



Transport
for NSW

Kandos to Gulgong Line Reinstatement Feasibility Study

Executive Summary

Executive Summary

The Kandos to Gulgong Line Reinstatement Feasibility Study has found that the project is marginal at a discount rate of 7%.

The proposed railway is around 93 kilometres long and generally passes through open farmland and the townships of Mudgee, Kandos, Rylstone and Lue. The engineering and demand assessments have determined that a 25-tonne axle load (TAL) construction is suitable to service the demand requirements of the Mount Piper Power Station.

The economic assessment of the various 25TAL scenarios returns a Benefit Cost Ratio (BCR) of between 1.20 (Scenario 3b) and 0.65 (Scenario 2a), discounted at 7% real, that varies depending on the scenario adopted. On the most optimistic scenario of demand and travel time savings, up to \$1.20 is estimated to be returned for every dollar invested.

Project benefits are derived primarily from either the travel time savings for freight demands movements, particularly for Scenario 2a and 3a, or alternatively the value of additional freight demand that can be attracted to the corridor, as realised under Scenario 2b and 3b. Based on the market and demand analysis Scenario 3b will generate benefits of \$422m over the life of the project, compared against a cost to achieve this benefit of \$350m (Scenario 3b) - both in present value terms, discounted at 7% real, leading to the 1.20 BCR. These costs vary by demand scenario and include the upfront and ongoing costs of providing the necessary rail infrastructure and the services and facilities required to deliver and manage this freight along the corridor. The cost benefit analysis does not take into consideration the actual or potential value of the commercial arrangements between Mount Piper Power Station and the coal mines.

The study has identified limited areas of significant ecological value that would be affected by the reinstatement of the railway, but it is likely that the project would still need to undertake a Review of Environmental Factors (REF) assessment to secure planning and environment approvals. The engineering requirements are manageable, though sections of the line have deteriorated significantly since the line was operational. The required asset interventions range from spot component renewals to full track reconstruction, depending on the recommended maximum TAL for the line. The recommendation of this report is that the provision of infrastructure suitable for 25TAL would provide the optimal cost and would be able to effectively accommodate the projected demands.

The engagement with stakeholders has indicated limited support for the proposal to complete the construction of the Kandos to Gulgong rail, other than for power who have a vested interest in the project. However, the Mid-Western Regional Council has indicated that they expect considerable public opposition to the reinstatement of railway operations on the line. They are particularly concerned about the impact of coal trains passing through Mudgee and other towns along the line. Consideration could be given to alternate route options to reduce the impacts through townships, though the costs will increase. These issues would need to be considered as part of a subsequent business case and the REF assessment.

The **Kandos to Gulgong line** is a non-operational railway line around 93-kilometres long that connects the northern extension of the Lithgow to Kandos line with the main east-west line from Newcastle to Gulgong and Dubbo (known as the Sandy Hollow to Gulgong line).

Rail services on the section from Kandos to Gulgong were suspended in 2007 due to lack of demand. Recently, a utility company has expressed interest in operating coal services on the line to source coal from other nearby mines from the western coalfields¹ region in the Hunter Valley to provide coal to the Mount Piper Power Station near Lithgow in central NSW. This would require reopening the line between Kandos and Gulgong, which is a part of the NSW Country Regional Network.

The line from Kandos to Gulgong is currently in non-trafficable condition as its age and non-operational status has led to degradation of the assets, including rail quality, sleeper degradation, timber bridge deterioration and discontinuation of rail line at several locations including sites where the rail corridor crosses existing roads.

¹ This study refers to the three mines at Ulan, Wilpinjong and Moolarben as the 'western coalfields'

As the main advocate and beneficiary of the rail corridor, the utility has been consulted on several occasions through the study process, to seek information and advice that provides the consulting team with a better understanding of the operations at the MPPS. The utility has also been engaged to determine the likely demand for coal along the corridor that would support the restoration of the railway suitable for coal transport.

The mines of Ulan, Moolarben and Wilpinjong are in close proximity within the western coalfields region of NSW. Each mine is considered a potential supplier of coal to the Mt Piper Power Station and each mine is currently equipped with rail infrastructure to enable rail transport for coal, though none currently has provision for west-facing coal train access. This study has not considered the commercial arrangements between MPPS and the mines of Ulan, Moolarben and Wilpinjong.

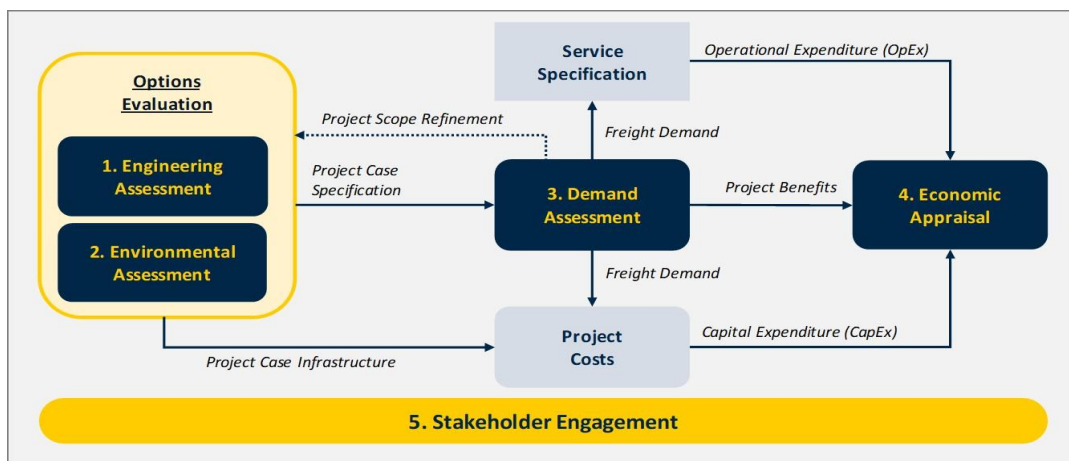
There are a number of townships along the route including Mudgee, Kandos and Rylstone. While trains previously passed through these towns the passage of time and the lack of rail activity has meant that the residents no longer expect to have train operations through the town. Concerns have been expressed by the Mid-Western Regional Council, based in Mudgee, that the reintroduction of trains would have a disruptive impact on these towns. Council has suggested that there would be a strong community response to trains in the towns, particularly from the residents of Mudgee, where recent development has been proximate to the rail corridor.

The NSW Government has funded this study to assess the feasibility of completing the construction of the railway line from Kandos to Gulgong. John Holland Rail (JHR), appointed by Transport for NSW to manage and operate the State's regional rail network, has commissioned a consultant to undertake the Kandos to Gulgong Line Reinstatement Feasibility Study (the Study). The Study needs to assess the engineering requirements for new and upgraded infrastructure to implement a functional rail corridor, investigate land use and environmental planning issues along the route, assess potential demand for the line and undertake an economic assessment of the rail corridor.

The scope of this study includes an analysis of the engineering requirements for completing the construction of the rail line (including the permanent way, cuttings, embankments and associated structures), a demand assessment, economic and financial modelling, assessment of operating and maintenance costs and detailing of land use and environmental planning issues. The scope of this study does not consider the viability or economic benefits of the MPPS, the Ulan, Moolarben or Wilpinjong coal mines, and does not include those factors in the benefit cost analysis of the rail corridor.

The approach to this study includes several parallel and interdependent streams of work, providing an overarching project appraisal framework as shown below. The project appraisal framework includes:

1. **Engineering assessment and costing**
2. **Environmental and land use assessment**
3. **Market and demand assessment**
4. **Economic appraisal (Financial and Economic)**
5. **Stakeholder engagement**



Engineering assessment and costing

The engineering assessment and costing analysis was conducted through a combination of condition assessments, engineering investigations and route development to determine a recommended line configuration and capital cost estimate for the reinstatement of the Kandos to Gulgong line.

The report determines the estimated capital costs for different maximum tonne axle load (TAL) based on completion by the end of 2023. Costs range from \$245.9 million (19TAL) and \$372.1 million (30TAL).

The recommended maximum TAL level to be dependent on the findings of the Market and Demand Assessment and the Economic Appraisal. The analysis conducted in this study, suggest that **reinstatement of the line to 25TAL** is the most feasible solution to achieve the defined objectives of the project.

The key rail network configuration assessment suggests that the optimal outcome is to implement the following solutions to form the reinstated railway from Kandos to Gulgong:

- Two passing loops to be constructed at locations to be defined as Renkan Loop and Canadian Lead Loop
- New rail spur to be constructed to bypass Gulgong Junction and connect the Kandos to Gulgong line directly with the western coalfields
- Retain the current track alignment of the existing non-operational line
- Train Order Working to be re-established as the line signalling system, with six track blocks recommended for the line section
- If 25TAL is adopted for the Kandos to Gulgong section reinstatement it will also be necessary to upgrade the line from Wallerawang to Kandos to the same TAL limit.

The final capital cost estimate for the reinstatement of the Kandos to Gulgong line as well as Wallerawang to Kandos line to 19TAL and 25TAL, along with +50% estimate as follows. While the Final Cost Estimate has been developed based on current knowledge of the project and current cost structures, there are still many unknowns that will need to be further explored before the project can be considered for implementation. While a 20% contingency has been incorporated in the Final Cost estimate, it was deemed prudent to also include a +50% estimate (consistent with the study brief). The 20% contingency is removed prior to the application of the +50% allowance to avoid doubling up.

Line Section	TAL Limit	Final Cost Estimate (\$m)	Estimate (+50%) * (\$m)
Kandos to Gulgong	19TAL	\$245.9	\$313.1
	25TAL	\$298.3	\$380.1
Wallerawang to Kandos	19TAL	-	-
	25TAL	\$18.8	\$24.0

*Note: The final cost estimate is inclusive of a 20% contingency that is removed prior to calculation of plus 50% costs

Environmental and land use assessment

The environmental assessment involved a desktop assessment that examined key environmental constraints as part of the evaluation of the route. The environmental considerations fall under four categories, with the specific elements of each shown below.



The desktop environmental assessment concluded that there will be no significant environmental issues (other than the community concerns from the people of Mudgee about trains running through the town) associated with the operation of freight trains along this route as summarised below.

- **Protected areas:** The closest National Park to the rail line is to the north of the rail corridor and will not be impacted by this line.
- **Flora and Fauna:** Flora and Fauna Reserves and koala habitats will not be affected by this corridor.
- **Soil and contaminations:** According to available data, there are no hazardous sites in the vicinity of the railway.
- **Heritage:** The existing route avoids World, Commonwealth and Aboriginal Heritage sites.
- **Social and community:** The extent of noise and air emissions effects on the community will need to be further investigated if the Kandos to Gulgong rail proposal is to proceed further.

The assessment of the planning approval pathways indicates that an REF may be required, but the project is not expected to require an EIS, as none of the consideration factors for an EIS are relevant in this case. However, it would be prudent for TfNSW to undertake a formal assessment of the necessary planning pathways and determine the appropriate approval pathways required under current regulations.

Market and demand assessment

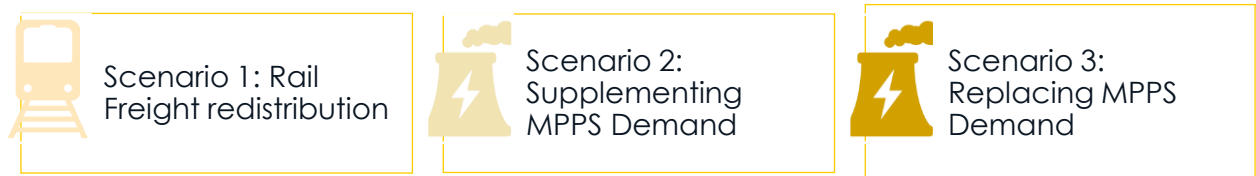
The purpose of the freight demand assessment is to quantify the potential freight movements that could use the new rail corridor. This analysis was based on a publicly available data source from TfNSW/TPA known as 'Strategic Freight Forecasts - NSW freight commodity demand volume forecasts for the 40-year period between 2016 to 2056'.

The main purpose of the analysis was to assess a scenario to provide a direct access to source coal to service the ongoing needs of the Mount Piper Power Station. The utility has suggested that the coal demand for Mount Piper Power Station is up to **4,000 kilotonnes per annum**. As the utility was unable to be definitive about the coal demand that they would need to source via the Kandos to Gulgong rail line, a range of coal demand levels were tested up to this value. The expectation is that coal demand would vary from year to year up to 4,000 kilotonnes per annum, with some years much lower if coal can be sourced locally from either the Springvale or Angus Place mines.

The utility has indicated that they would be keen to understand what level of demand would make the Kandos to Gulgong line feasible to reinstate. The utility suggested that their demand may be as low as 500 kilotonnes per annum up to full source of 4,000 kilotonnes per annum. Given this level of uncertainty it was deemed appropriate to test a range of demand levels.

The Kandos to Gulgong line has the potential to facilitate this direct link and is the primary driver for this study. In addition, the study has sought to identify other potential freight demand that could be captured from the broader freight network. A bespoke model was developed to consider potential markets and origin-destination pairs that could be attracted to the Kandos to Gulgong route.

Three scenarios were modelled to assess the viability of the project. These scenarios were:



- **Scenario 1: Rail Freight Redistribution** – directly provided by the new rail coming online and the presently forecast freight task in the area having the ability to use it
- **Scenario 2: Supplementing MPPS Demand** with **2,000 kilotonnes p.a.** from the western coalfields – sourcing coal from the western coalfields to supplement half the local coal supply from Springvale/Angus Place, through either (2a) diverting a portion of western coalfields coal bound for Newcastle or (2b) increasing production in the western coalfields
- **Scenario 3: Replacing MPPS Demand** with **4,000 kilotonnes p.a.** from the western coalfields – sourcing coal from the western coalfields to replace all the local coal supply from Springvale/Angus Place, through either (3a) diverting a portion of western coalfields coal bound for Newcastle or (3b) increasing production in the western coalfields

Due to the inherent uncertainty in forecasting decades into the future, a suite of assumptions is required to underpin the demand analysis. These provide overarching assumptions, as well as base case and Scenario specific assumptions. The key assumptions for Kandos to Gulgong are:

- The lifespan of MPPS is until 2043, noting it could be increased with further funding to potentially 2056 (though the recently released NSW Energy Policy suggests that this is unlikely)²
- MPPS currently requires approximately 4,000 kilotonnes of coal per year to fully service their power station energy demands, which is anticipated to remain constant over the life of the power station
- The life of local mines in the MPPS region are Springvale to 2024 and Angus Place to 2038, if Angus Place gets planning approvals to commence extraction in 2024 when Springvale closes
- Coal from the western coalfields mines cannot be transported via road freight due to contractual/policy issues
- Coal from western coalfields destined for MPPS would not be cost competitive if it had to go north first via the Merrygoen line and hence this scenario has not been considered as part of this evaluation
- The main ARTC rail line from the western coalfields mines to Newcastle has sufficient capacity to accommodate additional trains in both directions and for the purposes of this assessment there are no capacity constraints on the line – discussions with ARTC indicate that they consider capacity is currently available for the projected demand
- No additional freight rail line projects are expected to come online in the future that would change travel times or distances across the NSW freight rail network, so current travel times and distance hold into the future, with the exception of the Kandos to Gulgong line being reopened in the alternate scenarios
- For the purposes of project assessment all freight was assumed to be 'contestable'.

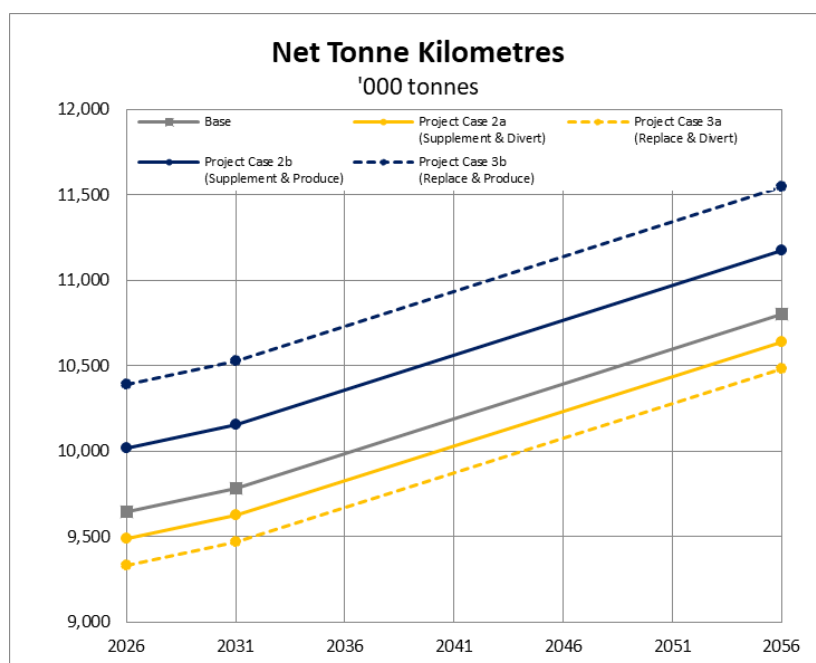
Supplying coal to MPPS from the western coalfields impacts the freight task in the region differently, dependent on the quantum of coal sourced and the option assumed to source the coal. One measure of comparison is to consider the Net Tonne Kilometres (NTK) of travel for coal.

The scenarios that considered the diverted coal (Scenarios 2a and 3a are shown in yellow) produce NTK savings, with coal previously destined for Newcastle now travelling a shorter distance to MPPS. The closer proximity of MPPS compared to Newcastle for the same amount of coal results in a reduction in NTK. The greater the amount of coal diverted to MPPS the greater the reduction in NTK.

The scenarios that considered additional coal production (Scenarios 2b and 3b shown in blue) result in additional NTK on the network, given this is new freight moving on the rail network, even though it is travelling to MPPS and not the Port of Newcastle. In summary, the analysis suggests that:

- Scenarios 2a and 3a have NTK **benefits** of 158,000 tonne-kilometres (2%) and 316,000 tonne-kilometres (3%)
- Scenarios 2b and 3b have NTK **disbenefits** of 374,000 tonne-kilometres (4%) and 748,000 tonne-kilometres (7%)

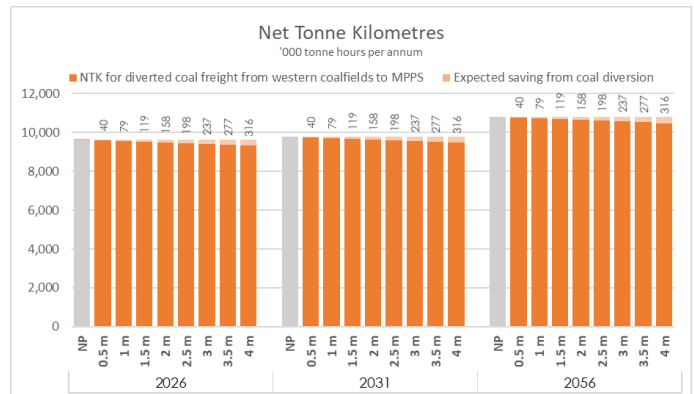
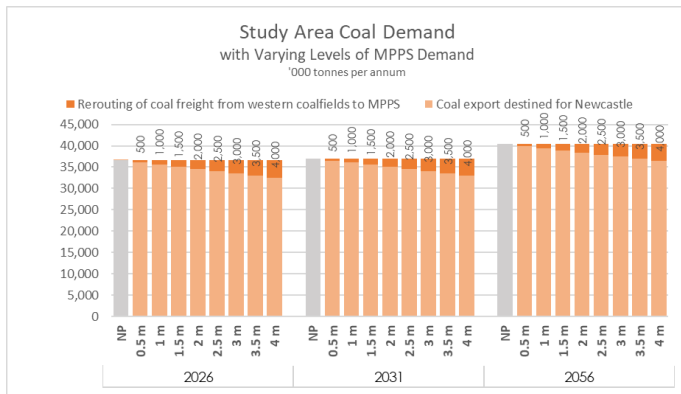
Discussions with the utility suggested that the level of coal that they would be seeking to source from the western coalfields mines is uncertain, but they have indicated that the Mount Piper coal demand may be as low as 500 kilotonnes per annum up to full source of 4,000 kilotonnes per annum. In order to understand the NTK and Net Tonne Hours (NTH) of travel, a series of sensitivity tests were undertaken at 500 kilotonnes per annum increments within the utility range of 500 kilotonnes to 4,000 kilotonnes per annum. The results are shown below.



² Shut down year updated to 2043 based on Detailed NSW Electricity Strategy

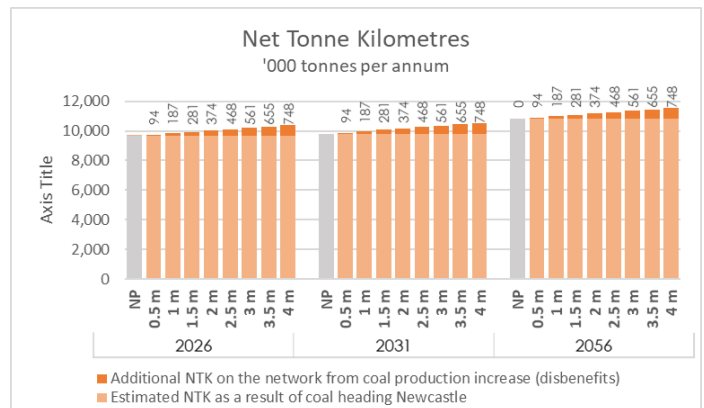
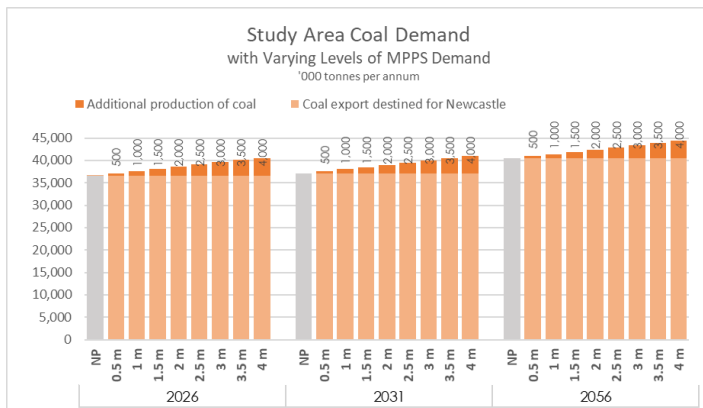
Option (a) – assumes that mines of the western coalfields would RETAIN its current coal production a part of which would be diverted to provide for the requirements of the MPPS – similar to Scenario 2a and Scenario 3a.

The resulting demand, NTK and NTH outcomes with the coal demand to MPPS shown as a component of each.



Option (b) – assumes that mines of the western coalfields would INCREASE its coal production to provide for the requirements of the MPPS – similar to Scenario 2b and Scenario 3b.

The resulting demand, NTK and NTH outcomes with the coal demand to MPPS shown as a component of each.



Financial analysis

Over the 50-year assessment period, there are 44 years of operation (and five (5) years of planning, design and construction, following the current financial year in which the feasibility assessment is completed). Scenarios 2b and 3b would result in the highest ongoing costs, at approximately \$1.88m and \$2.07m per annum, respectively.

Four Scenarios have been considered as part of this assessment, as outlined in the Demand Assessment namely:

- **Scenario 2a** - Supplementing MPPS Demand - (diversion of 2,000 kilotonnes p.a. that currently being transported from the western coalfields to Newcastle being redirected to MPPS)
- **Scenario 2b** - Supplementing MPPS Demand - (increased production of 2,000 kilotonnes p.a. from the western coalfields to provide coal to MPPS)
- **Scenario 3a** - Replacing MPPS Demand - (diversion of 4,000 kilotonnes p.a. that currently being transported from the western coalfields to Newcastle being redirected to MPPS)
- **Scenario 3b** - Replacing MPPS Demand - (increased production of 4,000 kilotonnes p.a. from the western coalfields to provide coal to MPPS)

Scenario 2a has the lowest Net Present Cost of the considered scenarios, at an estimated real cost of \$324.5 million, or \$255.7 million in present value terms discounted at 7% real based on the upgrade to 25TAL.

Scenarios	Financial Analysis Results, 50 years \$m, Net Present Cost for 25TAL scenario			
	Real \$m	Net Present Cost 4%	Net Present Cost 7%	Net Present Cost 10%
Scenario 2a	\$324.5	\$282.3	\$255.7	\$232.7
Scenario 2b	\$384.2	\$325.3	\$290.3	\$261.1
Scenario 3a	\$348.5	\$297.4	\$266.7	\$240.8
Scenario 3b	\$439.2	\$364.9	\$322.3	\$287.5

Economic analysis

For the purposes of an economic analysis a series of assumptions need to be adopted to frame the analysis. The definition of both a base case and scenario for this initiative rely on several fundamental (or 'global') assumptions, including:

- The MPPS, being the youngest coal-fired power station in NSW, and having undergone refurbishment works in recent years, is (perhaps) the most efficient coal fired power station in NSW
- Closure of MPPS is not in the interest of NSW, and to substitute the energy output with another energy generating asset or assets, would at a minimum cost NSW the equivalent of the asset value of the MPPS.
- The assessment period is 50 years, commencing in the current financial year, 2019-20, with the final year to be 2068-69.
- It is assumed that the operational life of MPPS will be not be extended beyond the notional current asset life end date of 2042 and would cease to operate throughout the remainder of the assessment period (until 2068-69).
- MPPS requires up to 4,000 kilotonnes per annum of coal to continue operations over the assessment period, utilising 55kcal coal.
- Road freight cannot be used to transport coal directly from current or future nominated mines within NSW to MPPS, due to operational constraints (i.e. volume of trucks would be substantial) and obligations to government (agreements with the NSW government to utilise rail and not road for movement of coal supply).

The Cost Benefit Analysis (CBA) has generated the economic Net Present Values (NPV) and Benefit Cost Ratios (BCR) for the scenarios as outlined below.

Component	Discounted @ 4%	Discounted @ 7%	Discounted @ 10%
Scenario 2a – 2,000 kilotonnes of coal supplied from western coalfields, taken from existing amount produced and exported			
Economic NPV	(\$0.1)	(\$87.7)	(\$129.5)
BCR	1.00	0.65	0.43
Scenario 2b – 2,000 kilotonnes of coal supplied from western coalfields, new production beyond existing amount exported			
Economic NPV	\$90.1	(\$23.4)	(\$83.4)
BCR	1.26	0.92	0.69
Scenario 3a – 4,000 kilotonnes of coal supplied from western coalfields, taken from existing amount produced and exported			
Economic NPV	\$24.3	(\$76.1)	(\$124.5)
BCR	1.09	0.70	0.46
Scenario 3b – 4,000 kilotonnes of coal supplied from western coalfields, new production beyond existing amount exported			
Economic NPV	\$230.9	\$71.7	(\$17.9)
BCR	1.57	1.20	0.94

At a 7 per cent discount rate, the only scenario that would deliver a BCR greater than 1.0 is Scenario 3b at 1.20.

This scenario represents the most optimistic case, with the highest demand assumptions and a cost estimate based on current knowledge of scope and construction costs. The costs may increase substantially as the engineering requirements are further refined through more detailed investigations. In addition, the demand assumptions may not be achievable on any continuous basis and may represent the peak demand that occurs only occasionally.

However, it should also be noted that this analysis does not consider broader benefits such as NSW energy security that may be threatened over time with the closure of other coal mines and potential increased reliance on more recent coal fired power stations like MPPS, at least until more sustainable energy sources come on line.

Stakeholder engagement

Transport planning studies such as this rail feasibility study require engagement with key stakeholders to inform the study processes and analysis. There is a need to collect information from key stakeholders and interested parties on matters such as:

- Local issues of concern to the residents and stakeholders in the area, including constraints, issues and opportunities
- Inputs that might add value to key aspects of the study, particularly the demand analysis.

On this basis the study team identified a need to engage with stakeholders in the area and seek information to inform the study.

Stakeholder engagement sessions were held with representatives from:

- Mid-Western Regional Council
- Utility and Power Station
- Rail Freight Industry Group Forum
- TfNSW Freight Network Design
- And various others who attended sessions in Mudgee, Dubbo, Sydney and Newcastle in late November 2019.

The engagement with these stakeholders has indicated limited support for the proposal to complete the construction of the Kandos to Gulgong rail, other than the utility who have a vested interest in the project. However, the Mid-Western Regional Council has indicated that they expect considerable public opposition to the reinstatement of railway operations on the line. They are particularly concerned about the impact of coal trains passing through Mudgee and other towns along the line.

Conclusion

There was limited support for the Kandos to Gulgong rail at each of the stakeholder engagement sessions. The utility is keen for the railway to enable continued operation of the Mount Piper Power Station. However, other stakeholders saw little benefit to any other freight movements, confirming the outcomes of the demand analysis. There was some support for the redundancy that the line would provide if it were to be reinstated. However, the Mid-Western Regional Council has indicated that they expect considerable public opposition to the reinstatement of railway operations on the line.

Nevertheless, the engineering assessment, demand analysis and financial and economic analysis conducted through this study indicate that it could be a viable proposition depending on the coal demand assumptions.

The costs of construction of the railway from Kandos to Gulgong are significant but are offset by the benefits to the power industry as outlined in the financial and economic analysis. However, it should also be noted that this analysis does not consider broader benefits such as NSW energy security that may be threatened over time with the closure of other coal mines and potential increased reliance on more recent coal fired power stations like MPPS, at least until more sustainable energy sources come on line.

The construction of the railway to meet the required design standards involves a significant cost. No significant environmental constraints (other than community concerns in Mudgee) have been identified that would adversely affect the delivery of the railway from Kandos to Gulgong. The assessment of the planning approval pathways indicates that an REF may be required, as none of the consideration factors for an EIS are relevant in this case. However, it would be prudent for TfNSW to undertake a formal assessment of the necessary planning pathways and determine the appropriate approval pathways required under current regulations.

It should be noted that there are some key assumptions that underpin the CBA and findings. Development of a subsequent business case coupled with associated investigation and planning activities would be a prudent approach to further test and validate these assumptions and constraints.