APPENDIX O AMENDED ECONOMIC ASSESSMENT

Bendemeer Solar Farm
Amended Economic Assessment

Prepared for

Athena Energy Australia (Holdings) Pty Ltd

By

Gillespie Economics

Email: gillecon@bigpond.net.au

Web: gillespieeconomics.com

April 2025

CONTENTS

EXECUTIVE SUMMARY **2**

1 INTRODUCTION **5**

1.1 BACKGROUND 5
1.2 PROJECT DESCRIPTION 5
1.3 ASSESSMENT GUIDELINES AND REQUIREMENTS 0
1.4 STRUCTURE OF THE REPORT 0

2 METHODOLOGY **1**

2.1 OVERVIEW 1
2.2 STUDY AREA 1
2.3 DESCRIPTION OF THE REGIONAL ECONOMY 1
2.4 INPUT-OUTPUT ANALYSIS 1

3 THE REGIONAL ECONOMY **3**

3.1 INTRODUCTION 3
3.2 RESIDENTS OF THE REGION 3
3.3 ECONOMIC ACTIVITY IN THE REGION 6

INDUSTRY **9**

GROSS VALUE ADDED ($M) **9**

PROPORTION OF REGIONAL ECONOMY (%) **9**

PROPORTION OF REGIONAL EMPLOYMENT (%) **9**

4 CONSTRUCTION ASSESSMENT **10**

4.1 THE PROJECT 10
4.1.1 Impacts *10*
4.1.2 Multipliers *13*
4.1.3 Main Sectors Affected *13*
4.2 AGRICULTURAL IMPACTS 14
4.3 OTHER IMPACTS 15

5 OPERATION PHASE **16**

5.1 THE PROJECT 16
5.1.1 Impacts *16*
5.1.2 Multipliers *17*
5.1.3 Main Sectors Affected *17*
5.2 AGRICULTURAL IMPACTS 18
5.3 OTHER IMPACTS 19

6 CUMULATIVE IMPACTS **20**

6.1 APPROACH TO CUMULATIVE IMPACTS 20
6.2 POTENTIAL CUMULATIVE IMPACTS 23

7 MITIGATION AND MANAGEMENT MEASURES **24**

8 CONCLUSION **25**

9 REFERENCES **26**

ATTACHMENT 1 – THE GRIT SYSTEM FOR GENERATING INPUT-OUTPUT TABLES **27**

ATTACHMENT 2 – UNDERLYING ASSUMPTIONS AND INTERPRETATIONS OF INPUT-OUTPUT ANALYSIS AND MULTIPLIERS **29**

EXECUTIVE SUMMARY

This Amended Economic Assessment has been prepared for the Bendemeer Solar Farm (the Project) for Athena Energy Australia (Holdings) Pty Ltd.

This report supports a State Significant Development (SSD) Development Consent approval under Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979* (SSD-36651552).

The Bendemeer Solar Farm Environmental Impact Statement (EIS) was submitted to the NSW Department of Planning and Environment (DPE: now the Department of Planning, Housing, and Infrastructure (DPHI)) and publicly exhibited between 27 July 2023 and 23 August 2023. Following the public exhibition of the EIS, a total of 244 submissions relating to the Project EIS were received from government agencies, local council, organisations, and members of the public. A Submissions Report has been prepared to respond to matters raised in these submissions and agency advice, as well as an Amendment Report to assess impacts associated with the amended Project.

This report assesses the potential economic impacts of the construction and operation of the amended Project on the regional and NSW economy.

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

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 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.

Methodology

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.

Existing environment

The regional economy is defined as the combined LGAs of Tamworth Regional, Armidale Regional, Uralla and Walcha. This is the region within which the Project is located, which has the potential to provide inputs to the Project and to derive economic benefits from the construction and operation of the Project. The population of the region in 2021 was 101,181 and has been growing at approximately half the rate of NSW. Tamworth Regional LGA accounts for 62 per cent of the total population and 63 per cent of the total labour force. Together the Tamworth Regional LGA and Armidale Regional LGA account for 92 per cent of the regional population and regional labour force. Aggregated one-digit Australian and New Zealand Industry Classification (ANZSIC) place of work data indicates the significance of the *Health Care and Social Assistance* sectors followed by *Education and Training sectors,* and *Retail Trade sectors*. However, the main employment in the region varies between LGAs. The main employment sector in the Tamworth Regional LGA is *Health Care and Social Assistance*, while the main employment sector in the Armidale Regional LGA is *Education and Training*. The main employment sector in both the Uralla and Walcha LGAs is *Agriculture, Forestry and Fishing*.

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 in the region by value are *Manufacturing, Education and Training, Construction* and *Agriculture, Forestry and Fishing.*

Potential construction impacts

Average annual direct construction employment (full time equivalent) from the Project is estimated at 250 workers.[1] The average construction impacts of the Project on the regional economy for one year are estimated at up to:

- $161M in annual direct and indirect output.
- $61M in annual direct and indirect value-added.
- $32M in annual direct and indirect household income.
- 451 direct and indirect jobs.

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

- $279M in annual direct and indirect output.
- $121M in annual direct and indirect value added.
- $76M in annual direct and indirect household income.
- 846 direct and indirect jobs.

These economic activity impacts are slightly lower than reported for the EIS (original) Project because of the lower average annual employment during the peak year of construction for the amended Project. Direct employment is the key driver of the economic modelling approach.

The construction phase of the Project will result in a temporary reduction in up to 606.9 ha of land available for agricultural activity – sheep and beef grazing. The economic activity impacts associated with this were assessed and identified as negligible relative to the economic activity impacts of the Project construction.

The construction of the Project will create demand for regional labour resources and regional inputs to production. However, this is not expected to lead to any observable impacts on regional wages or prices.

Potential operational impacts

The Project is estimated to make the following maximum total annual contribution to the regional economy during operation:

- $32M in annual direct and indirect regional output.
- $21M in annual direct and indirect regional value-added.
- $3M in annual direct and indirect household income.
- 35 direct and indirect jobs.

The Project operation is estimated to make the following maximum total annual contribution to the NSW economy:

- $44M in annual direct and indirect regional output.
- $27M in annual direct and indirect regional value-added.
- $7M in annual direct and indirect household income.
- 71 direct and indirect jobs.

These economic activity impacts are the same as reported for the EIS (original) Project because the amended Project has the same operational employment, which is the key driver of the economic modelling approach.

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.

[1] The IO model of the regional economy is based on average annual revenue, expenditure, and employment for each industry sector. So, to model impacts it is necessary to base it on average annual employment impacts rather than peak employment of 307.

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 Project operation will have more minor impacts than the construction phase i.e., 18.5 ha being unavailable for agriculture because of the BESS substation and associated infrastructure, and the remaining 588.4 ha having a 20% reduction in the livestock stocking rate. This level of agricultural impact during the operation of the Project is negligible.

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

The residual impacts of the Project on adjoining land values, after implementation of management and mitigation measures are predicted to be minimal.

Cumulative impact assessment

The main cumulative economic impact of this and other prospective projects in the region is to generate large demand for a suitably qualified construction workforce in the region and surrounds. This demand can help address the jobs growth imbalance between Australia's biggest cities and regions. The Project will provide opportunities for the existing and future regional workforces, attracting middle skilled and high skilled workers and families to regional areas, reducing outmigration of the regional workforce to look for employment in cities, and increase regional labour force participation.

Notwithstanding, cumulative demand for construction workers can in the short run potentially lead to increased construction wages, attraction of workers from other relevant sub-sectors and 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. The extent of these impacts for regional economies will depend on the balance of labour supply from inside the region, outside the region and drive-in drive-out (DIDO)/fly-in fly-out (FIFO), as well as adjustment of the overall labour market to respond to increased demand.

In addition, in the short run excess demand for inputs to construction such as quarry materials and concrete can result in rising costs for these factor inputs and potentially shortages for other uses.

These potential impacts will be more likely and larger as a result of cumulative projects across the region and the State, than from the individual project.

Management measures

The positive local employment and business opportunities can be maximised via:

- Employment of regional residents where they have the required skills and experience.
- Participating, as appropriate, in business groups, events or programs in the regional community.
- Locally sourcing non-labour inputs to production where local producers can be cost and quality competitive.
- Establishment of a Community Benefit Fund to be managed through a Voluntary Planning Agreement with Tamworth Regional Council with the intention of supporting local non-profit organisations, community programs/events, local businesses, training, and services/infrastructure.
- Lease payments to host landowners that provide an alternative drought proof income with potential flow-on benefits to the regional economy.
- Continued agricultural activities during the operational phase of the Project and reinstatement of full pre-project agricultural production following project decommissioning.

1 INTRODUCTION

1.1 Background

This Amended Economic Assessment has been prepared for the Bendemeer Solar Farm (the Project) for Athena Energy Australia (Holdings) Pty Ltd (Applicant).

This report supports a State Significant Development (SSD) Development Consent approval under Part 4, Division 4.7 of the Environmental Planning and Assessment Act 1979 (SSD-36651552).

The Bendemeer Solar Farm Environmental Impact Statement (EIS) was submitted to the NSW Department of Planning and Environment (DPE; now the Department of Planning, Housing, and Infrastructure (DPHI)) and publicly exhibited between 27 July 2023 and 23 August 2023. Following the public exhibition of the EIS, a total of 244 submissions relating to the Project EIS were received from government agencies, local council, organisations and members of the public. A Submissions Report has been prepared to respond to matters raised in these submissions and agency advice, as well as an Amendment Report to assess impacts associated with the amended Project.

1.2 Project Description

The Project is situated about 1.8 kilometres (km) east of the Bendemeer town centre, represented by the Bendemeer Hotel, and is located 46 km (by road) north-east of the Tamworth Post Office to the Project access. The Project is located within the New England Renewable Energy Zone (REZ), in the Tamworth Regional Council Local Government Area (LGA) in the New England Region of NSW. The Project Area extends across an area of approximately 606.9 hectares (ha), over three freehold land parcels, on land that is predominately used for agricultural activities.

The Project will involve the construction, operation and decommissioning of a photovoltaic (PV) solar farm, Battery Energy Storage System (BESS) and associated infrastructure. The Project includes:

- Solar Arrays with a Capacity of approximately 255[2] megawatts (MW) Direct Current (DC) and registered connection capacity of 200 MW Alternating Current (AC);
- BESS with a capacity of up to 150 MW / 300 MWh;
- Electricity infrastructure:
    - Power Conversion Units (PCU) housing up to 60 inverters;
    - One 33/330 kV collector substation and associated internal structures;
    - Switching station;
    - Electrical reticulation infrastructure including underground and overhead 33 kV cables;
    - Direct grid connection to existing 330 kV line 85 Armidale-Tamworth Transmission line;
- On-site permanent supporting infrastructure:
    - Site access road, entry and internal access roads;
    - Operations and Maintenance (O&M) Facility including control room, meeting facilities, storage facilities, SCADA facilities, workshop, parking, ablutions buildings, septic, static water supply, waste management facilities, lighting and maintenance facility, fencing and asset protection zones;
- Off-site supporting infrastructure:
    - Tamworth waste and wastewater disposal facilities;
    - Existing public road network; and
- 24 hours a day, seven days per week operation with up to 15 Full Time Equivalent (FTE) personnel.

Table 1.1 provides a comparison between the Project as presented in the EIS and the proposed amendment, as relevant to this assessment. The amended Project description and summary address the matters raised in submissions of the Project EIS and outcomes of ongoing engagement with the community, government agencies, landowners, and other stakeholders.

[2]The small change in capacity compared to an earlier version of this report, 257 MW, has no material impact on the modelled economic impacts.

Table 1.1 - Amended Project Summary

Project Elements	EIS (original) Project	Amended Project	Difference between EIS and Amended Project
Project Area	• 606.4 ha	• 606.9 ha	• Negligible (0.08% increase)
Disturbance Footprint	• 476.6 ha	• 369.2 ha	• Reduction by 107.4 ha (23%)
Solar Arrays	• 280 MW DC • 430,000 PV modules • 350.8 ha • 4.2 m panel height	• 255 MW DC • 354,330 PV modules • 301.0 ha • 2.66 m panel height	• DC capacity reduced by 25 MW (8%) • PV modules reduced by 75,670 modules (18%) • Area reduced by 49.8 ha (14%) • Panel height reduced by 1.54 m
BESS	• 150 MW/ 300 MWh • 3.2 ha • 120 BESS units • Lithium Iron Phosphate (LFP) or Nickel-Manganese-Cobalt (NMC) battery technology • Lot 2 DP 1211502 • 4 m high noise walls in the BESS Layout	• 150 MW/ 300 MWh • 1.9 ha • 264 BESS units • LFP battery technology • Lot 2 DP 1211502 • 4 m high noise walls in the BESS Layout	• No change in capacity • Area reduced by 1.3 ha (41%) • BESS units increased by 144 (120%) • Commitment to LFP battery technology • No change in location • No change in noise walls mitigation measure
Solar PV Power Conversion Units (PCU)	• 60 PCUs housing up to 60 inverters (within main solar area) • Lots 1, 2 and 3 of DP 1211502 • 3.5 m high noise walls for 14 inverters within solar array area	• 60 PCUs housing up to 60 inverters (within main solar area) • Lots 1, 2 and 3 of DP 1211502 • 3.5 m high noise walls for 28 inverters within solar array area • Noise attenuation kits for all 60 inverters within solar array area	• No change in number of PCUs or inverters (within main solar area) • Construction of noise walls for 14 additional inverters • Addition of noise attenuation kits for all inverters
Inverters	• 40 inverters within BESS with noise attenuation kits	• 44 inverters within BESS with noise attenuation kits	• Inverters increased by 4 units (10%) due to refinement in BESS and inverter proposed makes and models and to achieve National Electricity Rule compliance at the proposed 150 MW capacity
Substation and Switching station	• One 33/330 kV collector substation and associated structures • 330 kV switching station • 2.9 ha	• One 33/330 kV collector substation and associated structures • 330 kV switching station • 2.37 ha	• Reduced by 0.53 ha (18%) and slightly relocated 25 m further east • Addition of 6 m high noise walls around the substation transformers

Project Elements	EIS (original) Project	Amended Project	Difference between EIS and Amended Project
		• 6 m high noise walls around the substation transformers	
Electrical Reticulation Infrastructure	• Internal underground high-voltage (HV) cables between solar arrays, BESS and transformers and overhead 330 kV conductors • Approximately 100 m distance between the switching station and existing 330 kV line • Direct grid connection to existing 330 kV line	• Internal underground HV cables between solar arrays, BESS and transformers and overhead 330 kV conductors • Approximately 48 m distance between the switching station and existing 330 kV line • Direct grid connection to existing 330 kV line	• No change
On-site Permanent Supporting Infrastructure	Site access road, entry and internal roads		
	• APZ of minimum 10 m (PV modules), 17 m (BESS and Substation) and 12 m (associated infrastructure) • Internal roads 29.7 ha Perimeter and internal roads up to 6m wide, aligned on APZs and/or existing farm or other access tracks, where possible • Site access via B56 Oxley Highway	• APZ of minimum 10 m (PV modules), 12-31 m (BESS, Substation and associated infrastructure) • Internal roads 13.48 ha Perimeter and internal roads up to 6m wide, aligned on APZs and/or existing farm or other access tracks, where possible • Site access via B56 Oxley Highway, with internal roads realigned to avoid existing vegetation	• No change in APZ minimum for PV modules • Allowance for a minimum 12-31 m APZ width for BESS, Substation and associated infrastructure based on surrounding vegetation categorisation, including slight disturbance footprint adjustment to accommodate minimum 31 m APZ adjacent to some areas of the BESS • Internal roads reduced by 16.22 ha (55%) • No change in maximum road width • Minor (~10 m) adjustment of site access road location
	Operations and Maintenance (O&M) Facility		
	• Located within the construction compound and laydown area, to the north of the substation and BESS compound • 0.65 ha • 12 m APZ • 100 kL static water tank	• Located within the substation and BESS compound • 0.91 ha • 12-31 m APZ • 2x 100 kL static water tanks	• Relocated south of existing transmission line • Area increased by 0.26 ha (40%) • Adjustment of APZ width based on vegetation adjacent to the new location • Addition of a static water tank with total volume increased by 100 kL (100%)
Construction			

Project Elements	EIS (original) Project	Amended Project	Difference between EIS and Amended Project
Construction Duration	• Approximately 18 months	• Approximately 18 months	• No change in duration
Construction Workforce	• Peak workforce of approximately 307 Full Time Equivalent (FTE) (some additional contractor personnel) and average annual workforce of 260 FTE for the peak 12-month of construction of the Project	• Peak workforce of approximately 307 FTE (some additional contractor personnel) and average annual workforce of 250 FTE for the peak 12-month of construction of the Project	• 10 FTE reduction for peak 12-month average annual workforce (4%)
On-site Temporary Infrastructure	• Construction compound and laydown area located north of existing transmission line • 11.6 ha	• Construction compound and laydown area located to south of existing transmission line • 4.8 ha	• Relocated south of existing transmission line • Area reduced by 6.8 ha (59%)
Services and Utilities	• Adjustment, protection or relocation of existing utilities	• Adjustment, protection or relocation of existing utilities	• No change
Ancillary Activities	• Import of external gravel, aggregate and sand to site for on-site construction use	• Import of external gravel, aggregate and sand to site for on-site construction use	• No change
Traffic and Transport Route	• Main equipment deliveries via Port of Newcastle or Port of Brisbane • 62 heavy vehicles and 48 light vehicles movements per day during peak construction • Associated external road upgrades (also used for operational maintenance or decommissioning activities)	• Main equipment deliveries via Port of Newcastle or Port of Brisbane or Port of Melbourne • 94 heavy vehicles and 76 light vehicles movements per day during peak construction with an additional 36 shuttle bus movements • Associated external road upgrades (also used for operational maintenance or decommissioning activities)	• Port of Melbourne may also be used for deliveries of Project equipment • During peak construction increase in daily heavy vehicle movements by 32 (52%) and light vehicles by 46 (96%) • No upgrades to external roads required
Operations			
Duration	• Development Consent in perpetuity • Infrastructure life minimum of 30 years	• Development Consent in perpetuity • Infrastructure life minimum of 30 years	• No change

Project Elements	EIS (original) Project	Amended Project	Difference between EIS and Amended Project
Hours of Operation	• 24 hours a day, seven days a week	• 24 hours a day, seven days a week	• No change
Operational Workforce	• Approximately 15 FTE	• Approximately 15 FTE	• No change

1.3 Assessment guidelines and requirements

The Economic Assessment was prepared in accordance with the requirements of the DPE (now DPHI), which are set out in the project-specific Secretary's Environmental Assessment Requirements (SEARs), dated 15 March 2022. The SEARs identify matters which must be addressed in the EIS. Table 1.2 lists the requirements relevant to this Economic Assessment and where they are addressed in this report.

Table 1.2 - Relevant matters raised in SEARs

Requirement	Section addressed
The EIS must include:	
an assessment of the economic impacts or benefits of the project for the region and the State as a whole.	Chapters 4, 5 and 6 of this report.
detailed economic assessment of impacts on agricultural land, agricultural production, and agricultural supply chains.	Chapters 4 and 5 of this report and the Soil and Agricultural Impact Statement.

To inform preparation of the SEARs, DPE (now DPHI) invited relevant government agencies to advise on matters to be addressed in the EIS. These matters were considered by the Secretary for DPE (now DPHI) when preparing the SEARs.

There are no economic assessment guidelines for SSD solar farm projects.

1.4 Structure of the report

This report is structured as follows:

- Section 2 outlines the methodology used for the Economic Assessment.
- Section 3 provides an overview of the regional economy within which the Project is located.
- Section 4 assesses the economic impacts of construction of the Project on the regional and NSW economy.
- Section 5 assesses the economic impacts of operation of the Project on the regional and NSW economy.
- Section 6 considers potential cumulative impacts on the region and State.
- Section 7 identifies measures to mitigate and manage economic impacts.
- Section 8 provides the conclusions of the assessment.

2 METHODOLOGY

2.1 Overview

The Project would generate economic activity within the regional and NSW economy, during both construction and operation. It would also result in a minor 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/regional economy for this economic impact assessment is defined as the combined LGAs of Tamworth Regional, Armidale Regional, Uralla and Walcha. This is the region within which the Project is located, which has the potential to provide inputs to, 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

Prior to the assessment of impacts using IO analysis, a description of the regional economy is provided. This 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 Australian and New Zealand Standard Industrial Classification (ANZSIC), to provide a more complete picture of the regional economy.

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.

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 A1.
- 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 Athena and production ratios in the IO tables. Indirect effects were estimated using the *EconImp* program.[3]

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).

[3] 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 A2. 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 THE REGIONAL ECONOMY

3.1 Introduction

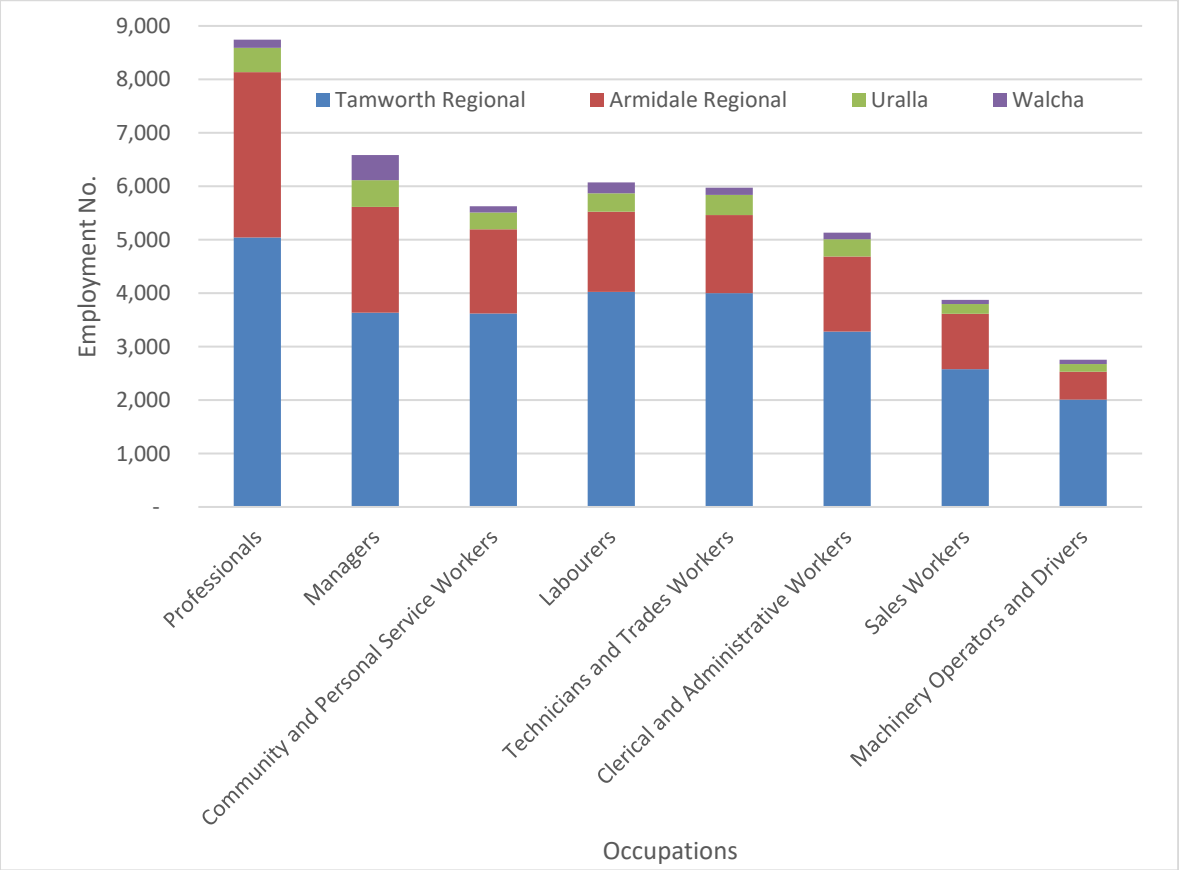
This section characterises the regional economy from two perspectives, residents of the region and workers in the region.

3.2 Residents of the Region

Table 3.1 provides some characteristics of the usual residents of the regional economy based on the 2021 ABS Census of Population and Housing. In 2021, the region had a population of 101,181 and a labour force of 47,687, with Tamworth Regional LGA accounting for 62 per cent of the total population and 63 per cent of the total labour force. Together the Tamworth Regional LGA and Armidale Regional LGA account for 92 per cent of the regional population and regional labour force. In the 2021 Census, 2,187 people (about 4.7 per cent of the total regional labour force) identified as being unemployed with the majority of these located in the Tamworth Regional LGA.

The main occupations of usual residents[4] in the region (Figure 3.1) were Professionals (19.5 per cent) followed by Managers (which includes farm managers) (14.7 per cent) and Labourers (13.6 per cent). While Tamworth Regional LGA has the greatest number of all occupations, the relative importance of different occupations varies by LGA. In Tamworth Regional LGA and Armidale Regional LGA the main occupation was Professionals. In Uralla LGA and Walcha LGA the main occupation was Managers,

Figure 3.1 – Employment by Occupation of Usual Residents



[4] Employed people aged 15 years and over.

Table 3.1 - Characteristics of Usual Residents

	Tamworth Regional		Armidale Regional		Uralla		Walcha		Total Region		NSW	
Demographics	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Population	63,070		29,124		5,971		3,016		101,181		8,072,163	
Median Age	39		37		47		50				39	
In labour force	29,980	59.5	13,482	56.5	2,806	57.1	1,419	56.6	47,687	58.4	3,874,012	58.7
Unemployed	1,314	4.5	715	5.3	115	4.1	43	3.0	2,187	4.7	189,852	4.9
Median household weekly income	1,416		1,404		1,346		1,224				1,829	
Unoccupied private dwellings %	2,298	8.9	1,422	11.8	299	11.6	321	21.4	4,340	10.3	299,524	9.4
Median rent	300		285		250		200				420	
Occupations	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Professionals	5,041	17.6	3,094	24.2	455	16.9	154	11.2	8,744	19.5	952,131	25.8
Managers	3,636	12.7	1,977	15.5	500	18.6	470	34.1	6,583	14.7	536,820	14.6
Community and Personal Service Workers	3,621	12.6	1,574	12.3	313	11.6	118	8.6	5,626	12.6	390,779	10.6
Labourers	4,024	14.0	1,499	11.7	346	12.9	203	14.7	6,072	13.6	300,966	8.2
Technicians and Trades Workers	4,000	14.0	1,462	11.5	376	14	134	9.7	5,972	13.3	436,589	11.9
Clerical and Administrative Workers	3,280	11.5	1,406	11.0	324	12.1	122	8.8	5,132	11.5	480,612	13.0
Sales Workers	2,579	9.0	1,034	8.1	184	6.8	76	5.5	3,873	8.7	294,889	8.0
Machinery Operators and Drivers	2,009	7.0	521	4.1	145	5.4	79	5.7	2,754	6.2	222,186	6.0

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

The main four-digit ANZSIC industry sectors in which usual residents were employed in 2021 is provided in Table 3.2. *Hospitals (except Psychiatric Hospitals*) was the most significant employment sector for residents of the region reflecting the significance of this sector to both the Tamworth Regional LGA and Armidale Regional LGA. *Beef Cattle Farming (Specialised)* was the second the most significant employment sector for usual residents of the region driven by the significance of this sector to the Armidale Regional LGA, Uralla LGA and Walcha LGA. The next most significant employment sector for residents of the region was *Other Social Assistance Services, Higher Education,* and *Secondary Education*.

9.4 per cent of employed usual residents work outside the region, mainly 'no fixed address' (NSW) (4.0%), Gunnedah LGA (0.6%), Liverpool Plains LGA (0.5%) and Narrabri LGA (0.5%).

Table 3.2 - Top 5 Industry Sectors of Employment for Usual Residents (Four Digit ANZSIC)

Tamworth Regional	%	Armidale Regional	%	Uralla	%	Walcha	%	Total Region	%
Hospitals (except Psychiatric Hospitals)	5.6	Higher Education	8.9	Beef Cattle Farming (Specialised)	5.0	Beef Cattle Farming (Specialised)	19.9	Hospitals (except Psychiatric Hospitals)	4.9
Secondary Education	3.3	Hospitals (except Psychiatric Hospitals)	3.9	Higher Education	4.5	Sheep-Beef Cattle Farming	7.9	Beef Cattle Farming (Specialised)	3.1
Meat Processing	3.2	Beef Cattle Farming (Specialised)	3.4	Local Government Administration	4.2	Sheep Farming (Specialised)	6.0	Other Social Assistance Services	3.0
Other Social Assistance Services	3.1	Combined Primary and Secondary Education	3.1	Sheep-Beef Cattle Farming	3.5	Local Government Administration	4.9	Higher Education	3.0
Supermarket and Grocery Stores	2.6	Other Social Assistance Services	3.0	Other Social Assistance Services	3.5	Aged Care Residential Services	2.8	Secondary Education	2.9

Source: Australian Bureau of Statistics, 2021 Census 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[5] 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 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 of NSW 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).

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

The result is that there has been declining population in many rural LGAs that are in non-coastal areas in NSW. 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 regional economy has been growing at an average annual rate of 0.8 per cent since 2006, approximately half the rate of NSW. This population growth rate is largely driven by the population growth rate for Tamworth Regional LGA i.e., average annual rate of 1.2 per cent since 2006. The population of Walcha LGA has declined since 2006 while the population growth rate for Armidale Regional LGA and Uralla LGA has been less than a third of that for Tamworth Regional LGA.

Table 3.3 - Population growth

	Population				Average Annual Growth Rate			
Local Government Area	**2006**	**2011**	**2016**	**2021**	**2006 - 2011**	**2011 - 2016**	**2016 - 2021**	**2006 - 2021**
Tamworth Regional	53,590	56,292	59,663	63,070	1.0%	1.2%	1.1%	1.2%
Armidale Regional	27,597	28,502	29,449	29,124	0.7%	0.7%	-0.2%	0.4%
Uralla	5,734	6,034	6,048	5,971	1.0%	0.0%	-0.3%	0.3%
Walcha	3,187	3,021	3,092	3,016	-1.0%	0.5%	-0.5%	-0.4%
Total Region	**90,108**	**93,849**	**98,252**	**101,181**	**0.8%**	**0.9%**	**0.6%**	**0.8%**
NSW	**6,549,177**	**6,917,658**	**7,480,228**	**8,072,163**	**1.1%**	**1.6%**	**1.6%**	**1.6%**

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

The population of the region (Table 3.4) is predicted to continue to grow at an average annual rate of 0.5 percent (approximately half that of the NSW population), largely driven by population growth in the Tamworth Regional LGA. The population of both Uralla LGA and Walcha LGA are predicted to decline (NSW DPE, 2022).

Table 3.4 – Projected population growth

Local Government Area	**2021**	**2041**	**Change**	**Annual %**
Tamworth Regional	62,769	71,956	9,187	0.7%
Armidale Regional	29,612	31,352	1,739	0.3%
Uralla	5,902	4,680	-1,223	-1.0%
Walcha	3,046	2,904	-142	-0.2%
Total Region	**101,329**	**110,892**	**9,561**	**0.5%**
NSW	**8,166,757**	**9,872,934**	**1,706,176**	**1.0%**

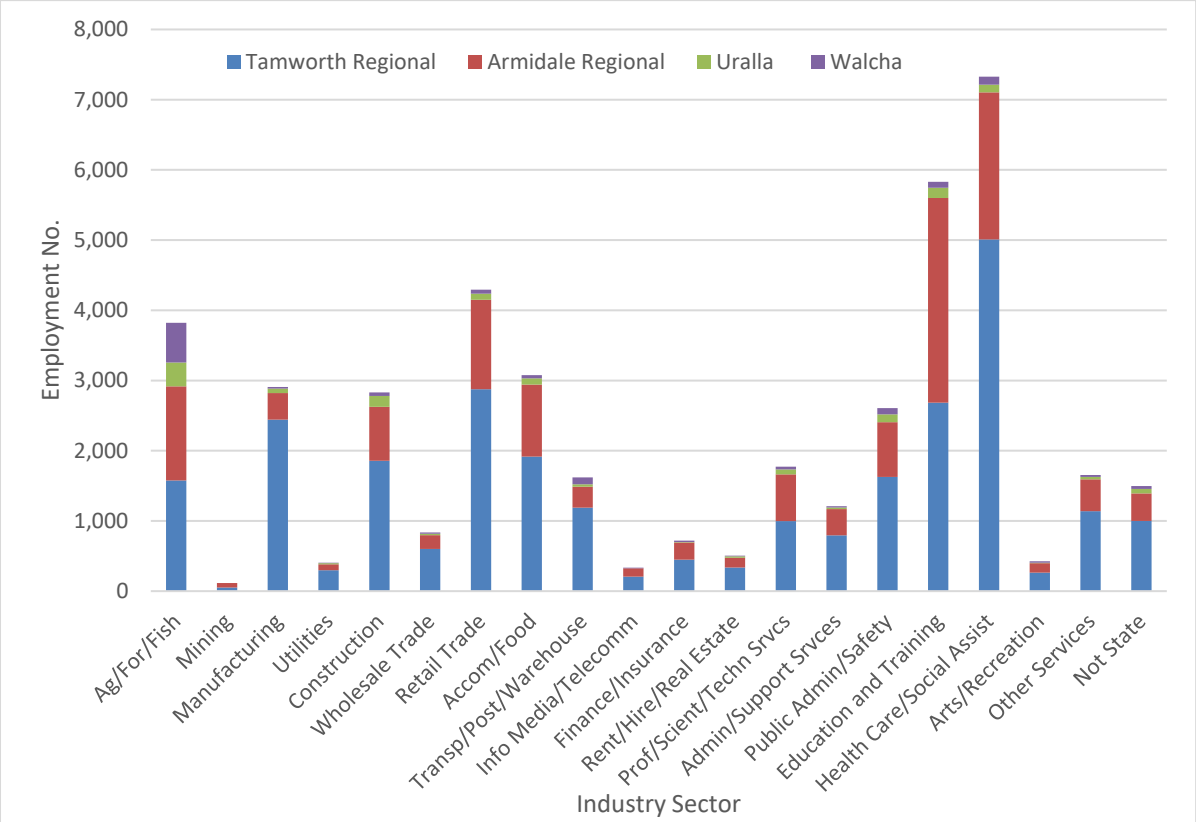
Source: NSW Department of Planning and Environment (2022)

3.3 Economic Activity in the Region

An indication of the nature of the regional economy can be gained by examining one-digit ANZSIC place of work employment by industry data - refer to Figure 3.2. This indicates the significance of the *Health Care and Social Assistance* sectors followed by *Education and Training* sectors, and *Retail Trade* sectors. However, the main employment in the region varies between LGAs. The main employment sector in the Tamworth Regional LGA is *Health Care and Social Assistance*, while the main employment sector in the Armidale Regional LGA is *Education and Training*. The main employment sector in both the Uralla and Walcha LGAs *is Agriculture, Forestry and Fishing*.

6.8 per cent of people who work in the region live outside region, mainly in Liverpool Plains LGA (0.9%), Gunnedah LGA (0.4%), and Inverell LGA (0.2%).

Figure 3.2 - Place of work employment by industry (One-digit ANZSIC)



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), Higher Education, Beef Cattle Farming (Specialised), Secondary Education, and Other Social Assistance Services* (See Table 3.5.). In the Tamworth Regional LGA the main industry sectors of employment are *Hospitals (except Psychiatric Hospitals), Meat Processing* and *Secondary Education*. In the Armidale Regional LGA *Higher Education, Hospitals (except Psychiatric Hospitals),* and *Beef Cattle Farming (Specialised*) are the main industry sectors of employment. For both Uralla LGA and Walcha LGA, *Beef Cattle Farming (Specialised)* and *Sheep-Beef Cattle Farming* are the most significant employment sectors.

Table 3.5 - Place of Work Top 5 Industry Sectors of Employment (Four-digit ANZSIC Sectors)

Tamworth Regional	%	Armidale Regional	%	Uralla	%	Walcha	%	Total Region	%
Hospitals (except Psychiatric Hospitals)	6.4	Higher Education	10.3	Beef Cattle Farming (Specialised)	8.7	Beef Cattle Farming (Specialised)	22.2	Hospitals (except Psychiatric Hospitals)	5.4
Meat Processing	3.4	Hospitals (except Psychiatric Hospitals)	4.3	Sheep-Beef Cattle Farming	7.2	Sheep-Beef Cattle Farming	8.8	Higher Education	3.4
Secondary Education	3.4	Beef Cattle Farming (Specialised)	3.2	Local Government Administration	7.1	Local Government Administration	6.0	Beef Cattle Farming (Specialised)	3.2
Other Social Assistance Services	3.2	Combined Primary and Secondary Education	3.0	Sheep Farming (Specialised)	5.4	Sheep Farming (Specialised)	5.8	Secondary Education	3.0
Supermarket and Grocery Stores	2.7	Other Social Assistance Services	2.9	Combined Primary and Secondary Education	5.2	Road Freight Transport	5.1	Other Social Assistance Services	3.0

Source: Australian Bureau of Statistics, 2021 Census of Population and Housing, Table Builder

The Gross Regional Product (GRP) of the regional economy was estimated at $5.32 billion for 2021 (Gillespie Economics IO Table). The largest exporting industries (One-digit ANZSIC) are:

- *Manufacturing ($1.1 billion),* mainly *Meat and Meat Product Manufacturing*
- *Education and Training ($0.5 billion)* mainly *Technical, Vocational, and Tertiary Education Services*
- *Construction ($0.4 billion)* mainly *Residential Building Construction*
- *Agriculture, Forestry and Fishing ($0.4 billion)* mainly *Sheep, Grains, Beef and Dairy Cattle Sector*

In combination these four industries accounted for $2.4 billion in total or 61% of the total exports by industry in the region.

Exporting sectors are based on a region's endowments and competitive advantages, and in regional economic development economics are the key drivers of the economy.

In terms of value-added, it is estimated that *Health Care and Social Assistance; Education and Training; Agriculture, Forestry and Fishing; Construction; and Public Administration and Safety* had the highest value-added in total, equal to approximately 44% of the regional economy and 49% of regional employment - Table 3.6.[6]

[6] Gross Value Added (GVA) measures the value of goods and services produced in a region.

Table 3.6 - Gross Value Added for the 5 Largest Industries in the regional economy (ANZSIC One Digit)

Industry	Gross Value Added ($m)	Proportion of Regional Economy (%)	Proportion of Regional Employment (%)
Health Care and Social Assistance	607	11%	17%
Education and Training	569	11%	14%
Agriculture/Forestry/Fishing	429	8%	9%
Construction	373	7%	7%
Public Administration and Safety	354	7%	2%
Total	**2,331**	**44%**	**49%**

Source: Gillespie Economics IO table of the regional economy

4 CONSTRUCTION ASSESSMENT

4.1 The Project

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

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:

- 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 on-site assembly of heavy electrical machinery from prefabricated components, transmission lines, road construction 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 industrial buildings.

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

Over the 18-month construction phase, average monthly employment is estimated to peak at 307, with average annual employment for the peak 12-months of construction (month 4 to month 15) being 250.[7]

Based on the IO coefficients of the abovementioned three construction sectors in the regional IO table, $86M of expenditure would be required across these sectors to generate this level of onsite workforce for a year.

The estimated direct and indirect regional economic impact of $86M expenditure in the regional and NSW economy is reported in Tables 4.2 and 4.3.

Table 4.2 – Average Annual Economic Impacts of the Construction on the Regional Economy ($2022)

	Direct	Production induced	Consumption induced	Total Flow on	TOTAL EFFECT
OUTPUT ($M)	86	55	20	75	161
Type 11A Ratio	*1.00*	*0.64*	*0.23*	*0.87*	*1.87*
VALUE ADDED ($M)	36	14	12	26	61
Type 11A Ratio	*1.00*	*0.39*	*0.33*	*0.72*	*1.72*
INCOME ($M)	20	8	5	12	33
Type 11A Ratio	*1.00*	*0.38*	*0.22*	*0.60*	*1.60*
EMPL. (No.)	250	115	86	201	451
Type 11A Ratio	*1.00*	*0.46*	*0.35*	*0.80*	*1.80*

Note: Totals may have minor discrepancies due to rounding.

[7] The IO model of the regional economy is based on average annual revenue, expenditure, and employment for each industry sector. So, to model impacts it is necessary to base it on average annual employment impacts rather than peak employment.

Table 4.3 – Average Annual Economic Impacts of the Construction on the NSW Economy ($2022)

	Direct	Production induced	Consumption induced	Total Flow on	TOTAL EFFECT
OUTPUT ($M)	86	97	96	192	279
Type 11A Ratio	*1.00*	*1.12*	*1.11*	*2.23*	*3.23*
VALUE ADDED ($M)	36	32	53	85	121
Type 11A Ratio	*1.00*	*0.90*	*1.49*	*2.40*	*3.40*
INCOME ($M)	27	23	27	50	76
Type 11A Ratio	*1.00*	*0.85*	*1.02*	*1.88*	*2.88*
EMPL. (No.)	250	238	358	596	846
Type 11A Ratio	*1.00*	*0.95*	*1.43*	*2.38*	*3.38*

Note: Totals may have minor discrepancies due to rounding.

In estimating the average annual regional impacts, 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.

Based on other similar projects in the region and indicative feedback provided by the Applicant's engineering, procurement and construction (EPC) contractor for a similar project, it is anticipated that approximately 70% of the construction workforce would reside in the region, that being the LGAs of Tamworth Regional, Armidale Regional, Uralla and Walcha. The assumptions resulting in the 70% regional employment estimate are detailed in Table 4.4.

Table 4.4 – Estimated Project's Peak Labour Breakdown

Scope	Total Peak Workforce	Region Resources	Region Peak Workforce
Surveying	8	100%	8
Site Works - Clearing and Grubbing	8	100%	8
Site Works - Excavation, Grading, & Access Roads	20	100%	20
Electrical Earthworks (Trenching)	20	40%	8
Landscaping	5	100%	5
Perimeter Fencing	8	100%	8
Piling	20	50%	10
Tracker Installation	50	75%	38
PV Module Installation	40	100%	40
DC Electrical Installation	40	75%	30
AC Electrical Installation	25	75%	19
PCU/BESS Foundation installation	8	50%	4
PCU/BESS Installation	8	20%	2
SCADA & Controls Installation	4	0%	0
HV - Substation Works	15	30%	5
Permanent Site Security System	4	0%	0
Operations & Maintenance Building Installation	8	50%	4

Scope	Total Peak Workforce	Region Resources	Region Peak Workforce
Management - Construction Manager, Engineering, Foreman, Leading Hands	9	20%	2
HSC and QA/QC Personnel	3	0%	0
Security	4	100%	4
Total	**307**		**215**
Region Peak Workforce Percentage	**70%**		

The remaining 30% of the Project's peak construction workforce are anticipated to originate from outside the region. This estimate is similar to the local workforce percentage for the New England Solar Farm, which has recently been reported by ACEN to be 80% from the New England Region (ACEN, 2023).

During construction, there will be a preference for employment of regional residents where they are able to demonstrate relevant skills and experience and a cultural fit with the Applicant, the EPC contractor and the relevant subcontractor(s), where applicable. The origins of the Project's peak construction workforce are anticipated to be approximately:

- Tamworth Regional LGA: 50% (given the size and proximity of the regional centre of Tamworth).
- Uralla Shire LGA: 5%.
- Walcha LGA: 5%.
- Armidale Regional LGA: 10%.
- Outside of local LGAs: 30%.

Based on the above, it is assumed for this analysis that approximately 70% of the construction workforce would be from the region. Consequently, Table 4.2 has been adjusted to only include 70% of consumption-induced flow-ons. At the NSW level all the construction workforce is expected to come from NSW and hence no adjustment to consumption-induced flow-ons is made.

The average construction impacts of the Project on the regional economy for one year are estimated at up to:

- $161M in annual direct and indirect output.
- $61M in annual direct and indirect value-added.
- $32M in annual direct and indirect household income.
- 451 direct and indirect jobs.

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

- $279M in annual direct and indirect output.
- $121M in annual direct and indirect value added.
- $76M in annual direct and indirect household income.
- 846 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.

These economic activity impacts are slightly lower than reported for the EIS (original) Project because of the lower average annual employment during the peak year of construction for the amended Project. Direct employment is the key driver of the economic modelling approach.

4.1.2 Multipliers

Multipliers are summary measures used for predicting the 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 Attachment 2). Type 11A ratio multipliers 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.

At the regional level, the adjusted type 11A ratio multipliers for the construction workforce of the Project range from 1.60 for income up to 1.87 for output. The NSW type 11A ratio multipliers for the construction workforce range from 2.88 for income up to 3.40 for value added. 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.

4.1.3 Main Sectors Affected

The IO analysis indicates 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 are likely to be as follows:

- *Professional, Scientific and Technical Services.*
- *Wholesale and Retail Trade.*
- *Road Transport.*
- *Employment, Travel Agency and Other Administrative Services*
- *Non-Residential Property Operators and Real Estate Services*
- *Cement Lime and Ready-Mixed Concrete Manufacturing.*

For the NSW economy the *finance sector* and *auxiliary finance and insurance* sector are also important production induced flow-on sectors.

Consumption induced flow-on effects in the region will be mainly in the following sectors:

- *Retail and Wholesale Trade.*
- *Food and Beverage Services.*
- *Health Care Services.*
- *Primary and Secondary Education.*
- *Residential Care and Social Assistance.*

For the NSW economy the *Finance; Professional, Scientific and Technical Services; Insurance and Superannuation; Personal Services; Other Services; Non-Residential Property Operators and Real Estate Services;* and *Road Transport,* are also important consumption induced flow-on sectors.

4.2 Agricultural impacts

Construction of the Project will impact approximately 606.9 ha of agricultural land that is currently used for beef cattle and sheep. Some indication of the magnitude of foregone production can be obtained by assuming gross revenue equivalent to that of the NSW DPI Gross Margin Budget for Merino Ewes (20 micron) – Merino Rams i.e., $794/ha.[8] On this basis, foregone agriculture during Project construction would be approximately $482,000 per annum in revenue.

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 revenue is summarised in Tables 4.5 and 4.6. Indirect impacts include economic activity associated with suppliers to agricultural production. These impacts would occur for approximately 1-year.

Table 4.5 Annual Regional Economic Impacts of Foregone Agriculture During Project Construction ($2022)

	Direct	Production induced	Consumption induced	Total Flow on	TOTAL EFFECT
OUTPUT ($M)	0.5	0.3	0.1	0.4	0.9
Type 11A Ratio	*1.00*	*0.53*	*0.26*	*0.78*	*1.78*
VALUE ADDED ($M)	0.2	0.1	0.1	0.2	0.4
Type 11A Ratio	*1.00*	*0.65*	*0.41*	*1.06*	*2.06*
INCOME ($M)	0.1	0.1	0.0	0.1	0.2
Type 11A Ratio	*1.00*	*0.81*	*0.42*	*1.23*	*2.23*
EMPL. (No.)	1.4	1.0	0.5	1.6	3.0
Type 11A Ratio	*1.00*	*0.73*	*0.39*	*1.12*	*2.12*

Table 4.6 Annual NSW Economic Impacts of Foregone Agriculture During Project Construction ($2022)

	Direct	Production induced	Consumption induced	Total Flow on	TOTAL EFFECT
OUTPUT ($M)	0.5	0.4	0.4	0.8	1.3
Type 11A Ratio	*1.00*	*0.91*	*0.85*	*1.76*	*2.76*
VALUE ADDED ($M)	0.2	0.2	0.2	0.4	0.6
Type 11A Ratio	*1.00*	*1.16*	*1.29*	*2.45*	*3.45*
INCOME ($M)	0.1	0.1	0.1	0.2	0.3
Type 11A Ratio	*1.00*	*1.51*	*1.38*	*2.89*	*3.89*
EMPL. (No.)	1.4	1.5	1.5	3.1	4.5
Type 11A Ratio	*1.00*	*1.11*	*1.10*	*2.21*	*3.21*

The annual regional direct and indirect impact of foregone agriculture during Project construction is estimated at up to:

- $0.9M in annual direct and indirect regional output.
- $0.4M in annual direct and indirect regional value-added.
- $0.2M in annual direct and indirect household income.
- 3 direct and indirect jobs.

This represents less than 0.1% of direct agricultural economic activity in the region and less than 0.6% of the direct and indirect economic activity of the Project construction.

[8] This is based on the same gross margin budget used in the Soil and Agricultural Impact Statement. However, here the focus is on revenue per ha rather than the gross margin per ha referred to in the Soil and Agricultural Impact Statement. This is because assessment of impacts using input-output analysis is driven by changes in revenue.

It is evident from the above that agricultural impacts from the construction of the Project are negligible.

4.3 Other impacts

The construction of the proposed Project will 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 will 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 will depend on the balance of labour supply from inside the region, outside the region and 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 will arise from an individual project is uncertain. For this Project where direct average annual construction demand is for in the order of 250 workers, no or modest observable price effects are anticipated. 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 will benefit the most from them. This reallocation of resources is therefore a positive impact for the economy not a negative.

5 OPERATION PHASE

5.1 The Project

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 operational employment of 15 (100% of which are assumed to reside in the region); annual output, wages, profit, taxes, depreciation, interest and other nonwage costs based on advice of Athena; and allocation of non-wage costs between inputs and intermediate sectors as per the coefficients in the *Electricity Generation* sector of the regional and NSW IO models.

5.1.1 Impacts

On this basis the total and disaggregated average annual 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 ($2022)

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($M)	25	5	2	7	32
Type 11A Ratio	*1.00*	*0.19*	*0.09*	*0.28*	*1.28*
VALUE ADDED ($M)	17	2	1	3	21
Type 11A Ratio	*1.00*	*0.12*	*0.08*	*0.20*	*1.20*
INCOME ($M)	2	1	1	1	3
Type 11A Ratio	*1.00*	*0.53*	*0.35*	*0.89*	*1.89*
EMPL. (No.)	15	10	10	20	35
Type 11A Ratio	*1.00*	*0.66*	*0.67*	*1.33*	*2.33*

Table 5.2 – Annual Economic Impacts of the Project on the NSW Economy ($2022)

	Direct Effect	Production Induced	Consumption Induced	Total Flow-on	TOTAL EFFECT
OUTPUT ($M)	25	11	8	19	44
Type 11A Ratio	*1.00*	*0.43*	*0.33*	*0.76*	*1.76*
VALUE ADDED ($M)	17	5	5	10	27
Type 11A Ratio	*1.00*	*0.29*	*0.27*	*0.56*	*1.56*
INCOME ($M)	2	3	2	5	7
Type 11A Ratio	*1.00*	*1.85*	*1.57*	*3.43*	*4.43*
EMPL. (No.)	15	25	31	56	71
Type 11A Ratio	*1.00*	*1.68*	*2.07*	*3.75*	*4.75*

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

- $32M in annual direct and indirect regional output.
- $21M in annual direct and indirect regional value-added.
- $3M in annual direct and indirect household income.
- 35 direct and indirect jobs.

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

- $44M in annual direct and indirect regional output.
- $27M in annual direct and indirect regional value-added.
- $7M in annual direct and indirect household income.

- 71 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 1.20 for value-added up to 2.33 for employment. Capital intensive developments tend to have a high level of linkage with other sectors in an economy thus contributing relatively high rates of flow-on employment while at the same time only having a lower level of direct employment (relative to output levels). This tends to lead to a relatively high ratio multiplier for employment. A lower ratio multiplier for income (compared to employment) also generally occurs because of comparatively higher wage levels in the Project compared to incomes in the sectors that would experience flow-on effects from the Project. 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 1.56 for value-added up to 4.75 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

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 Transmission, Distribution, On Selling and Electricity Market Operation.*
- *Finance.*
- *Construction Services.*
- *Auxiliary Finance and Insurance Services.*
- *Professional, Scientific and Technical Services.*
- *Employment, Travel Agency and Other Administrative Services.*
- *Wholesale Trade.*

For the NSW economy the *Electricity Generation sector* and *Non-Residential Property Operators and Real Estate* sector are also important production induced flow-on sectors.

Consumption induced flow-on effects in the region will be mainly in the following sectors:

- *Retail and Wholesale Trade.*
- *Food and Beverage Services.*
- *Health Care Services.*
- *Primary and Secondary Education.*
- *Finance.*
- *Residential Care and Social Assistance.*

For the NSW economy the *Finance; Professional, Scientific and Technical Services; Insurance and Superannuation; Personal Services; Other Services; Automotive Repairs and Maintenance; Non-Residential Property Operators and Real Estate,* are also important consumption induced flow-on sectors.

5.2 Agricultural impacts

The Project operation is assumed to result in 18.5 ha[9] being unavailable for agriculture because of the BESS substation and associated infrastructure, and the remaining 588.4 ha having a 20% reduction in the sheep stocking rate.

Some indication of the magnitude of foregone production can be obtained by assuming gross revenue equivalent to that of the NSW DPI Gross Margin Budget for Merino Ewes (20 micron) – Merino Rams i.e., $794/ha. On this basis, foregone agriculture during Project operation would be in the order of $108,000 per annum.

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 revenue is summarised in Tables 5.3 and 5.4. Indirect impacts include economic activity associated with suppliers to agricultural production. These impacts would occur for the duration of the Project operation.

Table 5.3 Annual Regional Economic Impacts of Foregone Agriculture During Project Operation ($2022)

	Direct	Production induced	Consumption induced	Total Flow on	TOTAL EFFECT
OUTPUT ($M)	0.1	0.1	0.0	0.1	0.2
Type 11A Ratio	*1.00*	*0.53*	*0.26*	*0.78*	*1.78*
VALUE ADDED ($M)	0.0	0.0	0.0	0.0	0.1
Type 11A Ratio	*1.00*	*0.65*	*0.41*	*1.06*	*2.06*
INCOME ($M)	0.0	0.0	0.0	0.0	0.0
Type 11A Ratio	*1.00*	*0.81*	*0.42*	*1.23*	*2.23*
EMPL. (No.)	0.3	0.2	0.1	0.3	0.7
Type 11A Ratio	*1.00*	*0.73*	*0.39*	*1.12*	*2.12*

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 ($M)	0.1	0.1	0.1	0.2	0.3
Type 11A Ratio	*1.00*	*0.91*	*0.85*	*1.76*	*2.76*
VALUE ADDED ($M)	0.0	0.0	0.1	0.1	0.1
Type 11A Ratio	*1.00*	*1.16*	*1.29*	*2.45*	*3.45*
INCOME ($M)	0.0	0.0	0.0	0.1	0.1
Type 11A Ratio	*1.00*	*1.51*	*1.38*	*2.89*	*3.89*
EMPL. (No.)	0.3	0.3	0.3	0.7	1.0
Type 11A Ratio	*1.00*	*1.11*	*1.10*	*2.21*	*3.21*

The annual regional direct and indirect impact of foregone agriculture during Project operation is estimated at up to:

- $0.2M in annual direct and indirect regional output.
- $0.1M in annual direct and indirect regional value-added.
- $0.03M in annual direct and indirect household income.
- 0.7 direct and indirect jobs.

[9] 17.08 ha being unavailable for agriculture and the remaining 589.82 ha having a 20% reduction in the sheep stocking rate has been considered for the purposes of calculations based on a draft Amended layout. This small change has no material impact on the modelled economic impacts.

This represents less than 0.02% of direct agricultural economic activity in the region and less than 2% of the direct and indirect economic activity of the Project operation. While there is a loss of potential agricultural activity to the region, this is a private economic decision made by the Project landholders for which they are compensated.

5.3 Other impacts

The operation of the Project will create a very small demand for regional labour resources (15 direct jobs in a labour market of 47,687) and regional inputs to production (that from the IO analysis represent 0.1% of interindustry transactions in the region). Consequently, no "crowding out" effects on other industry sectors are anticipated.

To ameliorate any land value impacts to nearby properties, the Project has been refined and where impacts could not be avoided, management and mitigation measures will be adopted to further reduce potential impacts. This includes the introduction of vegetation screening and landscaping, and noise barriers to reduce potential views and noise disturbance of Project infrastructures. Therefore, the residual impacts of the Project during operational phase, after implementation of management and mitigation measures are predicted to be minimal. Ongoing consultation with stakeholders will identify and address concerns if they arise.

6 CUMULATIVE IMPACTS

6.1 Approach to cumulative impacts

The cumulative impact assessment approach involves considering the impacts of the Project together with the impacts of other relevant future projects on economic activity. Relevant major projects within 100 km of the Project Area with the potential for cumulative impacts with the Project are identified in Table 6.1.

Table 6.1 Significant Projects in the Region

Project	Description	LGA	Current Status[10]	Distance from the Project (km)[11]
Bendemeer Wind Farm	Development of a wind farm, with up to 51 WTGs, as part of the Bendemeer Renewable Energy Hub, with ancillary infrastructure.	Tamworth Regional LGA	• In Planning (Preparing Scoping Report) • Construction duration of 24 months, anticipated to start in 2026 • Operational life of 30 years	Adjacent
New England REZ Transmission Project	Development of new transmission lines between Bayswater Power Station Substation and the New England REZ, new energy hubs within the New England REZ, and ancillary infrastructure.	LGAs of Muswellbrook Shire, Upper Hunter Shire, Liverpool Plains Shire, Tamworth Regional, Walcha Shire, Armidale Regional, Uralla Shire	• Planning Portal - Prepare EIS • Network operator procurement anticipated to start in 2025, Stage 1 expected to be operational in 2031 with Stage 2 in 2033	2
Thunderbolt Wind Farm	Development of a 192 MW wind farm, with up to 32 WTGs, as part of the Thunderbolt Energy Hub, with ancillary infrastructure.	Tamworth Regional LGA; Uralla Shire LGA	• Planning Portal- Approved (May 2024) • Construction duration of 18-24 months, anticipated to start in 2025 • Operational life of 25 - 30 years	16
Calala Battery Energy Storage System	Development of a battery energy storage system (300 MW / 1200 MWh) and underground transmission lines connecting to Tamworth substation plus ancillary works.	Tamworth Regional LGA	• Planning Portal – Approved (June 2024) • Construction duration of 12 months, with commissioning expected to be completed within 15-18 months, start date unknown • Operational life of 25 years	28
Tamworth Battery Energy Storage System	Development of a 200 MW battery energy storage facility with ancillary infrastructure	Tamworth Regional LGA	• Planning Portal - Response to Submissions • Construction duration of 12 months, start date unknown • Operational life of 25 years	34
Kingswood Battery Energy Storage System	Development of a battery energy storage system (270 MW/ 1,080 MWh), grid connection and associated infrastructure	Tamworth Regional LGA	• Planning Portal – Response to Submissions • Construction duration of 12-15 months, anticipated to start in 2025 • Operational life of 20 years	38

[10] *Project status current as of March 2025 based on DPHI's Major Projects website.*

[11] *Indicative direct-line distances from the Project.*

Project	Description	LGA	Current Status[10]	Distance from the Project (km)[11]
Lambruk Solar Farm	Development of a 500 MW solar farm and 300 MW / 1,200 MWh BESS	Tamworth Regional LGA	• Planning Portal - Prepare EIS • Construction duration of 24 months, anticipated to start in 2025 • Operational life of 30 years	42
Deeargee Solar Farm	Development of a 320MW solar farm, ancillary infrastructure, and BESS with a capacity of either 1,400 MW / 2,800 MWh or 700 MW / 2,800 MWh.	Uralla Shire LGA	• Planning Portal - Prepare EIS • Construction duration of 24 months, anticipated to start in 2025 • Operational life of 30 years	42
Hillview Solar Farm	Development of a 272 MW solar farm and ancillary infrastructure.	Uralla Shire LGA	• Planning Portal - Prepare EIS • Construction duration of 24 months, anticipated to start in 2027 • Operational life of 40 years	42
Hillview Wind Farm	Development of a 200-300 MW wind farm with up to 55 WTGs and associated infrastructure.	Uralla Shire LGA	• Planning Portal - Prepare EIS • Construction duration of 30 months, anticipated to start in 2028 • Operational life of 35 years	42
Eastern Hub Firming Battery	Development of a 1000MW battery energy storage system and associated infrastructure.	Uralla Shire LGA	• Planning Portal - Prepare EIS • Construction duration of 18 months, anticipated to start in 2027 • Operational life of 20 years	42
New England Solar Farm	Development of 720 MW solar farm with energy storage and ancillary infrastructure.	Uralla Shire LGA	• Planning Portal - Approved (March 2020) • Stage one (400 MW) operational • Stage 2 (320 MW + BESS) construction commenced in 2024 • Operational life of 30 years	45
Nottingham Park Solar Farm	Development of a 250 MW solar farm and ancillary infrastructure	Tamworth Regional LGA	• Planning Portal – Prepare EIS • Construction duration of 12-18 months, anticipated to start in Q1 2025 • Operational life of 35 years	45
Middlebrook Solar Farm	Up to 500 MW proposed solar farm, battery storage (100 MW) and ancillary infrastructure.	Tamworth Regional LGA	• Planning Portal – Approved (November 2024) • Construction duration of 18-24 months, anticipated to start in Q2 2025 • Operational life of 30 years	47
Winterbourne Wind Farm	Development of a 700 MW wind farm, with up to 118 WTGs, BESS up to 100 MW/ 200 MWh and ancillary infrastructure.	Walcha LGA; Uralla Shire LGA	• Planning Portal – Response to Submissions • Construction duration of 24-30 months, with peak construction of 9 to 10 months, anticipated to start 2025 • Operational life of 30 years	51

Project	Description	LGA	Current Status[10]	Distance from the Project (km)[11]
Tamworth Solar Farm	Development of a 65 MW solar farm with energy storage and ancillary infrastructure.	Tamworth Regional LGA	• Planning Portal – Approved (November 2020) • Construction timeframe 12 months • Operational life of 30 years	51
Eathorpe Battery	Development of a 100 MW / 200 MWh battery energy storage facility with ancillary infrastructure	Armidale Regional LGA	• Planning Portal – Prepare EIS • Construction duration of 12-18 months, anticipated to start in 2025 • Operational life of 20 years	59
Armidale Battery Energy Storage System	Development of a 150 MW battery energy storage facility with ancillary infrastructure	Armidale Regional LGA	• Planning Portal – Assessment • Construction duration of up to 24 months, anticipated to start in 2025 • Operational life of 20 years	60
Oxley Solar Farm	Approx. 225 MW photovoltaic (PV) energy generation facility, BESS, and ancillary infrastructure.	Armidale Regional LGA	• Planning Portal – Approved (December 2023) • Construction duration of 12-18 months, anticipated to start in 2025 • Operational life of 30 years	64
Gara Battery Energy Storage System	Development of a 400 MW / 1,760 MWh battery energy storage facility and associated infrastructure.	Armidale Regional LGA	• Planning Portal - Prepare EIS • Construction duration of 11 months, anticipated to start in 2025 • Operational life of 40 years	66
Tilbuster Solar Farm	Development of a 150 MW solar farm, energy storage facility and ancillary infrastructure.	Armidale Regional LGA	• Planning Portal – Approved (March 2019) • Construction duration of 12 months, anticipated to start in 2025 • Operational life of 30 years	68
Tilbuster 2 Solar Farm	Development of a solar farm adjacent to Tilbuster Solar Farm.	Armidale Regional LGA	• Planning Portal – Prepare EIS • Construction start and duration unknown	68
Wallabadah Battery Energy Storage System	Development of a 400 MW / 800 MWh battery energy storage facility and ancillary infrastructure.	Tamworth Regional LGA	• Planning Portal - Prepare EIS • Construction duration of 18-24 months, anticipated to start in 2026 • Operational life of 25 years	70
Metz Solar Farm	Development of a 100 MW solar farm and ancillary infrastructure.	Armidale Regional LGA	• Planning Portal – Approved (July 2017) • Currently operational • Operational life of 30 years	73
Orange Grove Solar Farm	Development of a 110 MW solar farm and ancillary infrastructure.	Gunnedah Shire LGA	• Planning Portal – Approved (March 2019) • Construction duration of 9 months, start date unknown • Operational life of 30 years	75

Project	Description	LGA	Current Status[10]	Distance from the Project (km)[11]
Armidale East Battery Energy Storage System	Development of a 500 MW / 1000 MWh battery energy storage facility with ancillary infrastructure.	Armidale Regional LGA	• Planning Portal – Prepare EIS • Construction duration of 18 months, anticipated to start in Q1 2026 • Operational life of 40 years	75
Gunnedah Solar Farm	Development of a 153 MW solar farm and ancillary infrastructure.	Gunnedah Shire LGA	• Planning Portal – Approved (March 2019) • Currently operational • Operational life of 30 years	79
Hills of Gold Wind Farm	Development of a wind farm with up to 62 WTGs each with a generating capacity of approximately 6 MW, BESS up to 100 MW/400 MWh, and ancillary infrastructure.	Tamworth Regional LGA; Liverpool Plains Shire LGA; Upper Hunter Shire LGA	• Planning Portal – Approved (September 2024) • Construction duration of 18-24 months, anticipated to start in 2025 • Operational life between 25-35 years	80
Oven Mountain Pumped Hydro Energy Storage Project	Development of a 600 MW pumped hydro energy storage and generation project and ancillary infrastructure	Armidale Regional LGA	• Planning Portal – Assessment • Construction duration of 36-48 months, anticipated to start in 2025 • Operational life over 50 years	90

6.2 Potential cumulative impacts

The main cumulative economic impact of the projects identified above is to generate large demand for a suitably qualified construction workforce in regional areas. This demand can help address the jobs growth imbalance between Australia's biggest cities which have grown by an average of 2.4% per annum since 2000 and the regions which have grown at 1.0% per annum (Sobyra, 2022). This imbalance has been attributed to the economy creating relatively more demand for high skilled jobs than previously with the vast majority of these located in big cities rather than regions (Sobyra, 2022).

Regional jobs can partly offset this trend by providing opportunities for the existing and future regional workforces, attracting middle skilled and high skilled workers and families to regional areas, reducing outmigration of the regional workforce to look for employment in cities, and increase regional labour force participation. Regional projects can therefore provide a boom to non-coastal regional economies that have experienced low growth or decline because of globalisation and associated structural adjustment.

Notwithstanding, excess demand for construction workers that has been generated by the government policy driven renewable energy transition can in the short run potentially lead to increased construction wages, attraction of workers from other relevant sub-sectors and 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 will depend on the balance of labour supply from inside the region, outside the region and DIDO/FIFO, as well as adjustment of the overall labour market to respond to increased demand.

In addition, in the short run excess demand for inputs to construction such as quarry materials, concrete etc can result in rising costs for these factor inputs and potentially shortages for other uses.

7 MITIGATION AND MANAGEMENT MEASURES

It is evident from Section 5 and 6 that the economic activity associated with the construction and operation of the Project would outweigh the loss of economic activity from the minor and temporary impact on agricultural production. However, at the same time it would create a demand for a suitably qualified construction workforce in the region.

Athena proposes to work in partnership with the local councils and community to help maximise the projected economic regional benefits whilst minimising any impacts. In this respect, a range of general economic mitigation and management measures are proposed and would include:

- Employment of regional residents where they have the required skills and experience.
- Participating, as appropriate, in business groups, events or programs in the regional community.
- Locally sourcing non-labour inputs to production where local producers can be cost and quality competitive.
- Establishment of a Community Benefit Fund to be managed through a Voluntary Planning Agreement with Tamworth Regional Council with the intention of supporting local non-profit organisations, community programs/events, local businesses, training, and services/infrastructure. Payments into the fund will be based on the per MW per annum of AEMO and Network Operator approved and commissioned capacity.
- Lease payments to host landowners that provide an alternative drought proof income with potential flow-on benefits to the regional economy.
- Continued agricultural activities during the operational phase of the Project and reinstatement of full pre-project agricultural production following project decommissioning.

To ensure regional jobs are prioritised, the Project and EPC Contractor will undertake the following recruitment measures to maximise community involvement and assist respective businesses in becoming 'job ready':

- Ensuring residents are made aware of employment opportunities and lead contractors are encouraged to hire regional residents where they have the required skills and experience and are able to demonstrate a cultural fit with the organization.
- Participation in business group meetings, events or programs in the community designed to make businesses aware of upcoming contracting opportunities and requirements.
- Encouraging lead contractors to purchase regional non-labour inputs to production, where these can be cost and quality competitive, to support local industries.

The Project will also implement measures to encourage local content where importance is placed on procurement of local non-labour inputs to production where local producers can be cost and quality competitive. The Bendemeer Solar Farm Social Impact Assessment (ERM, 2023) provides additional detail of management measures to be implemented.

8 CONCLUSION

The Project will provide economic activity to the regional economy during both the construction and operation phase. It would also result in a minor and insignificant contraction in regional economic activity from agricultural activity within the Project boundary and, more specifically, the development footprint. These regional economic impacts were assessed using IO analysis.

The construction and operation of the Project will have net positive impacts on the level of economic activity in the regional and NSW economy.

Athena proposes to work in partnership with local councils and the local community so that, as far as possible, the benefits of the projected economic growth in the region are maximised and impacts minimised. In this respect, a range of general economic impact mitigation and management measures are proposed.

9 REFERENCES

ACEN (2023) *New England Solar, one of Australia's largest solar projects, officially opened, https://www.acenrenewables.com/2023/03/acen-australia-new-england-solar-opens/*

Australian Bureau of Statistics (1995) *Information Paper Australian National Accounts Introduction to Input-Output Multipliers*. Cat. No. 5246.0.

Australian Bureau of Statistics, *2021 Census of Population and Housing, Community Profiles*.

Australian Bureau of Statistics, *2021 Census of Population and Housing, Working Population Profiles*.

ERM (2023) *Bendemeer Solar Farm Social Impact Assessment.*

Minesoils (2023) *Bendemeer Solar Farm Soil and Agricultural Impact Statement*.

NSW Department of Planning and Environment (2022) NSW Population Projections, Planning Portal, pp.planningportal.nsw.gov.au/populations

Sorensen, A.D. (1990) Virtuous Cycles of Growth and Vicious Cycles of Decline: Regional Economic Change in Northern NSW. In *Change and Adjustment in Northern New South Wales*. Ed D.J. Walmsley, University of New England, Armidale.

West, G. (1993) *Input-Output Analysis for Practitioners, Version 7.1, User's Guide*.

ATTACHMENT 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.
- 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).

REFERENCES

Bayne, B. and West, G. (1988) *GRIT – Generation of Regional Input-Output Tables: Users Reference Manual*. Australian Regional Developments No. 15, Office of Local Government, Department of Immigration, Local Government and Ethnic Affairs, AGPS.

Jensen, G. (1980) The concept of accuracy in regional input-output models. *International Regional Science Review*, 5:2, pp.139-54.

Powell, R. and Chalmers, L. (1995) *The Regional Economic Impact of Gibraltar Range and Dorrigo National Park*. A Report for the NSW National Parks and Wildlife Service.

ATTACHMENT 2 – UNDERLYING ASSUMPTIONS AND INTERPRETATIONS OF INPUT-OUTPUT ANALYSIS AND MULTIPLIERS

1. "The *basic assumptions* in IO 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).
- 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).

REFERENCES

Australian Bureau of Statistics (1995) Information Paper Australian National Accounts Introduction to Input-Output Multipliers. Cat. No. 5246.0.

Centre for Farm Planning and Land Management (1989) *Consultants report to State plantations impact study*. CFPLM, University of Melbourne.

Jensen, R. and West, G. (1986) *Input-output for Practitioners: Theory and Applications*. Prepared for Department of Local Government and Administrative Services, Local Government and Regional Development Division, Australian Government Publishing Service.

Powell, R. and Chalmers, L. (1995) *The Regional Economic Impact of Gibraltar Range and Dorrigo National Park*. A Report for the NSW National Parks and Wildlife Service.