Technical Paper 8 – Economic

Central-West Orana Renewable Energy Zone Transmission

Prepared for
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September 2023

Contents

Glossary

Project terms	
access roads	Permanent access roads to switching stations and energy hubs
access tracks	Temporary and permanent access tracks to transmission lines
Central-West Orana REZ (CWO REZ)	A geographic area of approximately 20,000 square kilometres centred on the regional towns of Dubbo and Dunedoo and extending west to Narromine and east beyond Mudgee and to Wellington in the south and Gilgandra in the north, that will combine renewable energy generation, storage and transmission infrastructure to deliver energy to electricity consumers
construction area	The area that would be directly impacted by the construction of project including (but not limited to) transmission towers and lines, brake and winch sites, access roads to switching stations and energy hubs, access tracks, energy hubs, switching stations, communications infrastructure (excluding the microwave repeater site at Botobolar), workforce accommodation camps, construction compounds and laydown and staging areas.
construction compound	An area used as the base for construction activities, usually for the storage of plant, equipment and materials, and/or construction site offices and worker facilities. It can also comprise concrete batching plant, crushing, grinding and screening plant, testing laboratory and wastewater treatment plant.
consumption-induced flow-on	The spending by households of the extra income they derive from the production of the extra $1 of output and production induced effects. This spending in turn generates further production by industries.
economic activity	Measures of economic activity include output, value-added, income and employment.
economic impact	Refers to the effect of a project on economic activity within a local area or region.
employment	The number of people employed (including full-time and part-time).
Enabling works	Activities that would be carried out before the start of substantial construction in order to make ready the key construction sites (including workforce accommodation camps and compounds), facilitate the commencement of substantial construction, manage specific features or issues and collect additional information required to finalise the final design and construction methodology.
EnergyCo	The Energy Corporation of New South Wales constituted by section 7 of the *Energy and Utilities Administration Act 1987* as the NSW statutory authority responsible for the delivery of NSW's REZs.
Energy hub/s	An energy hub is a substation where energy exported from renewable energy generators or storage is aggregated, transformed to 500 kV (where required) and exported to the transmission network. For the project, this includes Merotherie Energy Hub and Elong Elong Energy Hub.
Gross regional product	One of several measures of the size of a regional economy. It is the market value of all final goods and services produced by all firms in a regional economy.
Household income	The wages paid to employees including imputed wages for self-employed and business owners.

Project terms	
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment.
Input-output analysis	a method to assess the direct and indirect economic activity generated by a project through spending.
Intermediate good	a good that is used as an input into the production of other goods and services
renewable energy generators	A renewable energy provider to the CWO REZ.
renewable energy generation and storage projects	The various renewable energy generation and storage projects within the CWO REZ such as wind farms and solar farms.
Essential Energy	The asset owner of multiple distribution lines below 132kV in the region that cross the project at multiple locations.
Multiplier	a summary measure used for predicting the total impact on all industries in an economy from changes in the demand for the output of any one industry. There are many types of multipliers.
operation area	The area that would be occupied by permanent components of the project and/or maintained, including transmission line easements, transmission lines and towers, energy hubs, switching stations, communications infrastructure, access roads to the switching stations and energy hubs maintenance facilities and permanent access tracks to the easements.
Production-induced flow-on	the sum of the first round effects and industrial support effects (i.e. the total amount of output from all industries in the economy required to produce the initial change in output).
(the) proponent	EnergyCo
(the) project	The Central-West Orana REZ Transmission project as described in the Environmental Impact Statement.
Renewable Energy Zone (REZ)	A geographic area identified and declared by the NSW Government as a REZ.
(the) region	The region/regional economy for the purpose of the Economic Assessment is the combined Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter Shire Local Government Areas
study area	The study area/regional economy for this economic impact assessment is defined as the combined Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter Shire Local Government Areas (LGAs).
substation	A facility used to increase or decrease voltages between incoming and outgoing lines (e.g. 330 kV to 500 kV).
switching station	A facility used to connect two or more distinct transmission lines of the same designated voltage.

Project terms	
transmission line easement	An area surrounding and including the transmission lines which is a legal 'right of way' and allows for ongoing access and maintenance of the transmission lines. Landowners can typically continue to use most of the land within transmission line easements, subject to some restrictions for safety and operational reasons..
twin transmission line	A pair of single or double circuit transmission lines running parallel.
Type 11a ratio multiplier	Summarise the total impact on all industries in an economy in relation to the initial own sector effect e.g. total income effect from an initial income effect and total employment effect from an initial employment effect, etc.
Usual resident	A person who lives or intends to live at a location for six months or more.
Value-added	The difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output.
workforce accommodation camps	Areas that would be constructed and operated during construction to house the construction workforce.

Abbreviations

ABS	Australian Bureau of Statistics
ANZSIC	Australian and New Zealand Standard Industry Classification
CEMP	Construction Environmental Management Plan
CGE	Computable General Equilibrium
DPE	Department of Planning and Environment
EIS	Environmental Impact Statement
EP&A Act	*(NSW) Environmental Planning and Assessment Act 1979*
EP&A Regulation	*(NSW) Environmental Planning and Assessment Regulation 2000*
GRIT	Generation of Input-Output Tables
GRP	Gross regional product
IO	Input-Output (Analysis)
km	Kilometres
LGA	Local Government Area
NSW	New South Wales
OFD	Other final demands
OVA	Other value-added
RIA	Regional Impact Analysis

Executive summary

This technical paper assesses the potential impacts to the regional and NSW economy from the construction and operation of the Central-West Orana Renewable Energy Zone Transmission project (the project) and has been prepared to support and inform the Environmental Impact Statement (EIS) for the project.

The impacts have been assessed in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued by the NSW Department of Planning and Environment (DPE) and against the relevant legislation and guidelines as they apply to economics.

Project overview

The NSW Government is leading the development of Renewable Energy Zones (REZ) across NSW to deliver renewable energy generation and storage, supported by high voltage transmission infrastructure. Energy Corporation of NSW (EnergyCo) is proposing the construction and operation of new electricity transmission infrastructure and new energy hubs and switching stations required to connect new energy generation and storage projects within the Central-West Orana REZ to the existing electricity network (the project). The project is located within the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter local government areas (LGAs) and extends generally north to south from Cassilis to Wollar and east to west from Cassilis to Goolma.

The project would enable 4.5 gigawatts of new network capacity to be unlocked by the mid-2020s (noting the NSW Government's proposal to amend the Central-West Orana REZ declaration to allow for a transfer capacity of six gigawatts), and enable renewable energy generators within the Central-West Orana REZ who are successful in their bids to access the new transmission infrastructure to export electricity to the rest of the network. Importantly, the development of renewable energy generation projects in the Central-West Orana REZ is the sole responsibility of private generators and subject to separate planning and environmental approvals.

Methodology

The project would provide economic activity to the regional and NSW economy during both the construction and operation phase. It would also result in some reduction in regional economic activity from foregone potential agricultural and forestry activity within the disturbance footprint.

Economic activity impacts in the regional and NSW economy arises from changes in:

— expenditure in the region on non-labour inputs to production

— direct employment of local labour or in migration of labour; and

— expenditure of labour wages in the local economy.

These regional and NSW economic impacts are assessed using input-output (IO) analysis**.** Qualitative consideration is also given to potential impacts of the project, and cumulative projects, on demand for regional and NSW labour resources and other inputs to production.

The Economic Assessment predates the engagement of the future Network Operator, and so is based on a number of assumptions.

Existing environment

The regional economy is defined as the combined Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter LGAs. The population of the region has been growing since 2006, mainly reflecting growth in the Mid-Western Regional LGA and Dubbo Regional LGA. Aggregated one-digit Australian and New Zealand Industry Classification (ANZIC) place of work data indicates the significance of the *Health Care and Social Assistance*, *Education and Training*, *Retail Trade and Agriculture, Forestry and Fishing* sectors. However, the main employment in the region

varies across LGAs. The main one-digit ANZSIC employment sector in the Warrumbungle and Upper Hunter Shire LGAs is *Agriculture, Forestry and Fishing*. For the Mid-Western Regional LGA the main employment in the region is in the *Mining* sector. *Health Care and Social Assistance* is the main employment sector in the Dubbo Regional LGA.

Exporting sectors are key drivers of regional economies and reflect a region's endowments and competitive advantages. Using the IO industry sector classifications, the largest exporting industries by value are *Coal Mining; Sheep, Grains, Beef and Dairy Cattle Farming*; *Meat and Meat Products Manufacturing*; *Basic Non-Ferrous Metal Manufacturing; and Wine, Spirits and Tobacco Manufacturing*.

Potential construction impacts

Average annual direct construction employment from the project is estimated at up to 1,507 workers in 2026 and an average over four years of 934 workers.

The average annual construction impacts of the project on the regional economy for four years are estimated at up to:

— $512M in annual direct and indirect output

— $181M in annual direct and indirect value-added

— $111M in annual direct and indirect household income

— 1,363 direct and indirect jobs.

The average annual construction impacts of the project on the NSW economy are estimated at up to:

— $969M in annual direct and indirect output

— $420M in annual direct and indirect value added

— $265M in annual direct and indirect household income

— 2,994 direct and indirect jobs.

Construction of the workforce accommodation camps are a minor subcomponent of the above impacts. Due to likely centralised purchasing activities for the workforce accommodation camps, the during the construction phase is likely to provide only modest impacts to the regional economy.

The construction of the project would not impact any forestry activity during production but would result in a reduction in the area available for agricultural activity – grazing and cropping. These impacts are estimated at less than 0.3 per cent of agricultural activity in the region and a fraction of the economic activity gains from the project.

The construction of the project would create demand for regional labour resources and regional inputs to production. This has the potential in the short run to lead to increased construction wages, attraction of workers from other relevant sectors of the economy leading to labour shortages in these other areas of the economy (and associated shortages of goods and services), rising inflation as firms pass wage costs onto consumers etc. In addition, in the short run excess demand for inputs to construction of an individual project such as quarry materials, concrete etc can result in rising costs for these factor inputs and potentially shortages for other uses. However, whether, and the extent to which these types of effects would arise from an individual project is uncertain.

Potential operational impacts

The project is estimated to make up to the following total annual contribution to the regional economy during operation:

— $134M in annual direct and indirect regional output

— $54M in annual direct and indirect regional value-added

— $17M in annual direct and indirect household income

— 189 direct and indirect jobs.

The project is estimated to make up to the following total annual contribution to the NSW economy during operation:

— $186M in annual direct and indirect regional output.

— $81M in annual direct and indirect regional value-added

— $34M in annual direct and indirect household income

— 356 direct and indirect jobs.

The construction and operation impacts are larger for the NSW economy because there is less leakage of direct and indirect expenditure out of the NSW economy compared to the regional economy. i.e. the NSW economy because of its size and diversity is better placed to provide more of the inputs to production than the regional economy.

Businesses that can provide the inputs to the production process required by the project and/or the products and services required by the workforce would directly benefit from the project by way of an increased economic activity. However, because of the inter-linkages between sectors, many indirect businesses also benefit.

The workforce accommodation camps would not operate during the operation phase of the project and hence no regional or NSW economic impacts would occur.

The operation of the project would not impact any forestry activity during production but would result in a reduction in the area available for agricultural activity – grazing and cropping. These impacts are estimated at less than 0.06 per cent of agricultural activity in the region and a fraction of the economic activity gains from the project.

The operation of the project would create a small demand for regional labour resources and regional inputs to production. Consequently, no potential wage or price increases or production shortages are anticipated.

Management measures

The inclusion of the workforce accommodation camps has been proposed to ensure that the project does not significantly increase competition for labour and housing in the region. Notwithstanding, it is the intention of the project to provide positive local employment and business opportunities for the region.

These benefits can be maximised via the promotion of local workforce participation via the preparation and implementation of a Local Industry Participation Plan and Australian Industry Participation Plan, both of which are included as mitigation measures in Technical paper 7 – Social.

1 Introduction

1.1 Background

New South Wales (NSW) is currently undergoing an energy sector transformation that will change how we generate and use energy. The NSW Government is leading the development of Renewable Energy Zones (REZ) across NSW to deliver renewable energy generation and storage projects, supported by transmission infrastructure. A REZ connects renewable energy generation and energy storage systems to transmission infrastructure via energy hubs, requiring the coordination of power generation, power storage and transmission infrastructure. By doing so, REZs capitalise on economies of scale to deliver clean, affordable and reliable electricity for homes, businesses and industry in NSW.

The Central-West Orana REZ was formally declared on 5 November 2021 under the *Electricity Infrastructure Investment Act 2020* As NSW's first REZ, the Central-West Orana REZ will play a pivotal role in underpinning NSW's transition to a clean, affordable and reliable energy sector.

The Central-West Orana REZ declaration (November 2021) provides for an initial intended network capacity of three gigawatts. The NSW Government is proposing to amend the declaration to increase the intended network capacity to six gigawatts, which would allow for more renewable energy from solar, wind and storage projects to be distributed through the NSW transmission network.

The proposed amendment is consistent with the NSW Network Infrastructure Strategy (EnergyCo, 2023) which identifies options to increase network capacity to 4.5 gigawatts initially under Stage 1 (which would be based on the infrastructure proposed in this assessment) and up to six gigawatts by 2038 under Stage 2 (which would require additional infrastructure beyond the scope of this assessment, and subject to separate approval). The proposed amendment also supports recent modelling by the Consumer Trustee in the draft 2023 Infrastructure Investment Objectives Report (AEMO, 2023) showing more network capacity will be needed to meet NSW's future energy needs as coal-fired power stations progressively retire.

Energy Corporation of NSW (EnergyCo), a NSW Government statutory authority, has been appointed as the Infrastructure Planner under the *Electricity Infrastructure Investment Act* 2020, and is responsible for the development and delivery of the Central-West Orana REZ. EnergyCo is responsible for coordinating REZ transmission, generation, firming and storage projects to deliver efficient, timely and coordinated investment.

EnergyCo is seeking approval for the construction and operation of new electricity transmission infrastructure and new energy hubs and switching stations that are required to connect energy generation and storage projects within the Central-West Orana REZ to the existing electricity network (the project).

1.2 Purpose of this paper

This technical paper assesses the potential economic impacts from the construction and operation of the project and has been prepared to support and inform the Environmental Impact Statement (EIS).

This technical paper has been prepared to address the relevant Secretary's environmental assessment requirements (SEARs) for the project issued by the Secretary of the former NSW Department of Planning and Environment (DPE) for the project on 7 October 2022, and the supplementary SEARs on 2 March 2023. The SEARs relevant to the assessment of economics are presented in Table 1.1.

Table 1.1 - SEARs relevant to this paper

Reference	Assessment requirement	Location where it is addressed
Key issues – Economic	an assessment of the benefits of the project for the region and the State as a whole,	Sections 4 and 5
	including consideration of any increase in demand for community infrastructure and services, and details of how the construction workforce will be managed to minimise local impacts, including a consideration of the construction workforce accommodation and	Refer to Technical paper 7 (Social Impact Assessment) for matters relating to impacts to community infrastructure and services.
	an assessment of the impacts to State Forests.	Sections 4 and 5

1.2.1 Related technical papers

This technical paper is linked to the assessments completed in the following technical papers:

— Technical paper 2: Agriculture

— Technical paper 7: Social.

1.3 Project overview

The project comprises the construction and operation of electricity transmission infrastructure, energy hubs and switching stations within the Central-West Orana REZ. The project would enable 4.5 gigawatts of new network capacity to be unlocked by the mid-2020s (noting the NSW Government's proposal to amend the Central-West Orana REZ declaration to allow for a transfer capacity of six gigawatts)and enable renewable energy generators within the Central-West Orana REZ who are successful in their bids to access the new transmission infrastructure to export electricity onto the rest NEM A detailed description of the project, including a description of key project components, the construction methodology and how it would be operated is provided in Chapter 3 of the EIS.

1.3.1 Features

The project would comprise the following key features:

— a new 500 kV switching station (the New Wollar Switching Station), located at Wollar to connect the project to the existing 500 kV transmission network

— around 90 kilometres of twin double circuit 500 kV transmission lines and associated infrastructure to connect two energy hubs to the existing NSW transmission network via the New Wollar Switching Station

— energy hubs at Merotherie and Elong Elong (including potential battery storage at the Merotherie Energy Hub) to connect renewable energy generation and projects within the Central-West Orana REZ to the 500 kV network infrastructure

— around 150 kilometres of single circuit, double circuit and twin double circuit 330 kV transmission lines, supported on towers, to connect renewable energy generation projects within the Central-West Orana REZ to the energy hubs

— thirteen switching stations along the 330 kV network infrastructure at Cassilis, Coolah, Leadville, Merotherie, Tallawang, Dunedoo, Cobbora and Goolma, to transfer the energy generated from the renewable energy generation projects within the Central-West Orana REZ onto the project's 330 kV network infrastructure

— underground fibre optic communication cables along the 330 kV and 500 kV transmission lines between the energy hubs and switching stations

— a maintenance facility within the Merotherie Energy Hub to support the operational requirements of the project

— microwave repeater sites at locations along the alignment, as well as outside of the alignment at Botobolar, to provide a communications link between the project and the existing electricity transmission and distribution network. The Botobolar site will would be subject to assessment at the submissions report stage.

— establishment of new, and upgrade of existing access tracks for transmission lines, energy hubs, switching stations and other ancillary works areas within the construction area (such as temporary waterway crossings, laydown and staging areas, earthwork material sites with crushing, grinding and screening plants, concrete batching plants, brake/winch sites, site offices and workforce accommodation camps)

— property adjustment works to facilitate access to the transmission lines and switching stations. These works include the relocation of existing infrastructure on properties that are impacted by the project

— utility adjustments required for the construction of the transmission network infrastructure, along with other adjustments to existing communications, water and wastewater utilities. This includes adjustments to Transgrid's 500kV transmission lines 5A3 (Bayswater to Mount Piper) and 5A5 (Wollar to Mount Piper) to provide a connection to the existing NSW transmission network, including new transmission line towers along the Transgrid network along the frontage of the New Wollar Switching Station, and other locations where there is an interface with Transgrid’s network.

1.3.2 Location

The project is located in central-west NSW within the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter Local Government Areas (LGAs). It extends north to south from Cassilis to Wollar and east to west from Cassilis to Goolma. The location of the project is shown in Figure 1-1.

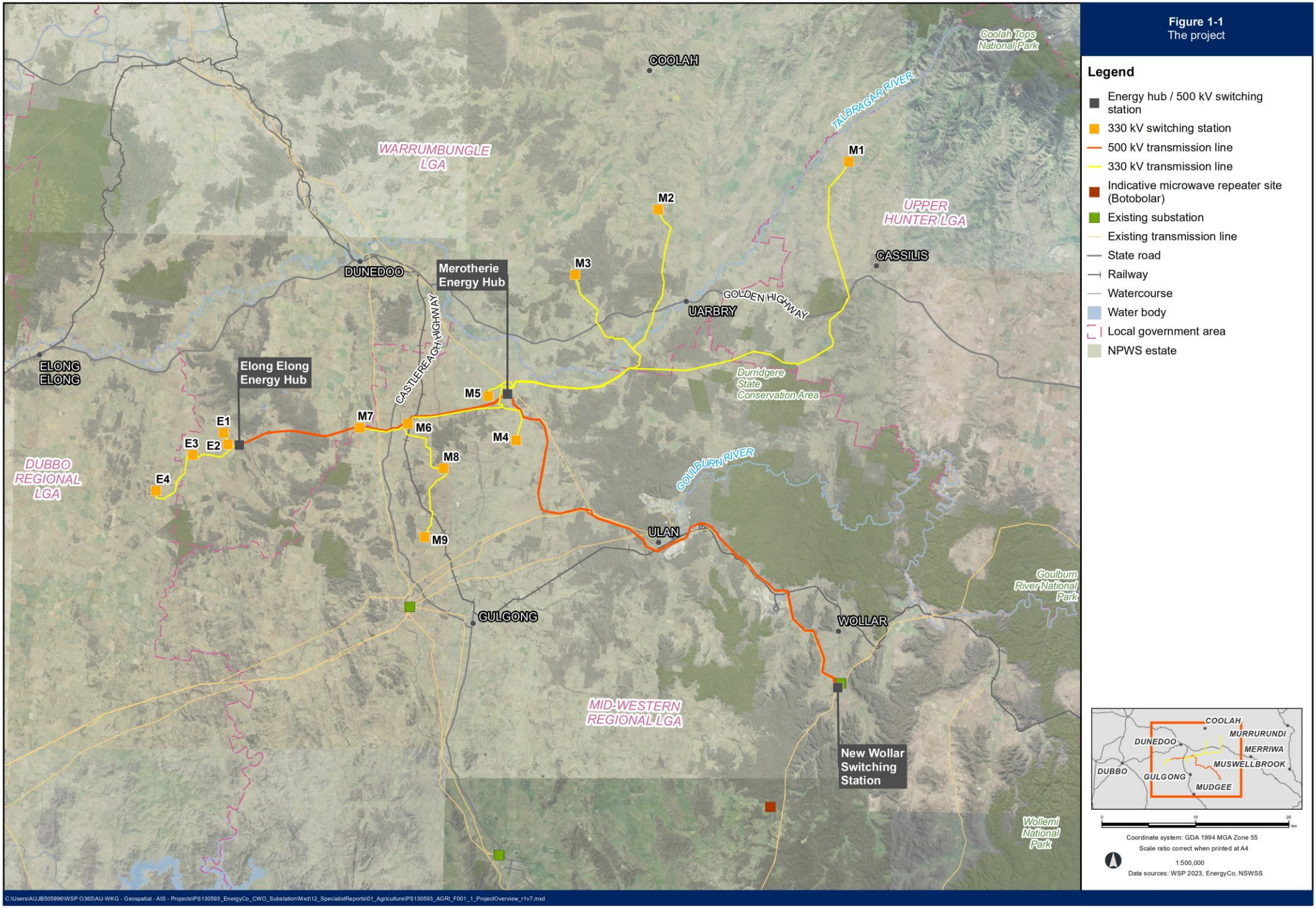

Figure 1-1
The project

Legend

- Energy hub / 500 kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Indicative microwave repeater site (Botobolar)
- Existing substation
- Existing transmission line
- State road
- Railway
- Watercourse
- Water body
- Local government area
- NPWS estate

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4

1:500,000

Data sources: WSP 2023, EnergyCo, NSWSS

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1.3.3 Timing

Construction of the project would commence in the second half of 2024, subject to NSW Government and Commonwealth planning approvals, and is estimated to take about four years. The project is expected to be commissioned/energised (i.e. become operational) in late-2027.

1.3.4 Construction

Key construction activities for the project would occur in the following stages:

— enabling works

— construction works associated with the transmission lines

— construction works associated with the energy hubs and switching stations

— pre-commissioning and commissioning of the project

— demobilisation and rehabilitation of areas disturbed by construction activities.

Excavation and land forming works within the construction area would be required for transmission line tower construction, site preparation works at the energy hubs and switching station sites to provide level surfaces, to create trenches for drainage, earthing, communications infrastructure and electrical conduits, and to construct and upgrade access tracks.

Construction vehicle movements would comprise heavy and light vehicles transporting equipment and plant, construction materials, spoil and waste from construction facilities and workforce accommodation camp sites. There would also be additional vehicle movements associated with construction workers travelling to and from construction areas and workforce accommodation camps. These movements would occur daily for the duration of construction.

To support the construction of the project a number of construction facilities would be required including construction compounds, staging and laydown areas, concrete batching plants, workforce accommodation camps and construction support facilities. The main construction compounds would be established as enabling work and demobilised at the completion of construction. The size of the construction workforce would vary depending on the stage of construction and associated activities. During the peak construction period, an estimated workforce of up to around 1,800 people would be required.

1.3.5 Operation

During operation, the project would transfer high voltage electricity from the Central West-Orana REZ to the NEM. Permanent project infrastructure would be inspected by field staff and contractors on a regular basis, with other operational activities occurring in the event of an emergency (as required). Regular inspection and maintenance activities are expected to include:

— regular inspection of all network infrastructure (ground and aerial)

— fault and emergency response (unplanned maintenance)

— general building, asset protection zone and landscaping maintenance

— fire detection system inspection and maintenance

— stormwater maintenance

— remote asset condition monitoring

— network infrastructure performance monitoring.

Operation of the project would require the establishment of transmission line easements. These easements would be around 60 metres for each 330kV transmission line and 70 metres for each500kV transmission lines. Where network infrastructure is collocated, easement widths would increase accordingly (for example, a twin double circuit 500kV

transmission line would have an easement about 140 meters wide). Vegetation clearing would be required to some extent for the full width of the transmission line easement, depending on the vegetation types present.

1.4 Structure of the paper

The structure and content of this economic assessment technical paper is as follows:

— Chapter 1 – provides an introduction to this technical paper (this chapter)

— Chapter 2 – outlines the methodology adopted for this economic assessment

— Chapter 3 – describes the regional economy within which the project is located

— Chapter 4 – describes the potential impacts to the regional and NSW economy from construction of the project

— Chapter 5 – describes the potential impacts to the regional and NSW economy from operation of the project

— Chapter 6 – identifies mitigation and management measures to avoid, minimise and manage any potential impacts to the regional economy from construction and/or operation of the project

— Chapter 7 – identifies the key reports and documents used to generate this paper.

The appendices to this paper are:

— Appendix 1 – The GRIT Method for Generating Input-Output Tables

— Appendix 2 – Underlying Assumptions and Interpretations of Input-Output Analysis and Multipliers

2 Methodology

2.1 Overview

The project would generate economic activity within the regional and NSW economy, during construction and operation. It would also result in some contraction in agricultural economic activity from the construction and operation footprint. The assessment of these potential economic impacts has been undertaken using input-output (IO) analysis. Other potential impacts are discussed qualitatively.

2.2 Study area

The study area for this economic impact assessment is defined as the combined Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter Shire Local Government Areas (LGAs). This is the region that has the potential to provide inputs to the project and derive economic benefits from the construction and operation of the project. It is also the region that may experience impacts from reduction in agricultural activity and from increased demand for labour and other inputs to production. While the region is the focus of the analysis, impacts on the NSW economy are also assessed.

2.3 Description of the regional economy

The description of the regional economy is based on Australian Bureau of Statistics (ABS) Census of Population and Housing data and information from the model of the regional economy developed for the IO analysis. Data is provided at different levels of aggregation i.e. one-digit and four-digit ANZSIC to provide a more complete picture of the regional economy. Some information is also provided in terms of IO sectors because IO analysis generates economic information on this basis that is not available from Census data.

2.4 Input-output Analysis

IO analysis is used to assess the direct and indirect impacts (gross economic footprint) of the construction and operation of the project on the regional and NSW economy.

The IO analysis involves two key steps:

— Development of an appropriate IO table (regional transaction table) that can be used to identify the economic structure of the region and multipliers for each existing sector of the economy. IO tables for the regional and NSW economy were developed using the Generation of Regional Input Output Tables (GRIT) procedure developed by the University of Queensland and recognised internationally - Refer to Appendix 1.

— Identification of the direct impact or stimulus of the project, in a form that is compatible with the IO equations, so that the IO multipliers and flow-on effects for the impacts or stimulus of the project can then be estimated (West, 1993). The direct impact of the project was estimated from data provided by EnergyCo and production ratios in the IO tables. Indirect effects were estimated using the EconImp program.1

IO analysis identifies the economic activity of a project on the economy in terms of four main indicators:

— gross regional output – the gross value of business turnover in a region

— value-added – the difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output. These costs exclude wage costs

— income – the wages paid to employees including imputed wages for self-employed and business owners

— employment – the number of people employed (including self-employed, full-time, and part-time).

[1] The EconImp program uses the Leontif Inverse Matrix to estimate indirect effects.

The IO method is based on several assumptions that are outlined in Appendix 2. Most notably IO analysis assumes that the regional economy has access to sufficient labour and capital resources (from both inside and outside the region) so that an individual project does not result in any regional price changes e.g. wages in other industries or house rentals, which would lead to contractions ("crowding out") of economic activity in other sectors in the same region. Any "crowding out" is assumed to occur outside the region where the project is concentrated, and the regional impact analysis is focused. A dynamic computable general equilibrium modelling approach may overcome the limitation of IO analysis but is unlikely to be warranted at local or regional scale or with small scale impacts.

The consequence of the assumptions of IO analysis, is that IO modelling provides an estimate of the gross economic impact or footprint of the project which is an upper bound estimate of net economic activity impacts.

Qualitative consideration is given to potential "crowding out" impacts from the project and cumulative projects on the region and State.

3 Existing environment – the regional economy

This section characterises the regional economy from two perspectives, residents of the region and workers in the region.

3.1 Residents of the Region

Table 3.1 provides some characteristics of the usual residents of the four LGAs comprising the regional economy based on the Australian Bureau of Statistics (ABS) 2021 Census of Population and Housing. In 2021, the region had a population of 104,089 and a labour force of 48,854, with Dubbo Regional LGA accounting for 53 per cent of the total population. Together the Dubbo Regional LGA and Mid-Western LGA account for 77 per cent of the regional population and 78 per cent of the regional labour force. In the 2021 Census, 1,861 people (about 1.8 per cent of the total regional population) identified as being unemployed with the majority of these located in the Dubbo Regional LGA.

The main occupations of usual residents were *Professionals* (16.4 per cent) followed by *Technicians and Trades Workers* (15.3 per cent) and *Managers* (which includes farm managers) (14.4 per cent). The percentage of usual residents employed as *Professionals* was greatest in the Dubbo Regional LGA. The percentage of usual residents employed as *Technicians and Trades Workers* was greatest in Upper Hunter Shire LGA and Mid-Western Regional LGA, while the percentage of usual residents employed as *Managers* was greatest in Warrumbungle LGA.

The main industry sectors in which usual residents were employed in 2021 is provided in Table 3.3. *Coal Mining* was the most significant employment sector for residents of the region as well as for the Mid-Western Regional LGA and Upper Hunter Shire LGA.[2] The role of Dubbo Regional LGA as a regional service centre is reflected in *Hospitals (except Psychiatric Hospitals), Other Social Assistance Services, Aged Care Residential Services, Primary Education* and *State Government Administration* being the most significant employment sectors for usual residents. The rural nature of the Warrumbungle LGA is reflected in *Beef Cattle Farming (Specialised)* being the most significant employment sector for usual residents.

[2] Most residents of the Upper Hunter Shire LGA that are employed in coal mining commute outside the region to work i.e. Muswellbrook and Singleton LGAs.

Table 3.1 - Characteristics of Usual Residents

	Warrumbungle		Mid-Western Regional		Dubbo Regional		Upper Hunter Shire		Total Region	
	No.	%	No.	%	No.	%	No.	%	No.	%
Demographics										
Population	9,225		25,713		54,922		14,229		104,089	
Median Age	50		42		36		42			
In Labour Force	3,624	39.3	11,897	46.3	26,326	47.9	7,007	49.%	48,854	46.9
Unemployed	221	6.1	470	4.0	946	3.6	224	3.2	1,861	3.8
Median household weekly income	1,068		1,486		1,597		1,429			
Unoccupied private dwellings	721	17.5	1,704	15.0	1,623	7.8	850	13.4	4,898	11.5
Median rent	200		330		300		270			
Occupations										
Managers	882	25.9	1,591	13.9	3133	12.3	1,037	15.3	6,643	14.4
Labourers	526	15.5	1298	11.4	2692	10.6	1,136	16.7	5,652	12.3
Professionals	463	13.6	1,607	14.1	4648	18.3	825	12.2	7,543	16.4
Community and Personal Service Workers	394	11.6	1,261	11.0	3822	15.1	631	9.3	6,108	13.2
Technicians and Trades Workers	353	10.4	1,998	17.5	3556	14	1,152	17	7,059	15.3
Clerical and Administrative Workers	277	8.1	1,110	9.7	3158	12.4	575	8.5	5,120	11.1
Machinery Operators and Drivers	238	7.0	1,473	12.9	1580	6.2	892	13.1	4,183	9.1
Sales Workers	199	5.9	893	7.8	2320	9.1	403	5.9	3,815	8.3

Source: ABS, 2021Census of Population and Housing, Community Profiles

An indication of the health of an economy can be gained from population changes. This theory of regional economic growth suggests that places that can attract population immigration[3] create increased demand for goods and services and thus more jobs. This growth leads to increasing local multiplier effects, scale economies and an increase in the rate of innovation and capital availability (Sorensen, 1990). Conversely, population losses can contribute to a 'vicious cycle' of decline whereby reduced populations results in closure of services, which in turn makes it difficult to attract new populations (Sorensen, 1990).

Trends in regional economies because of globalisation and associated structural adjustment include:

— loss of significant industries such as abattoirs and timber mills from many rural areas.

— increased mechanisation of agriculture and aggregation of properties, resulting in loss of employment opportunities in this industry.

— growth of regional centres, at the expense of smaller towns.

— preference of Australians for coastal living, particularly for retirement.

— preference of many of today's fastest growing industries for locating in large cities (Collits, 2000).

The result is that there has been declining population in many rural LGAs that are in non-coastal areas. There has also been a decline in the population of smaller towns even in regions where the population has been growing.

Against this backdrop, it is evident that the population of the project's regional economy has been growing at an average annual rate of 1.1 per cent since 2006 (see Table 3.2), with this mainly a result of growth in the Mid-Western Regional

[3] Mainly due to natural endowments and comparative advantage in certain industry sectors.

LGA and Dubbo Regional LGA. The population of Warrumbungle LGA has declined at an average annual rate of -0.4 per cent since 2006 and the growth rate of Upper hunter Shire has been negligible. The average annual population growth rate of the region is 68 per cent of that of NSW.

Table 3.2 - Population Growth

	Population				Average Annual Growth Rate			
	2006	**2011**	**2016**	**2021**	**2006 - 2011**	**2011 - 2016**	**2016 - 2021**	**2006 - 2021**
Warrumbungle	9,808	9,588	9,384	9,225	-0.4%	-0.4%	-0.2%	-0.4%
Mid-Western Regional	21,086	22,318	24,076	25,713	1.2%	1.6%	0.7%	1.5%
Dubbo Regional	45,963	47,298	50,077	54,922	0.6%	1.2%	1.0%	1.3%
Upper Hunter Shire	12,976	13,754	14,112	14,229	1.2%	0.5%	0.1%	0.6%
Total Region	**89,833**	**92,958**	**97,649**	**104,089**	**0.7%**	**1.0%**	**0.7%**	**1.1%**
NSW	**6,549,177**	**6,917,658**	**7,480,228**	**8,072,163**	**1.1%**	**1.6%**	**0.8%**	**1.6%**

Source: Australian Bureau of Statistics, 2006, 2011 2016 2021 Census of Population and Housing, Community Profiles

Table 3.3 - Top 5 Industry Sectors of Employment for Usual Residents (Four-digit ANZSIC)

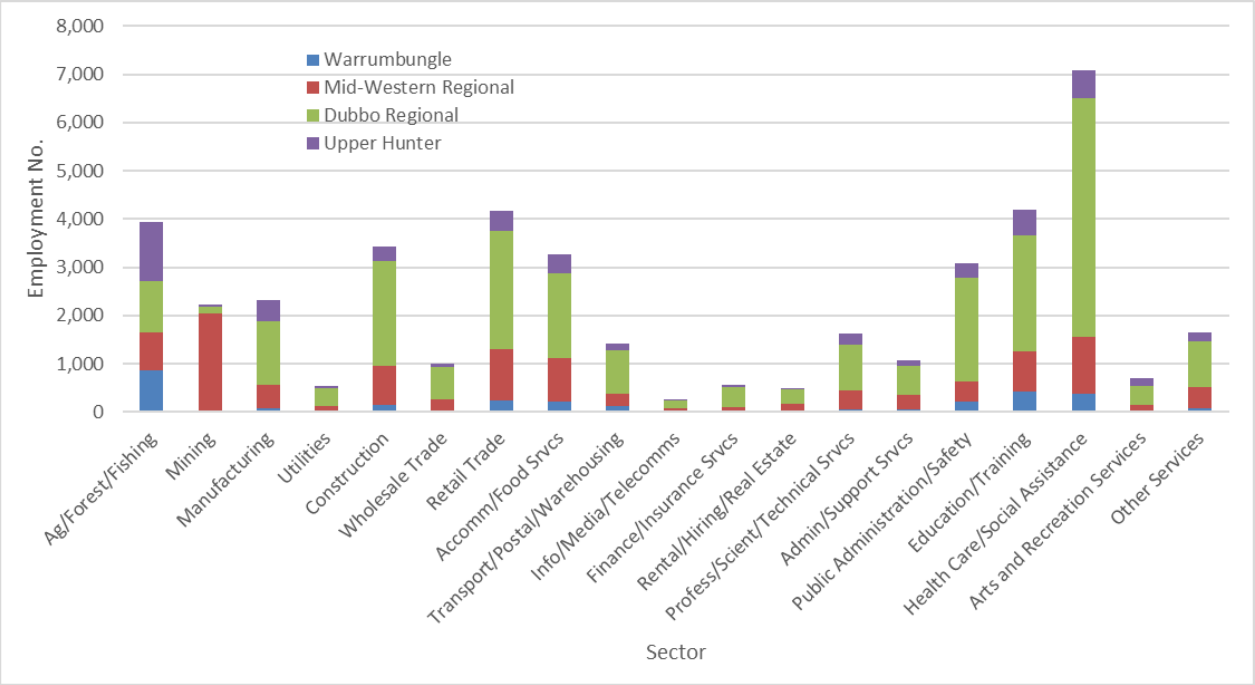
Warrumbungle	No.	%	Mid-Western Regional	No.	%	Dubbo Regional	No.	%	Upper Hunter	No.	%	Total Region	No.	%
Beef Cattle Farming (Specialised)	291	8.6	Coal Mining	1,676	14.7	Hospitals (except Psychiatric Hospitals)	1,367	5.4	Coal Mining	722	10.6	Coal Mining	2,471	5.4
Local Government Administration	139	4.1	Primary Education	323	2.8	Other Social Assistance Services	967	3.8	Horse Farming	429	6.3	Hospitals (except Psychiatric Hospitals)	1,907	4.2
Grain-Sheep or Grain-Beef Cattle Farming	137	4	Supermarket and Grocery Stores	294	2.6	Aged Care Residential Services	749	3	Beef Cattle Farming (Specialised)	410	6	Other Social Assistance Services	1,385	3.0
Combined Primary and Secondary Education	133	3.9	Aged Care Residential Services	290	2.5	Primary Education	723	2.8	Meat Processing	270	4	Aged Care Residential Services	1,319	2.9
Hospitals (except Psychiatric Hospitals)	125	3.7	Other Social Assistance Services	288	2.5	State Government Administration	600	2.4	Aged Care Residential Services	193	2.8	Primary Education	1,286	2.8

Source: Australian Bureau of Statistics, 2021 Census of Population and Housing, Community Profiles

3.2 Economic Activity in the Region

An indication of the nature of the regional economy can be gained by examining place of work employment by industry data (one-digit ANZSIC)) - as shown in Figure 3.1. This indicates the significance of the *Health Care and Social Assistance*, *Education and Training*, *Retail Trade* and *Agriculture, Forestry and Fishing* sectors. However, the main employment in the region varies across LGAs. The main employment sector in the Warrumbungle and Upper Hunter Shire LGAs is *Agriculture, Forestry and Fishing*. For the Mid-Western Regional LGA the main employment in the region is in the *Mining* sector. *Health Care and Social Assistance* is the main employment sector in the Dubbo Regional LGA.

Figure 3.1 - Place of Work Employment by Industry (One-digit Industry of Employment ANZSIC Sectors)



Source: Australian Bureau of Statistics, 2021 Census of Population and Housing, Working Population Profiles

At the more disaggregated level (place of work employment by four-digit ANZSIC) the main industry sectors of employment in the region are *Hospitals (except Psychiatric Hospitals)*, *Coal Mining*, *Other Social Assistance Services*, *Age Care Residential Services and Primary Education*. (See Table 3.3.).

Table 3.3 – Place of Work Top 5 Industry Sectors of Employment (Four-digit ANZSIC)

Warrumbungle	No.	%	Mid-Western Regional	No.	%	Dubbo Regional	No.	%	Upper Hunter	No.	%	Total Region	No.	%
Beef Cattle Farming (Specialised)	279	9.4	Coal Mining	1898	17.2	Hospitals (except Psychiatric Hospitals)	1470	5.8	Horse Farming	470	8.7	Hospitals (except Psychiatric Hospitals)	1,957	4.4
Combined Primary and Secondary Education	146	4.9	Primary Education	309	2.8	Other Social Assistance Services	968	3.8	Beef Cattle Farming (Specialised)	410	7.6	Coal Mining	1,947	4.4
Grain-Sheep or Grain-Beef Cattle Farming	138	4.6	Supermarket and Grocery Stores	292	2.6	Aged Care Residential Services	736	2.9	Meat Processing	327	6.1	Other Social Assistance Services	1,329	3.0
Local Government Administration	127	4.3	Aged Care Residential Services	266	2.4	Primary Education	716	2.8	Aged Care Residential Services	217	4.0	Aged Care Residential Services	1,320	3.0
Supermarket and Grocery Stores	114	3.8	Hospitals (except Psychiatric Hospitals)	263	2.4	State Government Administration	642	2.5	Local Government Administration	190	3.5	Primary Education	1,268	2.8

An IO table for the regional economy has been produced using the GRIT procedure - Refer to Appendix 1. From this IO table, the value-added of the regional economy was estimated at $6,942 million for 2020.

The regional economy is a net exporter, with exports out of the region totalling about $4,625 million and imports into the region of $4,597 million. Using the IO industry classifications, the largest exporting industries by value from the regional economy are:

— Coal Mining ($3,142 million)

— Sheep, Grains, Beef and Dairy Cattle Farming ($460 million)

— Meat and Meat Products Manufacturing ($417 million)

— Basic Non-Ferrous Metal Manufacturing ($202 million)

— Wine, Spirits and Tobacco Manufacturing ($58 million).

Exporting sectors are key drivers of regional economies and reflect a region's endowments and competitive advantages.

Conversely, the largest importing industries in the region are:

— Coal Mining ($843M)

— Sheep, Grains, Beef and Dairy Cattle Farming ($244M)

— Construction Services ($167M)

— Basic Non-Ferrous Metal Manufacturing ($165M)

— Public Administration ($97M).

The following analysis uses the IO table data but reports the findings in terms of both the IO industry classifications (Table 3.4) and the ANZSIC One-digit industry classification (Table 3.5). See ABS (2022) for concordance of industries between these classifications.

Using the IO industry classification, in terms of value-added, it is estimated that *Coal Mining*; *Sheep, Grains, Beef and Dairy Cattle Farming; Residential Care and Social Assistance Services, Primary and Secondary School Education*; and *Public Administration* had the highest value-added, in total equalling approximately 44 per cent of the regional economy value-added and 33 per cent of regional employment – Table 3.4.

Table 3.4 - Gross Value Added for the 5 Largest Industries in the Regional Economy (IO Sectors)

Industry	Gross Value Added ($m)	Proportion of Regional Economy (%)	Proportion of Regional Employment (%)
Coal Mining	1,813	26%	5%
Sheep, Grains, Beef and Dairy Cattle Farming	325	5%	7%
Residential Care and Social Assistance Services	316	5%	8%
Primary and Secondary Education Services (inc preschool and special schools)	306	4%	9%
Public Administration	276	4%	5%
Total	**3,036**	**44%**	**33%**

Source: Gillespie Economics Input-Output Table

Based on the ANZSIC One-digit industry classification, in terms of value-added, it is estimated that *Mining*; *Rental, Hiring and Real Estate Services*; *Health Care and Social Assistance*; *Agriculture, Forestry and Fishing*; *and Construction* had the highest value added - in total, equal to approximately 40 per cent of the regional economy value-added and 58 per cent of regional employment - Table 3.5.

Table 3.5 - Gross Value Added for the 5 Largest Industries in the Regional Economy (One-Digit ANZSIC)

Industry	Gross Value Added ($m)	Proportion of Regional Economy (%)	Proportion of Regional Employment (%)
Mining	1,854	27%	5%
Rental, Hiring and Real Estate Services	699	10%	1%
Health Care and Social Assistance	586	8%	17%
Agriculture/Forestry/Fishing	459	7%	9%
Construction	430	6%	8%
Total	**4,028**	**58%**	**40%**

Source: Gillespie Economics Input-Output Table

4 Construction assessment

4.1 Transmission and other infrastructure

Construction of the project would provide economic activity to the regional and NSW economy. It would also provide some contraction in agricultural activity in the construction area.

4.1.1 Impacts

Construction expenditure is associated with manufacturing of equipment and expenditure across the following three construction sectors of the IO industry classification (ABS 2022):

— the heavy and civil engineering construction sector which includes businesses involved in engineering construction and project management services for a diverse range of activities including construction of electricity transmission towers or lines, road construction, tunnelling etc

— the construction services sector which includes businesses involved in earthmoving work such as levelling of construction sites, excavation of foundations, trench digging, concreting services, electrical services, hire of earthmoving plant with operator etc

— the non-residential building construction sector which includes businesses engaged in the construction of non-residential buildings.

Conservatively, all machinery manufacturing is assumed to occur outside the region/NSW.

Over the four-year construction phase, average annual construction employment is estimated at a maximum of 1,507 workers in 2026 during peak construction and an average construction workforce over four years of 934 workers, as shown in Table 4.1.

Based on the IO coefficients of the abovementioned three construction sectors in the regional IO table, the expenditure that would be required in these sectors to generate these levels of onsite workforce are identified in Table 4.1.

Table 4.1 – Average Annual Construction Workforce and Expenditure in the Three Construction Sectors

Construction year	Construction workforce (expected)	Annual expenditure ($M)
2024	138	44
2025	1,480	476
2026	1,507	484
2027	611	196
Average	**934**	**300**

The direct and indirect regional economic impact of the average annual level of expenditure in the regional and NSW economy are reported in Tables 4.2 and 4.3. Further detail regarding the assumptions and interpretations used in the calculation of this data is provided in Appendix 2.

Table 4.2 – Average Annual Economic Impacts of the Construction Workforce on the Regional Economy

	Direct	Production induced	Consumption induced	Total Flow on	TOTAL EFFECT
OUTPUT ($M)	300	202	10	212	512
Type 11A Ratio	1.00	0.67	0.03	0.71	1.71
VALUE ADDED ($M)	129	46	6	52	181
Type 11A Ratio	1.00	0.35	0.05	0.40	1.40
INCOME ($M)	80	28	3	31	111
Type 11A Ratio	1.00	0.35	0.03	0.38	1.38
EMPL. (No.)	934	383	46	429	1,363
Type 11A Ratio	1.00	0.41	0.05	0.46	1.46

Note: Totals may have minor discrepancies due to rounding.

Table 4.3 – Average Annual Economic Impacts of the Construction Workforce on the NSW Economy

	Direct	Production induced	Consumption induced	Total Flow on	TOTAL EFFECT
OUTPUT ($M)	300	337	332	669	969
Type 11A Ratio	1.00	1.12	1.11	2.23	3.23
VALUE ADDED ($M)	129	106	185	291	420
Type 11A Ratio	1.00	0.82	1.43	2.25	3.25
INCOME ($M)	97	74	94	168	265
Type 11A Ratio	1.00	0.76	0.97	1.74	2.74
EMPL. (No.)	934	792	1,268	2,060	2,994
Type 11A Ratio	1.00	0.85	1.36	2.21	3.21

Note: Totals may have minor discrepancies due to rounding.

In estimating the average annual regional economic impacts of the project, it is important to separate the flow-on effects that are associated with firms buying goods and services from each other (production-induced effects) and the flow-on effects that are associated with employing people who subsequently buy goods and services as households (consumption-induced effects). This is because these two effects operate in different ways and have different spatial impacts.

Production-induced effects occur in a near-proportional way within a region, whereas the consumption-induced flow-on effects only occur in a proportional way if workers and their families are in the region or migrate into the region. Where workers commute from outside the region, some of the consumption-induced flow-on effects leak from the region. It is estimated that approximately 10 per cent of the construction workforce is expected to be from the region. Consequently, Table 4.2 has been adjusted to only include 10 per cent of consumption-induced flow-ons. At the NSW level all the construction workforce is assumed to come from NSW and hence no adjustment to consumption-induced flow-ons is made.

The average annual construction impacts of the project on the regional economy for four years are estimated at up to:

— $512M in annual direct and indirect output

— $181M in annual direct and indirect value-added

— $111M in annual direct and indirect household income

— 1,363 direct and indirect jobs.

The average annual construction impacts of the project on the NSW economy are estimated at up to:

— $969M in annual direct and indirect output

— $420M in annual direct and indirect value added

— $265M in annual direct and indirect household income

— 2,994 direct and indirect jobs.

The impacts are larger for the NSW economy because there is less leakage of direct and indirect expenditure out of the NSW economy compared to the regional economy and hence greater production induced and consumption induced flow-on effects.

Year by year impacts on the regional and NSW economies are shown in Figures 4.1 and 4.2, respectively.

Figure 4.1 – Annual Construction Impacts on the Regional Economy

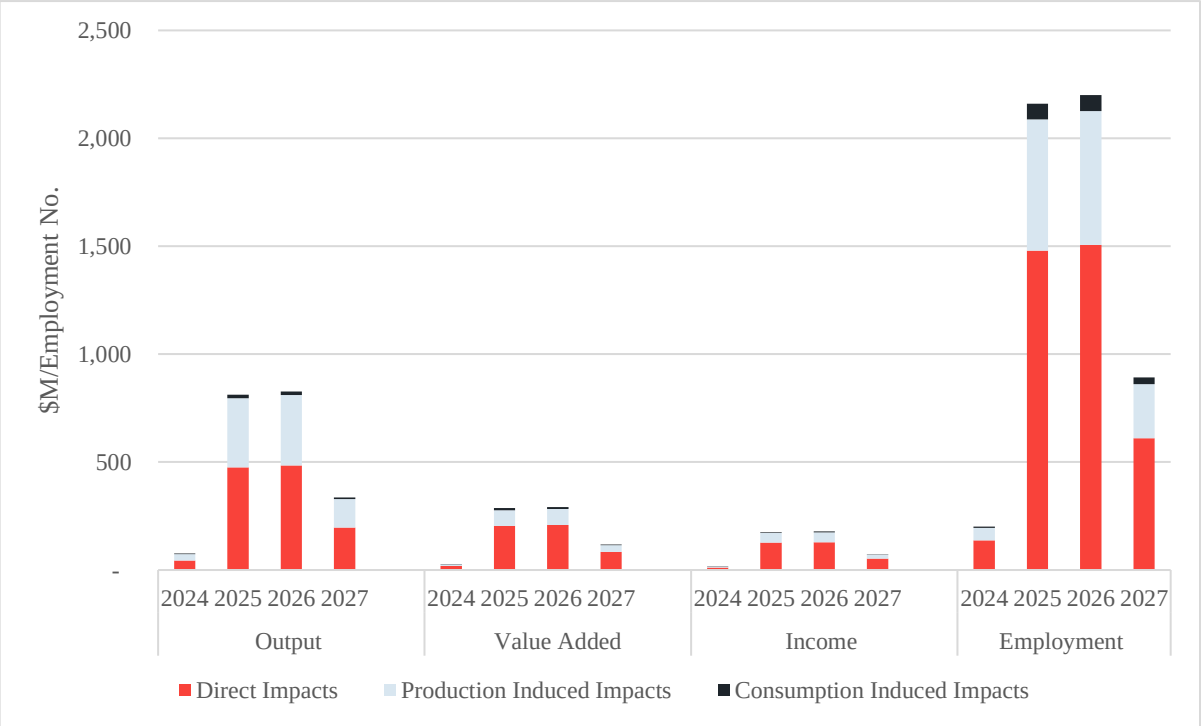
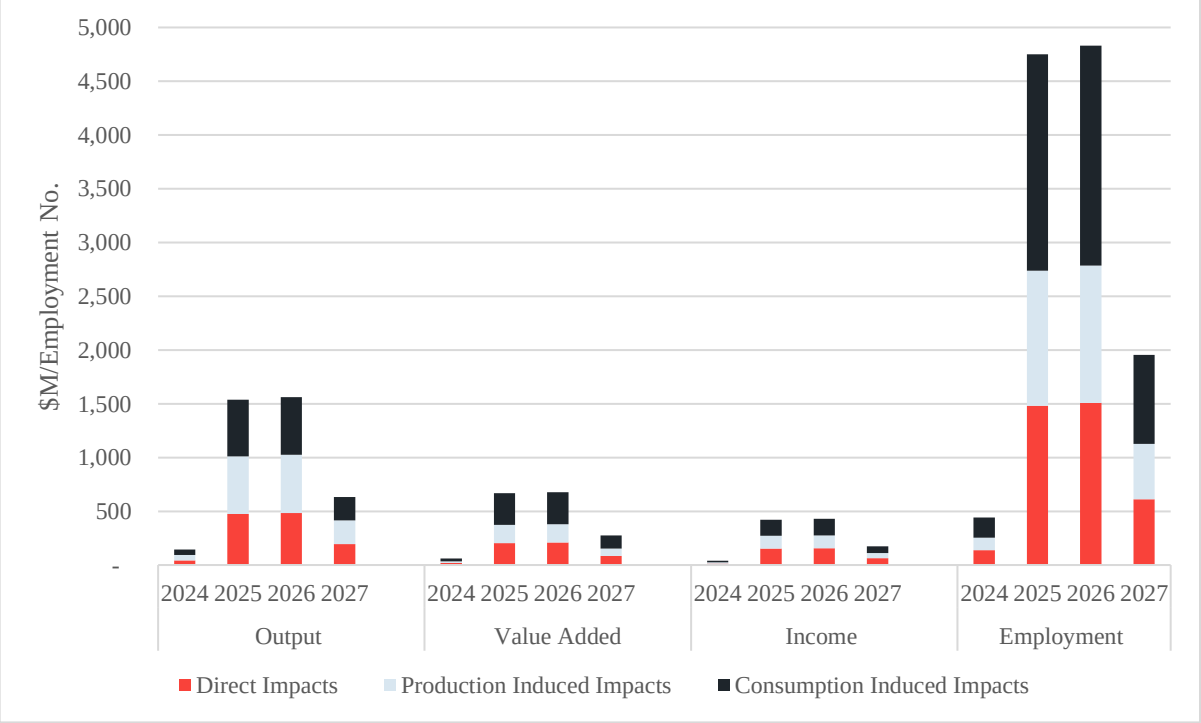


Figure 4.2 – Annual Construction Impacts on the NSW Economy



4.1.2 Multipliers

Multipliers are summary measures of the above impacts that identify total impact on all industries in an economy from changes in the demand for the output of any one industry (ABS, 1995). There are many types of multipliers that can be generated from IO analysis (refer to Appendix 2). Type 11A ratio multipliers summarise the total impact on all industries in an economy in relation to the direct own sector effect e.g. total income effect from an direct income effect and total employment effect from the direct employment effect, etc.

At the regional level, the adjusted type 11A ratio multipliers for the construction workforce of the project range from 1.38 for income up to 1.71 for employment. The multipliers are larger for the NSW economy because of the higher level of intersectoral linkages in the larger economy and hence larger level of flow-on impacts i.e. less leakages compared to the regional economy.

4.1.3 Main Sectors Affected

Construction is most likely to directly impact the *heavy and civil engineering construction sector, construction services sector and non-residential building construction sector*. Flow-on impacts from the construction of the project are likely to affect several different sectors of the regional and NSW economy.

The sectors of the regional economy most impacted by output, value-added, income and employment production induced flow-ons, associated with firms buying goods and services from each other are likely to be as follows:

- *professional, scientific and technical services*
- *wholesale and retail trade*
- *structural metal product manufacturing*
- *road transport*
- *employment, travel agency and other administrative services*
- *cement lime and ready-mixed concrete manufacturing.*

For the NSW economy the *residential building construction, non-residential property operators and real estate services*, and *finance sector* are also important production induced flow-on sectors.

Consumption-induced flow-on effects in the region, associated with employing people who subsequently buy goods and services as households will be mainly experienced in the following sectors:

- *retail and wholesale trade*
- *food and beverage services*
- *health care services*
- *primary and secondary education*
- *residential care and social assistance services*
- *road transport*
- *professional, scientific and technical services.*

For the NSW economy the *finance, insurance and superannuation, non-residential property operators and real estate services, and employment, travel agency* sectors are also important consumption induced flow-on sectors.

4.2 Accommodation camps

Construction of the workforce accommodation camps (WACs) would result in spending in the *non-residential building construction* sector which includes construction of non-residential buildings such as hotels, motels, hospitals, industrial buildings etc. The impacts from construction of the WACs are a subcomponent of the impact of transmission and other infrastructure in Section 4.1. This assessment assumed that 90 per cent of the required direct construction workforce for

the project would reside in the workforce accommodation camps and that none of the wages of these people would be spent in the regional economy. In reality, some portion of construction workforce wages may be spent in the regional economy. Overall, construction of the WACs would represent a minor component of overall construction impacts and has not been assessed separately.

The operation of the WACs may also potentially have some regional economic impacts from purchases of goods and services from the regional economy. In this respect, the future Network Operator would have certain targets in relation to procurement of local goods and services. However, there may be a limit to local procurement because of local unavailability of required inputs. Notwithstanding, some small regional businesses may be able to supply some of the non-labour inputs to production.

4.3 Agriculture

The construction of the project would not impact any forestry activity during construction but would result in a reduction in the area available for agricultural activity – grazing and cropping.

Technical paper 2 – Agriculture prepared by Tremain Ivey Advisory (2023) provides an assessment of the impacts on agriculture from the project. The direct impact of construction on gross agricultural value of production is estimated to be $1.35 M per year (3,660 ha times a weighted average of $368.85/hectare/year). Using revenue, expenditure and employment ratios in the *sheep, grain, beef and dairy cattle* sector of the regional and NSW IO tables, the direct and indirect impact of this level of gross regional production is summarised in Tables 4.4 and 4.5.

Table 4.4 - Annual Regional Economic Impacts of Foregone Agriculture During Project Construction

	Direct	Production induced	Consumption induced	Total Flow on	TOTAL EFFECT
OUTPUT ($M)	1.35	0.69	0.35	1.04	2.39
Type 11A Ratio	1.00	0.51	0.26	0.78	1.78
VALUE ADDED ($M)	0.50	0.30	0.21	0.51	1.01
Type 11A Ratio	1.00	0.61	0.42	1.03	2.03
INCOME ($M)	0.20	0.16	0.09	0.25	0.45
Type 11A Ratio	1.00	0.80	0.42	1.22	2.22
EMPL. (No.)	3.98	2.73	1.57	4.30	8.28
Type 11A Ratio	1.00	0.68	0.39	1.08	2.08

Table 4.5 - Annual NSW Economic Impacts of Foregone Agriculture During Project Construction

	Direct	Production induced	Consumption induced	Total Flow on	TOTAL EFFECT
OUTPUT ($M)	1.35	1.23	1.15	2.38	3.73
Type 11A Ratio	1.00	0.91	0.85	1.76	2.76
VALUE ADDED ($M)	0.50	0.58	0.64	1.22	1.72
Type 11A Ratio	1.00	1.16	1.29	2.45	3.45
INCOME ($M)	0.24	0.36	0.33	0.69	0.93
Type 11A Ratio	1.00	1.51	1.38	2.89	3.89
EMPL. (No.)	3.98	4.42	4.38	8.80	12.78
Type 11A Ratio	1.00	1.11	1.10	2.21	3.21

Using the regional IO table, the direct and indirect agricultural impacts of the project during construction are less than 0.3 per cent[4] of agricultural activity in the region and a fraction of the economic activity gains from the project.

4.4 Other impacts

The construction of the project would create demand for regional labour resources and regional inputs to production. Where there is excess capacity in the regional economy, or the region has access to labour and other resources from outside the region this demand would increase economic activity in the region as per the above analysis.

Non-marginal changes in labour demand from an individual project can in the short run potentially lead to increased construction wages, attraction of workers from other relevant sectors of the economy leading to labour shortages in these other areas of the economy (and associated shortages of goods and services), rising inflation as firms pass wage costs onto consumers etc. The extent of these impacts for regional economies would depend on the balance of labour supply from inside the region and outside the region (drive-in drive-out (DIDO)/fly-in fly-out (FIFO)), as well as adjustment of the overall labour market to respond to increased demand e.g. increased labour force participation. In addition, in the short run excess demand for inputs to construction of an individual project such as quarry materials, concrete etc can result in rising costs for these factor inputs and potentially shortages for other uses.

Notwithstanding, whether, and the extent to which these types of effects would arise from an individual project is uncertain. For instance, a study by Deloitte Access Economics (2011) for Singleton Council found no evidence of price rises (house prices, rents, or groceries) in the Singleton economy relative to non-mining regional economies. In any case, any "crowding out" of other economic activities represents the operation of the market system where scarce resources are reallocated to where they are most highly valued and where society would benefit the most from them. This reallocation of resources is therefore a positive thing for the economy not a negative. Notwithstanding, it may be associated with social impacts.

[4] This is slightly different to the estimated impact in Technical paper 2 – Agriculture, because this estimate includes direct and indirect impacts, is relevant across all the economic indicators, not just output, and the value of agriculture in the IO table is estimated based on the National IO tables rather than ABS LGA data.

5 Operational assessment

5.1 Transmission and other infrastructure

For the analysis of the operational phase of the project, a new project operation sector was inserted into regional and NSW IO tables reflecting average annual operation.

This sector was based on an estimated project operational workforce of 50 (100 per cent of which are assumed to reside in the region) and an output and expenditure profile as per the coefficients in the *electricity transmission, distribution, on selling and electricity market operation* sector of the regional and NSW IO models. The direct and indirect impact of this sector was estimated using the *EconImp* program.

5.1.1 Impacts

The total and disaggregated average annual economic impacts of the project on the regional and NSW economy (in 2022 dollars) is shown in Tables 5.1 and 5.2.

Table 5.1 - Annual Economic Impacts of the Project on the Regional Economy

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($M)	70	51	13	64	134
Type 11A Ratio	1.00	0.74	0.19	0.93	1.93
VALUE ADDED ($M)	26	20	8	28	54
Type 11A Ratio	1.00	0.77	0.30	1.07	2.07
INCOME ($M)	6	8	3	11	17
Type 11A Ratio	1.00	1.19	0.51	1.70	2.70
EMPL. (No.)	50	79	60	139	189
Type 11A Ratio	1.00	1.57	1.19	2.76	3.76

Table 5.2 - Annual Economic Impacts of the Project on the NSW Economy

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($M)	70	73	43	116	186
Type 11A Ratio	1.00	1.05	0.62	1.67	2.67
VALUE ADDED ($M)	26	31	24	55	81
Type 11A Ratio	1.00	1.20	0.92	2.12	3.12
INCOME ($M)	6	16	12	28	34
Type 11A Ratio	1.00	2.49	1.93	4.42	5.42
EMPL. (No.)	50	142	164	306	356
Type 11A Ratio	1.00	2.85	3.27	6.12	7.12

The project is estimated to make up to the following total annual contribution to the regional economy:

- $134M in annual direct and indirect regional output
- $54M in annual direct and indirect regional value-added
- $17M in annual direct and indirect household income
- 189direct and indirect jobs.

The project is estimated to make up to the following total annual contribution to the NSW economy:

— $186M in annual direct and indirect regional output.

— $81M in annual direct and indirect regional value-added

— $34M in annual direct and indirect household income

— 356 direct and indirect jobs.

The impacts are larger for the NSW economy because there is less leakage of direct and indirect expenditure out of the NSW economy compared to the regional economy.

5.1.2 Multipliers

The Type 11A ratio multipliers for the project's impact on the regional economy range from 1.93 for output up to 3.76 for employment. Capital intensive industries such as electricity transmission[5] tend to have a high level of linkage with other sectors in an economy thus contributing substantial flow-on employment and income while at the same time only having a lower level of direct employment and income (relative to output levels). This tends to lead to a relatively high ratio multiplier for employment and income. Capital intensive projects also typically have a relatively low ratio multiplier for output and value-added reflecting the relatively high direct output and value-added compared to that in flow-on sectors.

The NSW Type 11A ratio multipliers for the project range from 2.67 for value-added up to 7.12 for employment. The multipliers are large for the NSW economy because of the greater level of intersectoral linkages in the larger economy and hence larger level of flow-on impacts i.e. less leakages compared to the regional economy.

5.1.3 Main Sectors Affected

Project operation is most likely to directly impact the *electricity transmission, distribution, on selling and electricity market operation* sector. Flow-on impacts from the operation of the project are likely to affect several different sectors of the regional and NSW economy.

The sectors of the regional economy most impacted by output, value-added, income and employment production induced flow-ons, are likely to be as follows:

— electricity generation

— electricity transmission, distribution, on selling and electricity market operation

— construction services

— professional, scientific, and technical services

— finance

— auxiliary finance and insurance services

— wholesale and retail trade

— employment, travel agency and other administrative services.

For the NSW economy the *non-residential property operators and real estate services, road transport, transport support services and storage, and structural metal product manufacturing* are also important production induced flow-on sectors.

[5] Electricity transmission is a capital intensive industry because it requires little labour in comparison to its economic output.

Consumption-induced flow-on effects in the region, associated with employing people who subsequently buy goods and services as households would be mainly experienced in the following sectors:

— retail and wholesale trade

— food and beverage services

— health care services

— primary and secondary education

— residential care and social assistance services

— road transport

— professional, scientific, and technical services.

For the NSW economy the *finance, insurance and superannuation, non-residential property operators and real estate services, and employment, travel agency* sectors are also important consumption induced flow-on sectors.

Businesses that can provide the inputs to the production process required by the project and/or the products and services required by the workforce would directly benefit from the project by way of an increased economic activity. However, because of the inter-linkages between sectors, many indirect businesses also benefit.

5.2 Accommodation camps

The WACs would not operate during the operation phase of the project and hence no regional or NSW economic impacts would occur.

5.3 Agriculture

The project would not impact any forestry activity during production but would result in a reduction in the area available for agricultural activity – grazing and cropping.

As provided in Technical paper 2 – Agriculture, the estimated direct impact of the project operation on gross agricultural production is $317,550 per year (825ha times a weighted average of $384.91/ha/yr). Using revenue, expenditure and employment ratios in the *sheep, grain, beef and dairy cattle* sector of the regional and NSW IO table, the direct and indirect impact of this level of gross regional production is summarised in Tables 5.3 and 5.4.

Table 5.3 - Annual Regional Economic Impacts of Foregone Agriculture During Project Operation

	Direct	Production induced	Consumption induced	Total Flow on	TOTAL EFFECT
OUTPUT ($M)	0.32	0.16	0.08	0.24	0.56
Type 11A Ratio	1.00	0.51	0.26	0.77	1.77
VALUE ADDED ($M)	0.12	0.07	0.05	0.12	0.24
Type 11A Ratio	1.00	0.61	0.42	1.03	2.03
INCOME ($M)	0.05	0.04	0.02	0.06	0.11
Type 11A Ratio	1.00	0.80	0.42	1.22	2.22
EMPL. (No.)	0.94	0.64	0.37	1.01	1.95
Type 11A Ratio	1.00	0.68	0.39	1.08	2.08

Table 5.4 - Annual NSW Economic Impacts of Foregone Agriculture During Project Operation ($2022)

	Direct	Production induced	Consumption induced	Total Flow on	TOTAL EFFECT
OUTPUT ($M)	0.32	0.29	0.27	0.56	0.88
Type 11A Ratio	1.00	0.91	0.85	1.76	2.76
VALUE ADDED ($M)	0.12	0.14	0.15	0.29	0.41
Type 11A Ratio	1.00	1.16	1.29	2.45	3.45
INCOME ($M)	0.06	0.08	0.08	0.16	0.22
Type 11A Ratio	1.00	1.51	1.38	2.89	3.89
EMPL. (No.)	0.94	1.04	1.03	2.07	3.01
Type 11A Ratio	1.00	1.11	1.10	2.21	3.21

Using the regional IO table, the direct and indirect agricultural impacts of the project during operation are less than 0.06 per cent[6] of agricultural activity in the region and a fraction of the economic activity gains from the project operation.

5.4 Other impacts

The operation of the proposed transmission and other infrastructure would create a small demand for regional labour resources and regional inputs to production. Consequently, no "crowding out" effects on other industry sectors are anticipated.

[6] This is slightly different to the estimated impact in Technical paper 2 – Agriculture, because this estimate includes direct and indirect impacts, is relevant across all the economic indicators, not just output, and the value of agriculture in the IO table is estimated based on the National IO tables rather than ABS LGA data.

6 Recommended management and mitigation measures

Construction and operation of the project would provide positive economic activity to the regional and State economy. However, at the same time it would create a large demand for a suitably qualified construction workforce in regional areas.

The inclusion of the workforce accommodation camps has been proposed to ensure that the project does not significantly increase competition for labour and housing in the region. Notwithstanding, it is the intention of the project to provide positive local employment and business opportunities for the region.

These benefits can be maximised via the promotion of local workforce and industry participation via the preparation and implementation of a Local Workforce Participation Strategy and Industry Participation Plan, both of which are included as mitigation measures in Technical paper 7 – Social.

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Limitations

The Economic Assessment predates the engagement of the future Network Operator, and so is based on a number of assumptions about direct regional employment, income of employees and regional procurement.

Appendix 1 - The GRIT System for Generating Input-Output Tables

The Generation of Regional Input–Output Tables (GRIT) system was designed to:

- combine the benefits of survey based tables (accuracy and understanding of the economic structure) with those of non–survey tables (speed and low cost);
- enable the tables to be compiled from other recently compiled tables;
- allow tables to be constructed for any region for which certain minimum amounts of data were available;
- develop regional tables from national tables using available region–specific data;
- produce tables consistent with the national tables in terms of sector classification and accounting conventions;
- proceed in a number of clearly defined stages; and
- provide for the possibility of ready updates of the tables.

The resultant GRIT procedure has a number of well–defined steps. Of particular significance are those that involve the analyst incorporating region–specific data and information specific to the objectives of the study. The analyst has to be satisfied about the accuracy of the information used for the important sectors. The method allows the analyst to allocate available research resources to improving the data for those sectors of the economy that are most important for the study.

An important characteristic of GRIT–produced tables relates to their accuracy. In the past, survey–based tables involved gathering data for every cell in the table, thereby building up a table with considerable accuracy. A fundamental principle of the GRIT method is that not all cells in the table are equally important. Some are not important because they are of very small value and, therefore, have no possibility of having a significant effect on the estimates of multipliers and economic impacts. Others are not important because of the lack of linkages that relate to the particular sectors that are being studied. Therefore, the GRIT procedure involves determining those sectors and, in some cases, cells that are of particular significance for the analysis. These represent the main targets for the allocation of research resources in data gathering. For the remainder of the table, the aim is for it to be 'holistically' accurate (Jensen, 1980). This means a generally accurate representation of the economy is provided by the table, but does not guarantee the accuracy of any particular cell. A summary of the steps involved in the GRIT process is shown in Table A1.1 (Powell and Chalmers, 1995).

Table A1.1

The GRIT Method

Phase	Step	Action
PHASE I		ADJUSTMENTS TO NATIONAL TABLE
	1	Selection of national input–output table (1114–sector table with direct allocation of all imports, in basic values).
	2	Adjustment of national table for updating.
	3	Adjustment for international trade.
PHASE II		ADJUSTMENTS FOR REGIONAL IMPORTS
		(*Steps 4–14 apply to each region for which input–output tables are required*)
	4	Calculation of 'non–existent' sectors.
	5	Calculation of remaining imports.
PHASE III		DEFINITION OF REGIONAL SECTORS
	6	Insertion of disaggregated superior data.
	7	Aggregation of sectors.
	8	Insertion of aggregated superior data.
PHASE IV		DERIVATION OF PROTOTYPE TRANSACTIONS TABLES
	9	Derivation of transactions values.
	10	Adjustments to complete the prototype tables.
	11	Derivation of inverses and multipliers for prototype tables.
PHASE V		DERIVATION OF FINAL TRANSACTIONS TABLES
	12	Final superior data insertions and other adjustments.
	13	Derivation of final transactions tables.
	14	Derivation of inverses and multipliers for final tables.

Source: Bayne and West (1988).

Appendix 2 - Underlying Assumptions and Interpretations of Input-Output Analysis and Multipliers

1. "The *basic assumptions* in IO (input-output) analysis include the following:

- there is a fixed input structure in each industry, described by fixed technological coefficients (evidence from comparisons between IO tables for the same country over time have indicated that material input requirements tend to be stable and change but slowly; however, requirements for primary factors of production, that is labour and capital, are probably less constant);
- all products of an industry are identical or are made in fixed proportions to each other;
- each industry exhibits constant returns to scale in production;
- unlimited labour and capital are available at fixed prices; that is, any change in the demand for productive factors will not induce any change in their cost (in reality, constraints such as limited skilled labour or investment funds lead to competition for resources among industries, which in turn raises the prices of these scarce factors of production and of industry output generally in the face of strong demand); and
- there are no other constraints, such as the balance of payments or the actions of government, on the response of each industry to a stimulus.

2. The multipliers therefore describe average effects, not marginal effects, and thus do not take account of economies of scale, unused capacity or technological change. Generally, average effects are expected to be higher than the marginal effects.

3. The IO tables underlying multiplier analysis only take account of one form of interdependence**,** namely the sales and purchase links between industries. Other interdependence such as collective competition for factors of production, changes in commodity prices which induce producers and consumers to alter the mix of their purchases and other constraints which operate on the economy as a whole are not generally taken into account.

4. The combination of the assumptions used and the excluded interdependence means that IO multipliers are higher than would realistically be the case. In other words, they tend to overstate the potential impact of final demand stimulus. The overstatement is potentially more serious when large changes in demand and production are considered.

5. The multipliers also do not account for some important pre–existing conditions. This is especially true of Type II multipliers, in which employment generated and income earned induce further increases in demand. The implicit assumption is that those taken into employment were previously unemployed and were previously consuming nothing. In reality, however, not all 'new' employment would be drawn from the ranks of the unemployed; and to the extent that it was, those previously unemployed would presumably have consumed out of income support measures and personal savings. Employment, output and income responses are therefore overstated by the multipliers for these additional reasons.

6. The most appropriate interpretation of multipliers is that they provide a relative measure (to be compared with other industries) of the interdependence between one industry and the rest of the economy which arises

solely from purchases and sales of industry output based on estimates of transactions occurring over a (recent) historical period. Progressive departure from these conditions would progressively reduce the precision of multipliers as predictive device" (ABS 1995, p.24).

Multipliers indicate the total impact of changes in demand for the output of any one industry on all industries in an economy (ABS, 1995). Conventional output, employment, value–added and income multipliers show the output, employment, value–added and income responses to an initial output stimulus (Jensen and West, 1986).

Components of the conventional output multiplier are as follows:

Initial effect – which is the initial output stimulus, usually a $1 change in output from a particular industry (Powell and Chalmers, 1995; ABS, 1995).

First round effects – the amount of output from all intermediate sectors of the economy required to produce the initial $1 change in output from the particular industry (Powell and Chalmers, 1995; ABS, 1995).

Industrial support effects – the subsequent or induced extra output from intermediate sectors arising from the first round effects (Powell and Chalmers, 1995; ABS, 1995).

Production induced effects – the sum of the first round effects and industrial support effects (i.e. the total amount of output from all industries in the economy required to produce the initial $1 change in output) (Powell and Chalmers, 1995; ABS, 1995).

Consumption induced effects – the spending by households of the extra income they derive from the production of the extra $1 of output and production induced effects. This spending in turn generates further production by industries (Powell and Chalmers, 1995; ABS, 1995).

The *simple multiplier* is the initial effect plus the production induced effects.

The *total multiplier* is the sum of the initial effect plus the production–induced effect and consumption–induced effect.

Conventional employment, value–added and income multipliers have similar components to the output multiplier, however, through conversion using the respective coefficients show the employment, value–added and income responses to an initial output stimulus (Jensen and West, 1986).

For employment, value–added and income, it is also possible to derive relationships between the initial or own sector effect and flow–on effects. For example, the flow–on income effects from an initial income effect or the flow–on employment effects from an initial employment effect, etc. These own sector relationships are referred to as ratio multipliers, although they are not technically multipliers because there is no direct line of causation between the elements of the multiplier. For instance, it is not the initial change in income that leads to income flow–on effects, both are the result of an output stimulus (Jensen and West, 1986).

A description of the different ratio multipliers is given below.

$$\text{Type 1A Ratio Multiplier} = \frac{\text{Initial + First Round Effects}}{\text{Initial Effects}}$$

$$\text{Type 1B Ratio Multiplier} = \frac{\text{Initial + Production Induced Effects}}{\text{Initial Effects}}$$

$$\text{Type 11A Ratio Multiplier} = \frac{\text{Initial + Production Induced + Consumption Induced Effects}}{\text{Initial Effects}}$$

$$\text{Type 11B Ratio Multiplier} = \frac{\text{Flow–on Effects}}{\text{Initial Effects}}$$

Source: Centre for Farm Planning and Land Management (1989).