to NSW

The Guidelines list tasks 3–5 of NSW CBA as relating to quantifying producer surplus. For future editions of the Guidelines this should be amended. As discussed in the global CBA section above, it is important to first estimate producer surplus to understand the likelihood and size of any tax, royalties and transfer payments.

Ordinarily for a proposed development the value of the project would at least be positive to the shareholders (even if it was not a positive to the state), however in this case, the producer surplus (loss) represents a cost to the CBA.

Since this project is 100% foreign owned, however, the cost is fully borne by the citizens of South Korea (and foreign shareholders in POSCO), and not the citizens of NSW. The producer surplus (loss) included in this part of the CBA is therefore zero.

Economic benefit to existing landholders

According to the Guidelines:

> A mining or coal seam gas proponent may need to purchase land or pay an access fee to an existing landholder(s) to undertake the project's activities. Often these payments to existing landholders exceed the opportunity cost of land. The surplus is an economic benefit to existing landholders.[65]

Affected residents have blockaded a privately owned road and taken legal action to prevent Hume Coal from accessing their land. Clearly, there is no economic surplus to the landholders under the existing arrangements with Hume Coal. On the contrary,

[65] NSW Government Department of Planning and Environment, "Guidelines for the economic assessment of mining and coal seam gas proposals", p.12–13, (2015).

access arrangements have cost landholders large amounts of time, money and energy[66]. This is further discussed in the LEA.

Several local people including a real estate agent interviewed for this report said that Hume Coal had acquired property for the project at well above market prices. This does represent a benefit for the landholders who secured this deal. However, this is now a sunk cost and no further benefit seems likely. On the contrary, as discussed in the LEA, the project is contributing to lower prices and difficulties selling properties in the area.

Economic benefit to workers

The Hume Coal project is expected to employ a peak workforce 400 full-time-equivalent (FTE) workers during construction, followed by an operational contingent of approximately 300 FTEs for the remainder of the mine life[67].

The standard approach in most cost benefit analysis is to assume that markets for labour, supplies, etc, are operating efficiently and to assume that project proponents would not pay above the market value for labour, supplies or land. This general assumption is supported by consultants to the coal industry:

> BCA involves the comparison of the 'with and without' project circumstances. The use of resources with and without the mine must therefore be considered. Without the mine, the resources to be allocated to the mining operation would be engaged in other uses in the economy. These are the opportunity costs of the proposed mine. Given that markets for these resources (land, machinery, labour etc.) in the Australian economy are relatively competitive and not highly distorted by subsidies and regulations, market prices reflect these resources opportunity costs.[68]

This assumption of prices being equal to opportunity cost is also recommended in other NSW Guidelines to Economic Assessment:

> The use of resources (manpower, finance or land) in one particular area will preclude their use in any other. Hence the basis for valuing the resources used is the "opportunity cost" of committing resources; ie the value those resources would have in the most attractive alternative use …

[66] http://www.abc.net.au/news/2016-05-10/southern-highlands-families-win-appeal-against-hume-coal/7402054

[67] EMGA Mitchell Mclennan, "Hume Coal Project - Preliminary Environmental Assessment", p. 2, (2014)

[68] Bennett, J. (2011) Maules Creek Coal Project Economic Impact Assessment: A review.

> In certain cases, where a resource has a market price, that price may not reflect the marginal social cost of using the resource. Such cases are reasonably rare.[69]

The standard assumption for CBA is that labour is priced at its opportunity cost. In other words, we assume that workers could get another job at similar wages in the absence of this project.

The 2015 *Guidelines for the economic assessment of mining and coal seam gas proposals* take this standard approach as a 'starting assumption':

> An appropriate starting assumption should be that workers do not receive a wage premium, even if they will earn more working in the mining sector.[70]

Even though a mine may offer a wage premium to attract workers from other industries, this is often to compensate for greater risk, or worse working conditions, and therefore it doesn't represent a net benefit to workers.

It is debateable how many workers will be new to the mining industry, or receive any premium. During construction Hume Coal has relaxed the geographical restriction and will draw workers from a wider catchment area, suggesting that many will come from other mining projects. The DPE Guidelines correctly state that higher wages in this case are generally compensation for relocating to the Southern Highlands. Recently, the company has also advertised in Goulburn, over 45 minutes away. Realistically, the company is likely to have access to existing mining industry workers who live in the Illawarra and in South West Sydney. The base case assumption in this assessment will therefore be that no incremental benefits accrue to workers as a result of the Hume Coal project.

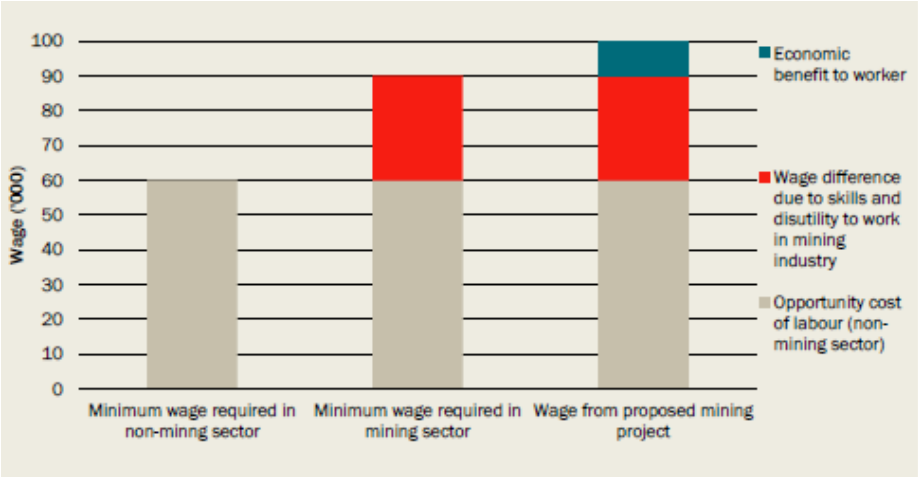
If the project does proceed, it is unlikely that no workers experience any wage premium. Some workers are likely to experience an increase in wages, beyond what is strictly required to compensate them for working in a mine. Unemployment in the Southern Highlands and Shoalhaven region is high at 8.2% of the workforce[71], so some benefit would be likely to occur. The economic benefit to these workers is explained in the chart below, taken from the 2015 Guidelines:

[69] NSW Treasury (2007) *NSW Government Guidelines for Economic Appraisal*

[70] NSW Government Department of Planning and Environment, "Guidelines for the economic assessment of mining and coal seam gas proposals", p.13, (2015)

[71] The Australian Government Department of Employment, "New South Wales – Unemployment Rate by Labour Force Region", (2016)

Exhibit 13 Identifying the economic benefit to workers



Source: NSW Government Department of Planning and Environment, "Guidelines for the economic assessment of mining and coal seam gas proposals", p.14, (2015)

However, against this benefit – shown in blue in Exhibit 12 above, would need to be considered the cost to workers in other Southern Highlands industries. As discussed in the LEA, there are substantial numbers of businesses that are currently delaying investments and employment due to uncertainty around the Hume Coal project.

Treatment of employment benefits in other CBAs

The treatment of worker or employment benefits in recent coal mine CBAs has been inconsistent. To provide some context, and to justify the analysis presented here, a brief commentary of some of these CBAs is given here.

Beginning with the Mount Owen Continuation and the Bulga Optimisation Project, they have both been consistent with the DPE's current advice by including no employment benefits. They assumed that the labour market was already priced at its opportunity cost, and that their projects would not hire otherwise unemployed workers, or pay above market rates once factoring in risk and relocation costs.

For the Boggabri, Maules Creek, and Watermark coal projects, the economic value of employment was not included, but rather the value society places on avoiding unemployment. This pushes the boundaries of what can be considered a hard economic benefit, and in the words of Dr Jerome Fahrer, "while it is likely that there is some social value added to mining employment, per se, given alternative opportunities and given the history of mining in the region … it is best excluded in the quantitative calculation of the CBA"[72]

[72] Fahrer, J. "Ashton South East Open Cut Project Economic Assessment - Expert Report of Dr Jerome Fahrer", (ACIL Allen Consulting, 2013)

The merit of that technique aside, there is another internal inconsistency associated with this approach. The authors acknowledge "that labour resources used in a project would otherwise be employed elsewhere"[73], but then go onto argue that social value is created for the project through reducing unemployment. The project either does or does not reduce unemployment, it can't do both.

The Warkworth Mine Extension economic assessment also contains an oversight, in that it assumes that if people weren't working in the mining industry, they would be either unemployed or working for the average wage received in their locality. While it might true that their project pays above market wages for the skill set required, it is highly unlikely that these highly skilled workers would go back to earning the average wage if made redundant by the mining industry.

Finally, and most flawed of all, is the Airly mine extension, which attributes the full value of employment to the project case, effectively assuming that every employee was sitting around unemployed beforehand.

Table 14 Comparison of recent Cost–Benefit Analyses

Proposal	Year	Prepared by	Supplier benefit included?	Worker benefit included?	Benefit calculation method
Mount Owen continuation	2014	Deloitte Access Economics	No	No	GMR less costs
Bulga optimisation project	2012	Economics Consulting Services	No	No	GMR less costs
Boggabri coal mine	2010	Gillespie Economics	No	Yes (social value)	GMR less costs
Maules creek project	2011	Gillespie Economics	No	Yes (social value)	GMR less costs
Watermark coal project	2012	Gillespie Economics	No	Yes (social value)	GMR less costs
Warkworth mine extension	2014	BAE Economics	No	Yes (proportion)	Itemised
Airly mine extension	2014	Aigis Group	No	Yes (full value)	Itemised
Ashton SEOC project	2013	ACIL Allen	No	No	

Source: Environmental Impact Statements from respective proposals

[73] Gillespie Economics, "Continuation of Boggabri Coal Mine Economic Assessment", (2010)

Net benefit to NSW suppliers

Consistent with the other mining CBAs presented in Table 14, no supplier benefits have been included in this CBA. As discussed in the LEA, few local businesses expected to benefit from the project. The main business that could benefit from the project is Joy Mining, an international manufacturer of mining equipment with facilities in Moss Vale. Joy were contacted repeatedly for comment. Significantly, Joy is part of a global business. Any actual surplus due to Hume Coal buying equipment there is likely to be moved offshore.

POTENTIAL COSTS TO NSW

Most of the potential environmental costs discussed in the Global CBA above are relevant to CBA for NSW, relating to groundwater impacts. Groundwater is the largest, and most uncertain, with a central cost estimate of $131 million in present value terms. Other relevant costs to NSW from the global CBA section are:

- Surface water impacts
- Opportunity cost of land
- Air quality and noise impacts
- Heritage impacts
- Transport impacts
- Biodiversity impacts
- Loss of surplus to other industries
- Aboriginal heritage impact
- Potential cost of infrastructure investment

While greenhouse gas emissions should be of concern to decision makers, including the implications of expanding supply of thermal coal, from a strictly NSW CBA perspective, much of these costs are borne by the rest of the world and are generally not considered as a major cost in state-level CBA. Readers interested in the development of the draft CBA Workbook should note that the workbook currently considers all costs of greenhouse gas emissions as being incurred by the NSW community.

POTENTIAL NET BENEFITS TO NSW

As discussed above, the Hume Coal Project is unlikely to go ahead as currently proposed as it represents a large economic loss at a global level and to the proponent's South Korean owners. Hypothetically if the project was to proceed in the

current form, the quantified net present value to the NSW community would be negative $12.5 million, as summarised in the draft CBA Workbook table below:

Table 15: Quantified net benefits to NSW

Net benefit of project – Approach 2

Benefit		
Direct benefit: royalties payable	AU$ ('000)	118,044
Direct benefit: company income tax apportioned to NSW	AU$ ('000)	–
Net indirect economic benefit	AU$ ('000)	–
Total net economic benefit	AU$ ('000)	118,044
Cost		
Net indirect economic cost	AU$ ('000)	130,553
Total net economic cost	AU$ ('000)	130,553
NPV of project	AU$ ('000)	-12,509.28
BCR (benefit cost ratio)		0.90

The key costs in Table 13 are the impact on groundwater. Our central estimate of this value is greater than the royalties payable at the Commonwealth Treasury's forecast coal price. Depending on the level and value of groundwater impacts, the project is likely to represent a net loss in economic welfare to the NSW community, even if approved and pursued by the proponent. Furthermore, consideration needs to be given to the many unquantified impacts listed above.

SENSITIVITY ANALYSIS

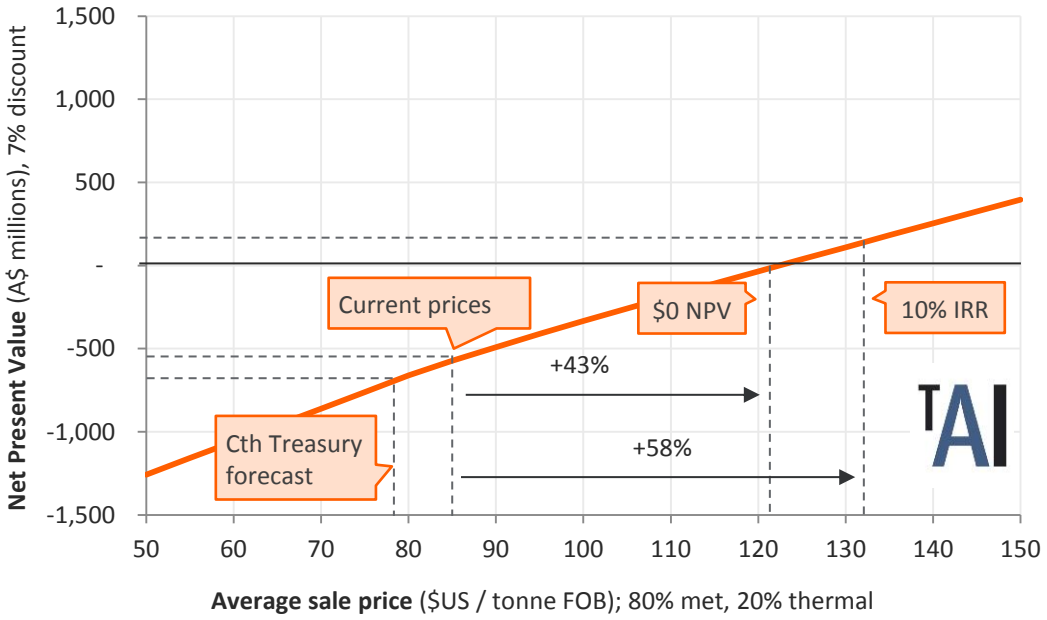
The project as currently proposed has a large negative NPV, based on our central assumptions. In this section we change some of these key assumptions to:

provides decision makers with the potential range in the level of net benefits that could arise from the project.[74]

Coal price

For the project to generate positive NPV, in other words for the project to 'break even' economically, higher coal prices are needed. Based on current metallurgical and thermal coal prices, Hume's average received price is US$85.4 per tonne, or at current exchange rates, A$110/t. Under our cost assumptions average price received by Hume needs to be 43% higher than current prices to break even in NPV terms, US$122/t (A$159/t). To achieve a more commercial 10% rate of return, prices would have to be 58% higher at US$135 per tonne (Exhibit 13).

Exhibit 14 Net Present Value versus average sale price
A$ Millions, $US / tonne FOB



Source: TAI analysis; Commonwealth Treasury

The likelihood of such an increase in coal prices is low. Even if coal prices rose to levels where the Hume Coal Project was viable in the coming years, this price rise would need to be sustained for the life of the project. This is unlikely in the context of historical coal prices.

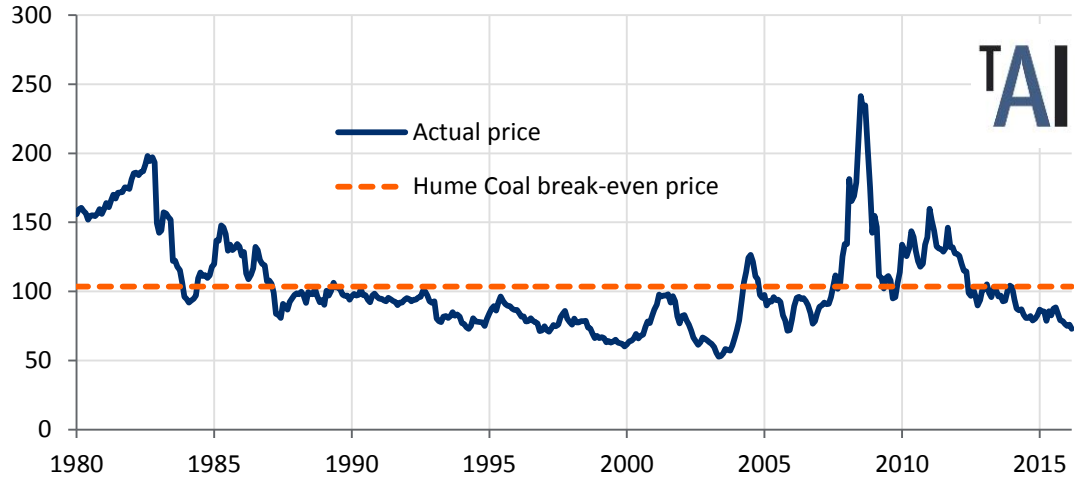
To put this in historical context, Hume's average received price for 80% metallurgical and 20% thermal coal needs to be A$158/t to break even. Given the average premium

[74] NSW Government Department of Planning and Environment, "Guidelines for the economic assessment of mining and coal seam gas proposals", p.18, (2015)

paid for metallurgical coal, this translates to a thermal coal price of A$103/t and a metallurgical coal price of A$172/t.

Longer historical data is available for thermal coal. Exhibit 14 compares Hume's required break even thermal coal price, A$103/t, with historical coal prices. It shows that such prices are historically infrequent:

Exhibit 15 Australia thermal coal price FOB, 1980–2016
A$ per tonne FOB Newcastle (real 2016 dollars)



Source: https://www.quandl.com/collections/markets/coal;

Exhibit 14 shows that shows that coal prices have only traded at more than a 43% premium to their current level (in real terms) for the equivalent of 12 out of the last 36 years, or 33% of the time. Aside from the 2008 and 2011 coal price peaks, sufficiently high coal prices for the Hume Project to break even have rarely occurred since the mid 1980s. The project would not have broken even in any from 1989 to 2004. The probability of sufficiently high prices being maintained for the twenty years of the project's proposed life is extremely low.

Operating costs

Operating costs are a major driver of coal mine NPV and Hume is no exception. As discussed above, our estimates are based on comparison with other coal mines of similar size and location. Hume's proposal is unusual, using relatively uncommon techniques and low rates of extraction to reduce environmental impacts. While we believe our cost assumptions are optimistic, for the reasons discussed above, Hume may be able to reduce costs to improve project viability.

At Commonwealth Treasury's forecast coal prices, used in our central estimates, Hume would need to reduce operating costs by 38 percent in each year over the life of the

project for it to return a positive NPV. While there could be potential to substantially reduce the mine's operating costs, these changes, such as to longwall mining or other techniques, would be almost certain to increase the impacts of the project on groundwater resources.

Groundwater and royalties

From the perspective of the NSW community, the NPV of the project depends on the impacts on groundwater, unquantified environmental impacts and the payment of royalties. As mentioned above, there is huge uncertainty around the potential value of groundwater impacts and what flow on effects might be experienced elsewhere in the local environment and economy with even Hume Coal's forecast depletion of groundwater. Reproducing the table above:

Table 16 Ground water cost estimates at various inflow and water values, present value

	$2000/ML	$4000/ML	$6000/ML
Hume coal (3.2ML)	11	21	32
SHCAG mid (9.7ML)	65	131	196
SHCAG high (16.0ML)	108	216	235

Source: TAI interviews, PEA, Pell Consulting and TAI calculations

In our hypothetical estimate above, where the proponents operate the project despite large financial losses, we estimated royalties payable at $118 million in present value terms. While this would seem sufficient to offset quantified groundwater impacts at Hume Coal's estimates of inflow, this decision comes with risks around both groundwater impacts and timing.

Timing is important as the project is likely to be financially marginal at best. Any delay or period in care and maintenance reduces the present value of royalties. In the table below we present the likely value of royalties at different coal prices and with periods in care and maintenance after three years of production.

Table 17 Royalty payments, and years of delay, present value at 7%

	Price – Treasury forecast	Price –break even (+43%)	Price – IRR=10% (+ 58%)
Years in C&M – zero	$118	$154	$187
Years in C&M – two	$104	$135	$166
Years in C&M – five	$87	$113	$138
Years in C&M – ten	$64	$83	$102

Table 17 shows that if the project goes ahead, but experiences delays, the present value of royalties rapidly decreases. Even if coal prices rise by 58 percent, to a level that would provide a reasonable rate of economic return, any delay makes it difficult for royalty payments to offset our central estimate of cost of groundwater impacts. Even then the project is unlikely to bring economic benefit at a state level, as several of the unquantified externalities are likely to be significant.

Discount rates

The results of the analysis are not particularly sensitive to changes of the discount rate. The global CBA figures are shown at different discount rates in Table X below:

Discount rate	NPV (A$m)
4%	-635
7%	-556
10%	-497

As the project produces an economic net loss in every year under our central assumptions, the loss is minimised with a higher discount rate, and is higher under a lower discount rate.

Conclusion

The Hume Coal Project is likely to represent a loss of economic welfare at both a global and NSW level. From an economic perspective, the project should be rejected as it represents a loss in economic welfare relative to the base case scenario of no mining.

As proposed it is almost certainly unviable for the proponents. If approved it is likely to be deferred indefinitely, in the hope of higher coal prices, or kept as a potential alternative supply for corporate strategic reasons. It is unlikely to be built without modifications that would likely increase costs to the community.

Even as a proposal, the project imposes costs on the local economy due to the uncertainty created. These impacts are further explored in the local effects analysis that accompanies this cost benefit analysis.

If the project is approved and proceeds, it will cause economic loss. If the project is approved but does not proceed, the indefinite uncertainty will harm the region and community.

The strong conclusion of the cost benefit analysis is that the project should be rejected by planning authorities.

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