ECONISIS

POWER AND TELECOMMUNICATION OUTAGES

IMPACT ON THE NEWROC ECONOMY

Client: NEWROC

Title: NEWROC POWER AND TELECOMMUNICATION OUTAGES IMPACT

Version: FINAL

Date: Friday 1 March 2024

Prepared for:

NEWROC

On behalf of the Western Australian shires of;

Mukinbudin, Mount Marshall, Nungarin, Koorda, Trayning, Wyalkatchem & Dowerin

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DISCLAIMER

VERSION CONTROL

VERISON	PURPOSE	AUTHOR	REVIEWER	APPROVER	APPROVAL DATE
DraftA	Draft for internal review	CT	MW	MW	19/02/2024
DraftB	Draft for client review	MW/CT	EW	MW	20/02/2024
FINAL	Final draft	MW/CT	EW	MW	01/03/2024

APPROVAL FOR ISSUE

APPROVER	CONTACT	SIGNATURE	DATE
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CONTENTS

FIGURES AND TABLES

1 INTRODUCTON

This section provides an overview of the background, purpose and scope of the report.

1.1 Background and Context

In January 2024, the Wheatbelt and Goldfields region were subject to an extreme weather event that resulted in a prolonged power outage peaking at over 34,000 businesses and households.

The severe storm caused extensive damage to WA's main electricity network in the Central Wheatbelt and Goldfields areas. The 220KV transmission line that supplies Kalgoorlie-Boulder sustained significant damage with five large transmission towers downed, along with hundreds of kilometres of wires[1].

This outage resulted in a range of serious and threatening challenges for households. Water supplies were interrupted, emergency telecommunication services were severed, essential health services were closed, and extreme heat raised a number of critical health risks for residents.

Similarly, business and industry were severely impacted, with some businesses recording economic and financial losses in excess of $100,000[2]. While Extended Power Outage compensation of $240 per household was offered by the WA Government for residents, no compensation has thus far been offered to businesses that experienced significant loss.

Power was finally restored in the wider region to all households 9 days after the storm event. Despite the rapid nature of the extensive rebuild of the main transmission lines, this event highlighted serious concerns about the resilience of the regional and remote power networks. Considering the impacts of climate change in accelerating and intensifying essential power and telecommunication disruptions, the potential for extensive economic loss and impact from regular outages is of significant concern.

1.2 Report Purpose and Structure

Econisis was engaged to prepare an economic impact assessment for the North Eastern Wheatbelt Regional Organisation of Council (NEWROC) of power and telecommunication outages across the NEWROC Councils.

This report is comprised of the following key sections:

- **Introduction –** This Section provides an overview of the Report, its purpose and structure.
- **Assessment Context –** this section provides an overview of research on the economic loss and impact of power and telecommunications, including direct and indirect impacts on the industry, business, households and the wider economy.
- **Regional Economic Profile –** This section reviews key data sets and indicators relating to the NEWROC economy.
- **Economic Impact of Power Outages–** this section assesses the scape of the impact on regional economic output from power outages.
- **Telecommunications Impacts** – this section examines the impacts of telecommunications outages, independent of power outages, on the regional economy.
- **Conclusions**

[1] Western Power (2024) Accessed at https://www.westernpower.com.au/news/western-power-network-in-central-wheatbelt-and-goldfields-sustains-extensive-storm-damage/

[2] ABC (2024) Goldfields and Wheatbelt business owners still waiting for compensation month after blackout accessed at https://www.abc.net.au/news/2024-02-15/power-compensation-blackout-kalgoorlie-wheatbelt-business-owners/103466804

1.3 Statistical Geography

NEWROC is a voluntary organisation of Councils and includes seven Local Governments in the North Eastern sub-region of the Wheatbelt, WA. Relevant local governments include:

- Shire of Koorda
- Shire of Mt Marshall
- Shire of Mukinbudin
- Shire of Dowerin
- Shire of Nungarin
- Shire of Trayning
- Shire of Wyalkatchem

Figure 1 NEWROC Location

1.4 Glossary and Abbreviations

The following terms and abbreviations are referenced in this report.

Table 1 Glossary and Abbreviations

Term/Abbreviation	Definition
ABS	Australian Bureau of Statistics
EIA	Economic Impact Assessment
Externalities	External Costs or Benefits not captured in market prices
FTE	Full time equivalent
GVA	Gross Value Added
IO	Input-output
LGA	Local Government Area
NPV	Net Present Value
OIA	Office of Impact Analysis

2 ASSESSMENT CONTEXT

This section provides an overview of research on the economic loss and impact of power and telecommunications, including direct and indirect impacts on the industry, business, households and the wider economy.

2.1 Role of Natural Disasters in Power Outages

Small, localised power outages can be caused by a wide range of factors, such as lightning, floods, heatwaves, bushfires, high winds, fallen trees, or car accidents. Large-scale blackouts are less common but can have very severe impacts on human health and economic activity[3].

There are numerous national and international examples of widespread and prolonged blackouts due to a natural disasters and extreme weather, including:

- In 2015, 200,000 business and households in NSW faced extended blackouts of up to a week
- In 2016, a widespread power outage in South Australia occurred as a result of storm damage to electricity transmission infrastructure, affecting 850,000 customers.
- In 2017, 100,000 properties lost power due to Cyclone Debbie
- In 2018, the Hokkaido Eastern Iburi earthquake knocked out power to about 2.95 million households in Hokkaido, mainly due to damage to the coal-fired thermal power station at Atsuma, according to a Japan Federation of Electric Power Companies report.
- In 2018, a windstorm caused outages to 600,000 BC Hydro customers across the Lower Mainland, Vancouver Island and Gulf Islands. The storm damaged 300 power poles and 170 transformers. Power was fully restored December 31 (after 11 days).
- In 2019, a major storm left nearly 2,000,000 people without power. In some areas of eastern Ontario and most of southern Québec, 964,000 people were affected.[247] The same storm also cut power to over 800,000 customers in 14 US states between Thursday, October 31 and Saturday, November 2, with 420,000 still without power after three days.
- In 2020, a power outage struck Central and South Kalimantan, leaving an estimated total of 6.8 million people without electrical supply due to a thunderstorm.
- In 2020, an ice storm, bringing snow from New Mexico into Oklahoma and northern Texas, left over 400,000 people without power in Oklahoma for multiple days, with over 40,000 still without power 10 days after.
- In 2021, a severe windstorm hit Melbourne, knocking out power to more than 520,000 customers - the largest number of customers without power in the state's history.
- In 2022, the South East Queensland Flood Event saw 180,000 households lose power, with 20,000 households losing power for more than 5 days.
- In 2023, parts of Buenos Aires and the provinces of Buenos Aires, Santa Fe, Neuquén, Córdoba and Mendoza, experienced blackouts, plunging millions of people into darkness for at least two hours during a heatwave as traffic lights went out of order and Buenos Aires Metro stations underwent total darkness. The outage was believed to have been caused by a fire in a field near high-tension lines connected to the Atucha Nuclear Power Plant
- In 2024, 500,00 households in Victoria are without electricity, after two transmission towers collapsed near Anakie, north of Geelong, causing Loy Yang A power station to trip and go offline down during storms. Wind gusts of up to 130km an hour was recorded.

[3] Energy Facts Australia (2019) Blackouts explained accessed at https://www.energyfactsaustralia.org.au/explainers/blackouts-explained/

- In 2024, Tropical Cyclone Kirrily resulted in about 66,000 customers experienced a power outage in Townsville[4].

In 2023, the Australian Electricity Market Operator (which manages the Eastern Australian interconnected power network) highlighted several critical issues with the reliability of Australia's power infrastructure. These issues included:

- **Aging infrastructure:** A significant portion of Australia's energy infrastructure is nearing the end of its operational life. This includes power plants, transmission lines, and distribution networks. The aging infrastructure is increasingly susceptible to breakdowns and disruptions, leading to potential energy shortages.
- **Renewable energy integration**: The growing adoption of renewable energy sources, such as wind and solar, has introduced variability into the energy supply. This variability can lead to challenges in balancing supply and demand, particularly during extreme weather events or periods of high energy demand.
- **Investment gap**: AEMO has identified a substantial investment gap in maintaining and upgrading the energy infrastructure to meet current and future needs. The lack of adequate investment hinders the development of a resilient and reliable energy system.
- **Extreme weather events**: Australia is no stranger to extreme weather events, including bushfires, heatwaves, and storms. These events can disrupt energy supply and infrastructure, causing significant reliability issues.
- **Climate change and energy vulnerability**: As temperatures continue to rise, the demand for electricity for air conditioning and cooling systems surges, placing immense stress on the energy grid[5].

2.2 Economic Loss and Business Impacts of Power Outage

Significant research has been undertaken national and internationally on the economic loss and business impacts of widespread and long duration outages (WALDOs).

Modelling in 2020 by the Australian Energy Regulator (in partnership with Acil Allen) establishes a number of economic modelling scenarios and estimates of different WALDO events across Australia. This includes direct and indirect economic loss to commercial, industrial, residential and other sectors, as well as estimates of the value of customer reliability (VCRs)[6].

The modelling revealed that depending on the composition of economic activity in a region, the level of residential and business load impacted and the duration of the outage event, the economic and social impact of a WALDO can exceed $500m.

The scenarios and the results are outlined in the figures below.

[4] Collated desktop review
[5] Energy Matter (2023) AEMO Calls for Urgent Investment in Energy to Prevent Summer Power Outages accessed at https://www.energymatters.com.au/renewable-news/aemo-calls-for-urgent-investment-in-energy-to-prevent-summer-power-outages/
[6] AER (2020) Widespread and Long Duration Outages -Values of Customer Reliability Consultation Paper accessed at https://www.aer.gov.au/system/files/AER%20-%20Values%20of%20Customer%20Reliability%20Review%20-%20Widespread%20and%20Long%20Duration%20Outages%20Consultation%20Paper%20-%20Updated%2021%20April%202020.pdf

	Scenario 1 - Regional Victoria	Scenario 2 - Suburban Queensland	Scenario 3 - South Australia
Timing of outage			
Season	Winter	Summer	Summer
Day of Week	Weekend	Weekday	Weekday
Start time	5pm (peak)	7 am (peak)	7 am (peak)
Location			
Climate Zone/Remoteness	6/Regional Australia	2/Suburban Australia	5/CBD Adelaide 5/Suburban South Australia 5/Regional Australia
Area Impacted	Medium	Medium	Large
Residential load impacted	258 GWh pa	1,176 GWh pa	3,120 GWh pa
Business load impacted	774 GWh pa	5,881 GWh pa	9,362 GWh pa
Business composition by industry sector	As suggested by the model based on the inputs and National Accounts		
Nature of the outage	USE = 1 GWh Duration = 10.5 hours	USE = 7 GWh Duration = 5.5 hours	USE = 14 GWh Duration = 7 hours

Figure 2 AER WALDO Modelling Scenarios

	Scenario 1 - Regional Victoria	Scenario 2 - Suburban Queensland	Scenario 3 - South Australia
Residential	5.3	16.1	57.6
Agricultural	1.3	2.6	8.8
Industrial	9.4	92.6	194.4
Commercial	8.9	116.1	202.6
Social	5.7	63.9	111.0
Total	**30.5**	**291.3**	**574.48**

Figure 3 AER WALDO Modelling Economic Impacts ($m)

A review of the international economic loss assessments of power outages by Shui, M etal divided economic impact into direct and indirect impacts. The direct impacts can be divided into blackouts on the power industry and the economic impact of power users.

Examples of direct impacts:

- Economic loss to the power industry including sales revenue reduction due to a decline in electricity sales and troubleshooting costs. Brings huge economic loss to the whole power industry which affects the development of the industry. In 2011, there was a power outage of 8000MW in Northeast Brazil, accounting for 90.1% of the grid. This led to an economic loss of $60 million.
- Also affect power users, resulting in industrial production interruption and the reduction in total production. Electronic transactions in business affairs can't be completed. Residents health can be in trouble with no electricity. Other effects are traffic confusion, tourist stagnation, financial transactions interruption. It causes billions of dollars of loss to companies, let alone consumers.

Examples of indirect impacts:

- Additional costs that users pay for reducing the impact of power outages and adjusting their activities
- Economic loss caused by psychological panic caused by power failure
- Invisible loss of inconvenience
- Industrial related economic loss e.g. insufficient supply of commodities impacting trading and consumption, or the reduction of trade caused by blackouts impacting industrial production

The research found a number of factors affecting the economic loss of power outages:

- Interruption frequency: the more power outages, the greater loss they cause because of more frequent user activity interference and power sectors needing to invest more in troubleshooting repair costs and unit start-stop costs.
- Lack of power supply: the higher the reliability level of the power grid, the smaller the blackout caused by power outage, the smaller the lack of power supply and the smaller the loss.
- Interruption duration: the cost of unit blackout increases with the extension of the interruption duration. After the interruption duration exceeds a certain critical value, the cost of unit blackout gradually tends to be stable.
- User types: different users have different power consumption modes and tolerance to power outages so the loss will be different to them.
- Blackout time: different time of day and season will affect the loss
- Time in advance notice of power outages: the earlier the power limit and blackout notifications are, the lower the loss[7].

2.3 Methods of Estimates Economic Loss from Outages

US specific research from 2023 by the Lawrence Berkeley National Laboratory reviewed of methods of estimating the cost of power system outages and the value of outage mitigation or system resilience.

Financial impacts identified include:

[7] Shui, M et al Review on Economic Loss Assessment of Power Outages accessed at https://www.sciencedirect.com/science/article/pii/S1877050918305131

- The cost to restore electricity to consumers
- The cost to repair generation components
- The indirect costs associated with outages such as lost economic activity due to the inability to operate commercial and industrial processes
- Impacts to infrastructure such fallen power lines, damaged generation components due to flooding or debris, and damaged transformers.

Customers in vulnerable socio-economic classes are hit especially hard by outages. Low income communities experience more frequent blackouts and less reliable electricity.

The research confirmed that direct costs of outages are best assessed by analysing the economic consequences of not having access to electricity, typically lost production and consumption. Similarly, the costs to commercial and industrial customers should be calculated by lost profit to the business. Includes additional costs for extra labour, replacing damaged equipment, lost revenue from reduced production, and offsets from reduced energy or labour costs.

For indirect costs, spillover effects of disruptions to other sectors and other changes in economic activity (e.g. price increases that result from shortages) are relevant[8].

[8] Macmillian, M et all (2023) Shedding light on the economic costs of longduration power outages A review of resilience assessment methods and strategies accessed at https://eta-publications.lbl.gov/sites/default/files/erss_manuscript_preprint_0.pdf

3 REGIONAL ECONOMIC PROFILE

This section reviews key data sets and indicators relating to the NEWROC economy.

3.1 General Economic Structure

3.1.1 Census Profile

NEWROC LGAs have a significantly older median age, than the WA and Australian median of 38. This indicates an older age profile in the region, confirmed by the high share of the population which is 65+.

Mt Marshall is the only LGA which has a higher than average Personal weekly income. Every other LGA has lower than State and Australian wage averages across, personal, family and household. Most households are lone person households or couple families with children.

A high percent of dwellings are unoccupied, while a higher than average share of homes are owned outright.

Table 2 Census Socioeconomic Profile, NEWROC, WA and Australia, 2021[9]

Indicators	Koorda	Mt Marshall	Mukinbudin	Dowerin	Nungarin	Trayning	Wyalkatchem	Western Australia	Australia
Headline									
Population	361	459	579	715	255	298	470	2,660,026	25,422,788
Median Age	51	47	44	45	49	55	54	38	38
Average Household Size	2.2	2.3	2.3	2.3	2.1	1.9	1.9	2.5	2.5
Share of Population 0-14 (%)	18.0%	15.9%	21.7%	21.8%	12.4%	10.6%	11.9%	19.0%	18.2%
Share of Population 65+ (%)	26.0%	18.8%	20.1%	25.9%	26.8%	28.8%	33.4%	16.1%	17.2%
Born in Australia	82.3%	81.9%	78.4%	81.7%	68.6%	71.1%	74.7%	62.0%	66.9%
Share of People Attending Educational Institutions									
Pre-School	10	10	7	16	0	0	0	45,452	484,185
Primary	43	35	50	69	16	9	31	222,555	2,075,224
Primary - Government	53.8%	32.4%	29.4%	31.6%	11.1%	13.2%	29.1%	19.3%	18.5%
Primary - Catholic	0.0%	0.0%	0.0%	1.5%	11.1%	0.0%	0.0%	4.5%	5.2%
Primary - other non-Government	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.6%	2.2%
Secondary	7	11	31	33	7	11	14	175,841	1,629,624
Secondary - Government	3.8%	2.8%	13.6%	12.2%	10.0%	19.1%	14.6%	12.7%	12.2%
Secondary - Catholic	0.0%	3.7%	0.0%	0.0%	0.0%	4.4%	0.0%	4.5%	4.8%
Secondary - other non-Government	0.0%	2.8%	2.8%	3.1%	0.0%	0.0%	0.0%	4.6%	4.2%
Tertiary	9	16	19	16	5	5	13	172,239	1,789,994
Tertiary - Vocational education (including TAFE and private training providers)	3.8%	6.5%	4.5%	3.1%	0.0%	8.8%	11.7%	7.4%	7.8%

[9] ABS (2022) Census of Population and Housing 2021, accessed at abs.gov.au

Indicators	Koorda	Mt Marshall	Mukinbudin	Dowerin	Nungarin	Trayning	Wyalkatchem	Western Australia	Australia
Tertiary - University of other higher education	6.2%	3.7%	4.5%	4.1%	8.9%	4.4%	2.9%	13.9%	15.4%
Weekly Incomes									
Personal	$759	$868	$756	$758	$640	$512	$582	$848	$805
Family	$1,524	$1,802	$1,875	$1,531	$1,268	$1,125	$1,481	$2,214	$2,120
Household	$1,341	$1,396	$1,547	$1,197	$1,087	$864	$916	$1,815	$1,746
Share of Household									
Couple family without children	35.1%	30.2%	36.2%	31.2%	33.3%	32.8%	26.3%	28.0%	27.6%
Couple family with children	23.2%	26.4%	27.1%	23.7%	23.3%	12.0%	15.2%	32.0%	31.1%
One parent family	2.0%	7.7%	6.3%	7.8%	8.9%	10.4%	7.4%	11.0%	11.3%
Other family	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	1.0%	1.2%
Lone Person Households	37.1%	33.0%	28.1%	35.3%	34.4%	44.8%	45.6%	25.0%	25.1%
Group Households	2.6%	2.7%	2.3%	2.0%	0.0%	0.0%	4.1%	3.0%	3.8%
Dwelling Occupancy									
Occupied	66.0%	61.3%	73.4%	72.3%	83.8%	57.7%	64.5%	89.1%	89.9%
Unoccupied	34.0%	38.7%	25.3%	26.4%	16.2%	43.2%	35.8%	10.9%	10.1%
Dwelling Type									
Separate house	98.1%	96.0%	100.0 %	96.1%	92.5%	95.4%	96.2%	79.7%	72.3%
Semi-detached, row or terrace house, townhouse etc	0.0%	3.4%	0.0%	1.4%	0.0%	2.3%	2.9%	13.0%	12.6%
Flat or apartment	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.5%	14.2%
Other dwelling	0.0%	0.0%	0.0%	3.5%	4.3%	0.0%	0.0%	0.6%	0.6%
Tenure									
Owned outright	53.5%	49.4%	49.8%	47.2%	51.6%	56.5%	50.2%	29.2%	31.0%
Owned with a mortgage	17.2%	13.2%	16.7%	20.9%	12.9%	13.0%	17.2%	40.0%	35.0%
Rented	16.6%	21.8%	21.9%	20.6%	19.4%	19.8%	22.0%	27.3%	30.6%
Other tenure type	5.7%	15.5%	12.1%	8.5%	9.7%	6.9%	8.1%	2.1%	2.0%
Tenure type not stated	5.7%	1.7%	1.4%	3.2%	3.2%	4.6%	1.9%	1.4%	1.5%

3.1.2 Business Registrations

Dowerin LGA has the most registered businesses in NEWROC with 130. Nungarin has the least amount of registered businesses with 28[10].

[10] ABS (2023) Count of Businesses accessed at abs.gov.au

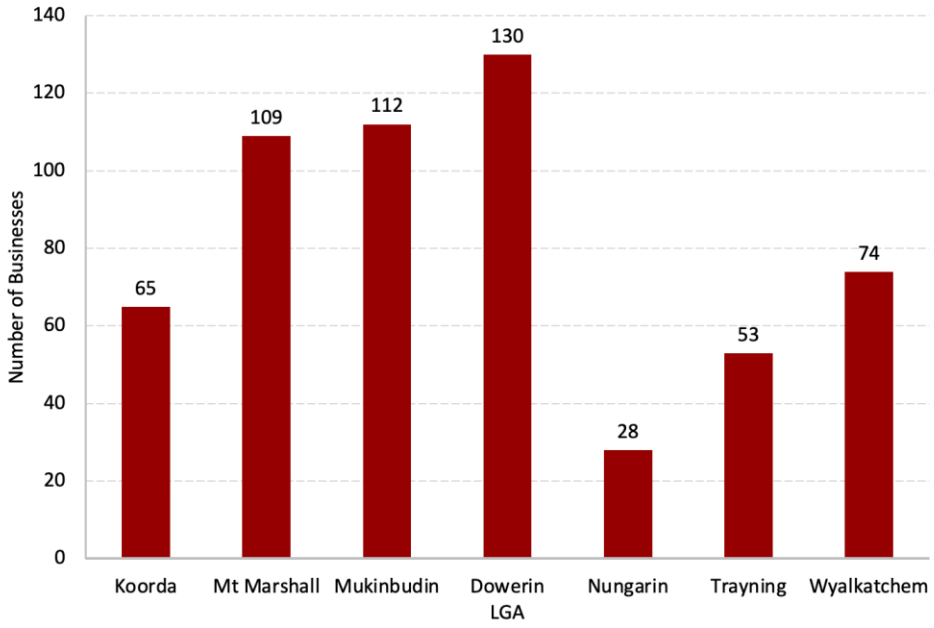

Figure 4 Business Registrations, NEWROC LGAs, 2022

The business registrations by industry show that 349 of the businesses in the NEWROC area are Agriculture, Forestry or Fishing businesses. This reflects the NEWROCs reliance on the Agriculture sector. Real Estate and Construction businesses also make up a reasonable share of businesses.

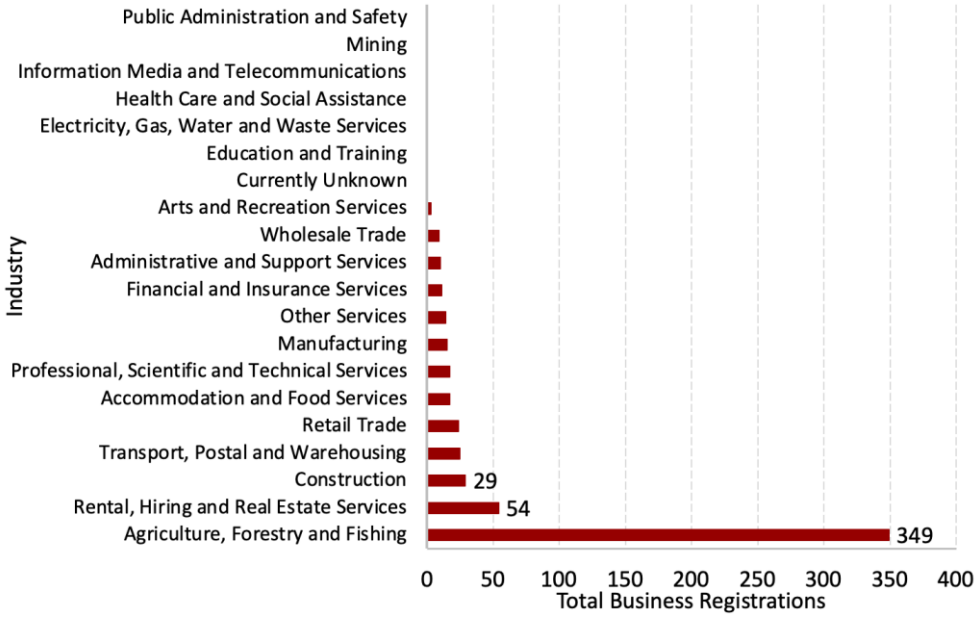

Figure 5 Business Registrations by Industry, NEWROC, 2022[11]

3.2 Economic Activity and Output

NEWROC had a Gross Regional Product of $304.89m in 2023 and a total economic output in excess of $605.47m[12]

[11] As above
[12] REMPLAN (2024) Wheatbelt Region, NEWROC Councils, GRP and Economic Output

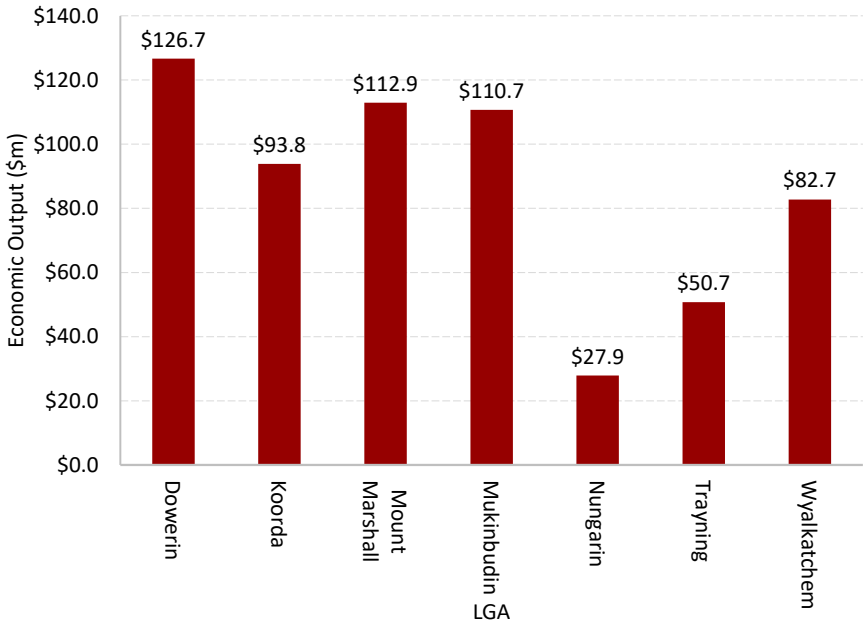

Figure 6 Economic Output by NEWROC LGA, 2023

As with business registrations, the Agriculture, Forestry and Fishing industry accounts for the largest share of economic output with over $338m in 2023.

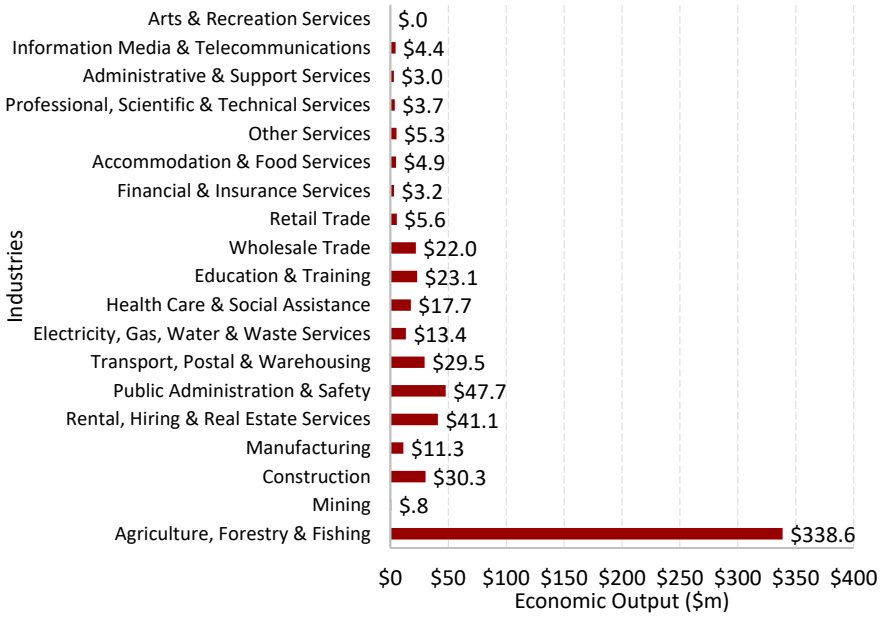

Figure 7 Economic Output by Industry, NEWROC, 2023[13]

When Agriculture is discounted, other notable contributors to regional economic output include:

- Public Administration and Safety - $47.7m
- Rental, Hiring & Real Estate - $41.1m
- Construction - $30.3m and
- Transport, Postal and Warehousing - $29.5m

[13] As Above

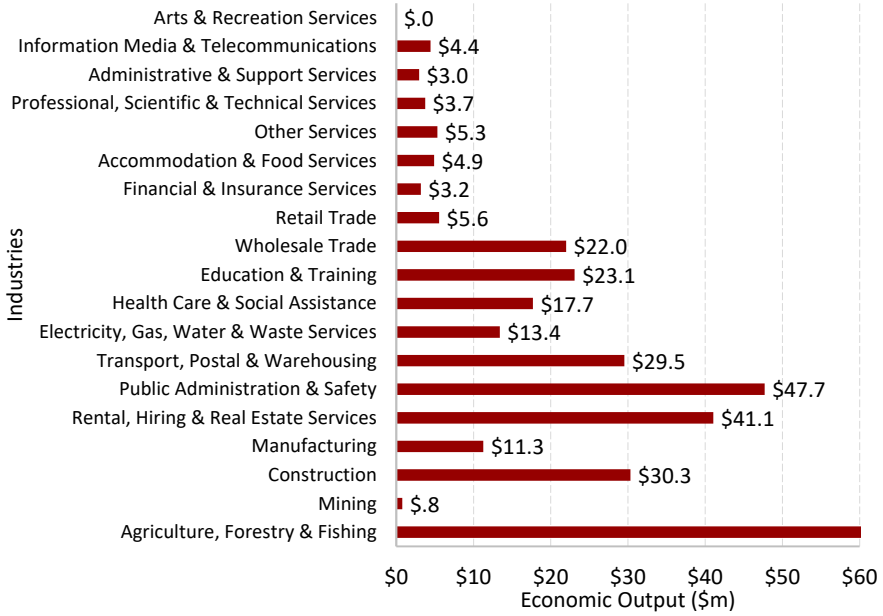

Figure 8 Economic Output by Industry (Zoomed), NEWROC, 2023[14]

[14] As Above

4 ECONOMIC IMPACTS OF POWER OUTAGES

This section assesses the scape of the impact on regional economic output from power outages.

4.1 Weekly Distribution of Economic Activity

It is acknowledged that economic activity and output is not evenly distributed across the 24 hours in a day, nor between weekdays and weekends. The timing of a power outage is therefore particularly important in understanding its impact and scale.

For the purpose of this analysis, Econisis has drawn on data and research on Core Night Time Economy analysis to understand the extent to which economic activity is distributed across the weekdays as well as in 4 hour blocks across a 24 hour day.

The results of this analysis form the following key assumptions on the distribution of economic activity.

Table 3 Assumed Share of Weekly Activity by Day

Day	Share of Weekly Economic Activity
Monday	12%
Tuesday	14%
Wednesday	15%
Thursday	16%
Friday	19%
Saturday	13%
Sunday	10%

Additionally, approximately 96.8% of economic activity tables place between the hours of 6am and 6pm. The remaining 3.2% takes place in the remaining hours[15]. This reflects the night time economy share of the Australian economy in 2021/22. This rate is marginally higher than that of Perth but has been adopted to align with national averages.

Weekly economic output estimates for 2023, derived from REMPLAN for the NEWROC councils were then applied across the week and across 4 hour blocks based on the assumptions above.

4.2 Impacts Scenarios

For the purpose of this assessment, Econisis has tested the economic output impact of three power outage scenarios. These include:

1. 6 Day Outage (Tuesday to Sunday) for 24 hours per day
2. 2 Day Outage (Monday and Tuesday) 24 hours per day
3. 12 Hour Outage (Friday) from 10am to 10pm

4.3 Exclusion of Agriculture

For the purpose of this analysis, agriculture related economic output was excluded. This was due to the significant share of total output accounted for by farming activity, as well as the high propensity for farms to have either independent or backup power supplies. This means that while farming activity is likely to be impacted by a power outage, they have been excluded from this analysis to

[15] Council of Capital City Lord Mayors (2023) Measuring the Australian Night Time Economy 2021-22

ensure it is conservative and focuses principally on the impact on activity more directly related to higher concentrations of power usage in the NEWROC regions (i.e. the towns).

4.4 Economic Multipliers

4.4.1 Approach to Calculating Multipliers

At the core of an Economic Multiplier based impact assessment is Input–Output (IO) tables. IO tables are part of the national accounts by the ABS and provide detailed information about the supply and use of products in the Australian economy, and the structure of and inter–relationships between Australian industries.

IO tables are converted, through statistical analysis, into a series of Economic Multipliers. These Multipliers represent the relationship between the direct activity (expenditure or production) associated with an industry and the wider economy.

The results of an EIA are generally presented as both direct effects, that is effects from the direct activity of the Project or event, and indirect effects, which are additional effects from further rounds of spending in the supply chain. A third or consumption effect, resulting from rounds of consumer spending generated by the additional income in the region can also be calculated.

There are two broad levels of Multipliers that can be utilised for Impact Assessments:

4. **Simple Multipliers** – including the Direct or Initial Effect, First Round and Industry Supply Chain effects.
5. **Total Multipliers** – including the Simple Multipliers plus subsequent Induced Production and Household Consumptions effects.

Impact Assessments can assess:

- **Output** - the actual dollar amount spent on the Project in the Region.
- **Income** - the number of wages and salaries paid to labour.
- **Employment** - the full-time equivalent (FTE) per annum employment generated by the Project; and
- **Value Added** - the value added to materials and labour expended on the Project.

Econisis has undertaken an Impact Assessment for the NEWROC economy, focused providing separate analysis of **Simple and Total Multipliers**.

For the NEWROC economic impacts, this entailed the following tasks:

1. Transaction tables were developed from National IO tables for the NEWROC economy. For the regional economy, the Regional Transaction Table was calculated by applying employment-based location quotients for the Region, based on the results of the 2016/2021 Census of Population and Housing. This has the effect of excluding spending on imports to the Region since they generate no local economic activity.
2. Economic Multipliers were then generated for WA economy across 119 industry categories defined by the ABS.
3. Construction and operational expenditure and production associated with the development were allocated across 119 industry categories.
4. Economic impacts associated with the Project are calculated.

Economic Impact Assessments based on IO-tables and Economic Multipliers have been criticised by Government and academia. Econisis recognises Economic Multipliers are based on limited assumptions that can result in multipliers being a biased estimator of the benefits or costs of a Project.

Shortcomings and limitations of multipliers for economic impact analysis include:

- **Lack of supply**–side constraints: The most significant limitation of economic impact analysis using multipliers is the implicit assumption that the economy has no supply–side constraints. That is, it is assumed that extra output can be produced in one area without taking resources away from other activities, thus overstating economic impacts. The actual impact is likely to be dependent on the extent to which the economy is operating at or if it is near capacity.
- **Fixed prices**: Constraints on the availability of inputs, such as skilled labour, require prices to act as a rationing device. In assessments using multipliers, where factors of production are assumed to be limitless, this rationing response is assumed not to occur. Prices are assumed to be unaffected by policy and any crowding out effects are not captured.
- **Fixed ratios for intermediate inputs and production**: Economic impact analysis using multipliers implicitly assumes that there is a fixed input structure in each industry and fixed ratios for production. As such, impact analysis using multipliers can be seen to describe average effects, not marginal effects. For example, increased demand for a product is assumed to imply an equal increase in production for that product. In reality, however, it may be more efficient to increase imports or divert some exports to local consumption rather than increasing local production by the full amount.
- **No allowance for purchasers' marginal responses to change**: Economic impact analysis using multipliers assumes that households consume goods and services in exact proportions to their initial budget shares. For example, the household budget share of some goods might increase as household income increases. This equally applies to industrial consumption of intermediate inputs and factors of production.
- **Absence of budget constraints**: Assessments of economic impacts using multipliers that consider consumption induced effects (type two multipliers) implicitly assume that household and government consumption is not subject to budget constraints.
- **Not applicable for small regions**: Multipliers that have been calculated from the national IO table are not appropriate for use in economic impact analysis of Projects in small regions. For small regions multipliers tend to be smaller than national multipliers since the inter–industry linkages are normally relatively shallow. Inter–industry linkages tend to be shallow in small regions as they usually do not have the capacity to produce the wide range of goods used for inputs and consumption, instead importing a large proportion of these goods from other regions.

Despite this, IO tables and Economic Multipliers remain popular due to their ease of use and communication of results. Econisis has undertaken a number of steps and made appropriate adjustments to the EIA methodology to address and mitigate these concerns.

Econisis has presented ***Simple and Total Multipliers*** separately in the Assessment. This has the effect of isolating and separating Household Consumption impacts from the core economic supply chain and industry related impacts. By doing so, only those industries with a first round or supply chain connection are considered first.

Additionally, Econisis has developed economic multipliers for the ***NEWROC economy only***. This has the effect of internalising and limiting the extent of the economic impact outside of the State.

Econisis regards the use of Economic Multipliers as part of this Assessment as appropriate and reliable. The results of the assessment are conservative, defensible and suitable for informing decision making.

4.4.2 Economic Output and Supply Chain Impacts

Overall, Econisis estimates that the economic output and supply chain impacts (i.e. simple multipliers) to the NEWROC economy across the scenarios ***range from $900,000 for a 12 hour outage to $5.7m for a 6 day outage***.

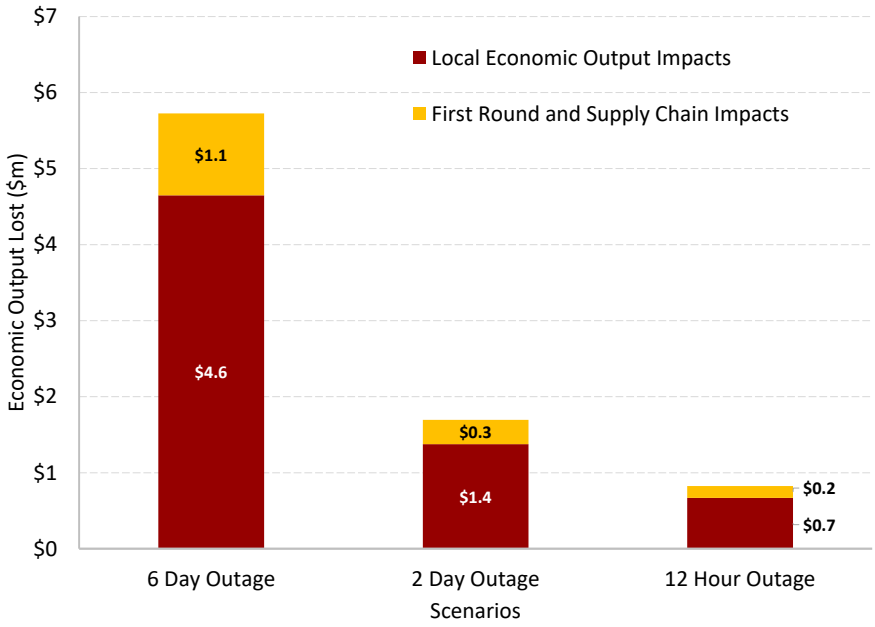

Figure 9 NEWROC Economic Output and Supply Chain Impacts

Note that while the scenario modelling this in assessment assumes that the power outage is for a period of consecutive days, the fact is that the impact would be similar if the same number of days of outage occurred, spread out across the year. The impact does not need to be in a single event.

4.4.3 Household Consumption and Productive Capacity Impacts

The direct impact of power outages on output and supply chains are also expected to have a secondary impact on the households and communities in which these businesses operate. This includes through reduced incomes, earnings and expenditure into the wider economy and the impacts on the economies over productive capacity.

Econisis has estimated this impact through the application of indirect economic multipliers relating to household consumption and production induced impacts.

These impacts have the effect of effectively doubling the scale of the economic loss from power outages, with the loss from a 6 day outage reaching $11m of output. This is equivalent to an average impact of $1.83m in direct and indirect economic impacts per day from an wide and long duration outage (WALD).

Even a comparative short Friday-based 12 hour outage sees its impact increase to $1.7m when indirect household and productive capacity impacts are included.

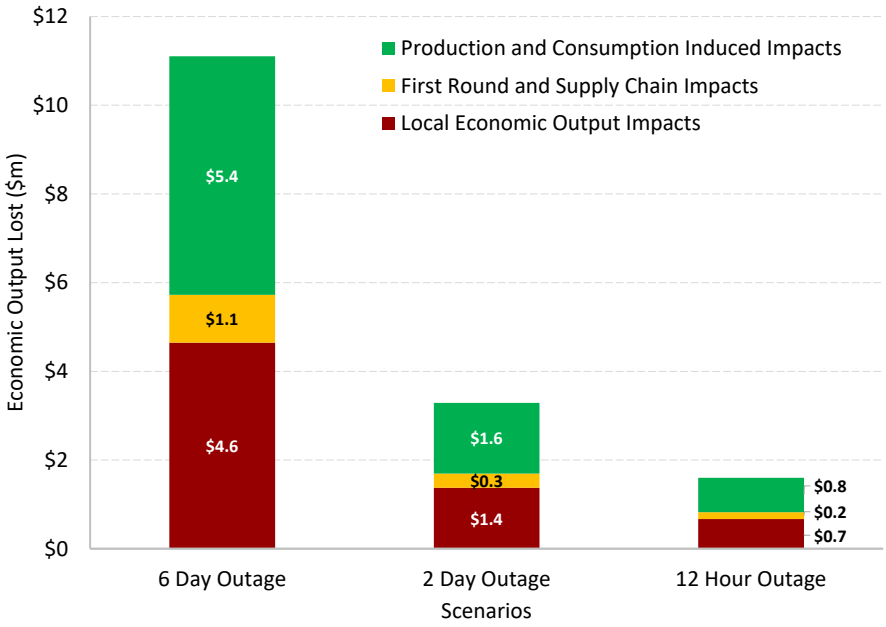

Figure 10 NEWROC Economic Output, Supply Chain and Household Consumption/Production Impacts, by Scenario, Present Value over 20 Years at 7%

4.5 Long Term Discounted Impacts

The above economic output impacts relate only to single outages. However, long-term systemic challenges with power supply and the increasing threats to network sustainable and supply reliability for consumers means a frequency of outages is likely to increase without significant investment in regional network resilience.

Econisis has assessed long-term impacts by assuming one outage for each scenario every year for 20 years. These future outage impacts have then been subject to discounting in line with both WA Treasury and the Australian Government Office of Impact Analysis Cost Benefit Analysis Guidelines.

A compounding discount rate of 7% (medium discount) has been applied to all values past the first year.

The results are that over 20 years annual 6 day outages across the NEWROC region ***would cost the regional economy a present value of $125.9m in output***. Similarly, an annual 2 day outage would see $37.3m in output lost in present value terms, while a single 12 hour outage each year over the court of 20 years would result in a loss of $18.1m in economic output for NEWROC.

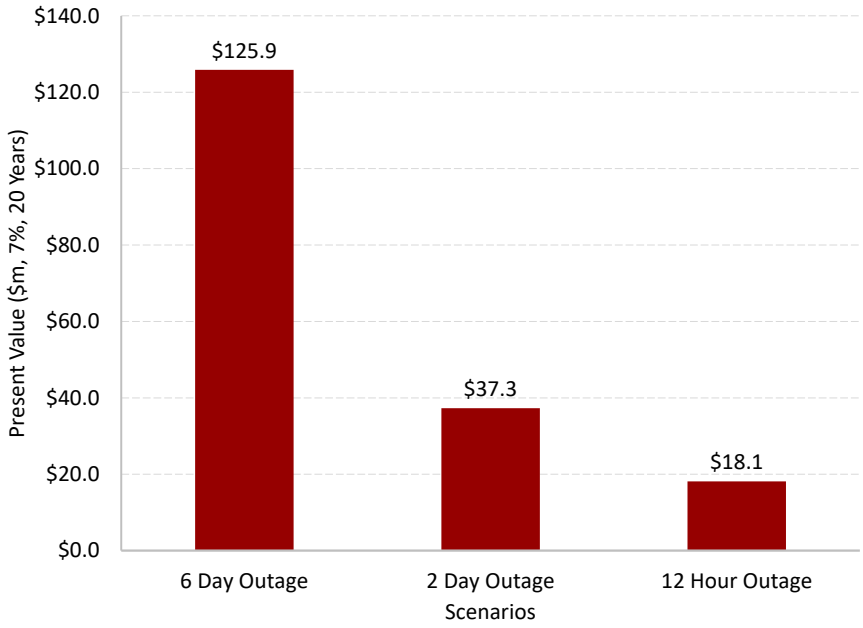

Figure 11 Present Value of Power Outage Economic Output Impacts, 7% Discount Rate over 20 Years, NEWROC

5 TELECOMMUNICATION OUTAGES

The experience of NEWROC councils is that outages of telecommunication services for several days can have a significantly detrimental impact on the regional economy. Considering that part of the impact of power outages is the loss of communication access, particularly in a modern, digitally focused economy, its important to understand the impact of telecommunication outages themselves independent of power outages.

5.1 Research on Telecommunication Outage Impacts

Less research has been undertaken on the economic impacts of telecommunication outages separate and distinct from power outages. In particular, the strongest focus of telecommunication impacts has been on internet access.

Analysis in 2016 by Deloitte Ireland found that in a highly internet connected country, the per day impact of a temporary shutdown of internet and related services would cost an average of US$23.6m in gross value added (or approximately $50m in economic output) for every 10 million people per day[16]. This is equivalent to a daily reduction of GDP by 1.9%.

This was however based on a 35% penetration rate of fixed broadband, which is far below national and even regional rates of between 85-95% . It is also based on analysis from 2016, since when fixed broadband adopt through the NBN and other providers has become increasingly ubiquitous and since the adoption of digital commerce platforms has become the norm.

Data from the Australian Communications and Media Authority in 2024 found that digital communications usage soared in 2023 across a range of metrics. This includes:

- over 85% of the Australian population now enjoys coverage by 5G networks
- 81% of Australian households have adopted a National Broadband Network (NBN) connection.
- 98% of Australian adults possess internet access at home through fixed or fixed wireless networks,
- 81% of households choosing the NBN as their preferred connection method
- Australians downloaded approximately 12.9 million terabytes of data in the three months to June 2023
- 36% of these mobile services utilised 5G in 2023
- 95% of Australians went online for news and information and 87% engaging in online shopping.
- 95% of Australian adults engaging with communication or social media platforms[17]

5.2 Assessing Economic Impact of Internet Outages

While the quality and capacity of internet services across the Wheatbelt remains a critical issue, the delay in restoration of both internet and mobile phone usage for an extended period of time post a power outage remains a major source of economic loss for the NEWROC region.

Econisis has made the following adjustments to the Deloitte data to account for the currency and relevance of the date.

[16] Deloitte (2017) The economic impact of disruptions to Internet connectivity accessed at https://www.deloitte.com/global/en/Industries/tmt/perspectives/the-economic-impact-of-disruptions-to-internet-connectivity-report-for-facebook.html

[17] Independent Australia (2024) Australia's digital evolution soared in 2023 accessed at https://independentaustralia.net/business/business-display/australias-digital-evolution-soared-in-2023,18208

Namely, Econisis has:

- Adjusted fixed broadband penetration to 85%.
- Increased digital share of economic activity from 5.7% to 7.5% based trends from ABS digital activity in the Australian economy data[18]
- Allowed for 10% of economic activity across all sectors being "internet dependent" to reflect the narrow definition of digital activity by the ABS to exclude internet-connected point of sale, stock management or business management systems.

These assumptions have been applied to the economic output of NEWROC. This time agriculture is included considering the high rates of connectivity of NEWROC and Wheatbelt.

Based on the above, a day without internet in NEWROC costs the regional economy 16.01% of economic output. Over a three day period, ***this equates to over $799,800 of lost economic output***.

Applying a similar 20 year approach of an annual 3 day internet outage discounted at 7%, ***this equates to a present value economic output loss of $9.07m***.

[18] ABS (2022) Digital activity in the Australian economy accessed at https://www.abs.gov.au/articles/digital-activity-australian-economy-2020-21

6 CONCLUSIONS

NEWROC and the wider Wheatbelt was subject to a wide and long duration power outage in early 2024, the economic costs of which have likely been significant to both regional and State economies.

The analysis undertaken by Econisis for the economic impact of power outages demonstrates the significant economic loss and foregone production and activity resulting from power outages. Even a short power outage can result in hundreds of thousands of dollars of lost economic output. More prolonged outages, lasting several days, can result in millions of dollars of economic activity being lost to the region and State.

Table 4 Economic Output Loss, by Single Power Outage Scenarios ($m), NEWROC

Scenarios	6 Day Outage	2 Day Outage	12 Hour Outage
Local Economic Output Impacts	$4.6	$1.4	$0.7
First Round and Supply Chain Impacts	$1.1	$0.3	$0.2
Production and Consumption Induced Impacts	$5.4	$1.6	$0.8
Total Economic Impacts	**$11.1**	**$3.3**	**$1.6**

This loss is significant enough when only direct and supply chain related impacts are considered. However, when wider household and production related impacts are also factored in, the value of lost economic activity from power outages almost doubles, across all scenarios. This reflects the essential and critical nature of power supplies to economic and residential sectors and the significant negative impacts on households direct and through the economy from power outages.

AEMO has warned of increased power supply irregularity and interruptions in Australia owing to a range of contributing and coalescing factors. When considered over the long-term, with appropriate discounting, the scale of the potential future lost economic output due to power outages becomes readily apparent, with yearly 6 day outages potentially costing the NEWROC economy almost $126m in output (in present value, discounted terms) over a 20 year period. This translates to reduced incomes, employment, exports and economic and business activity for the region and State.

Table 5 Present Value of Economic Loss, Annual Incidences for 20 Years, by Power and Internet Outage Scenarios ($m), 7% Discount Rate, NEWROC

Scenarios	$m
Power	
6 Day Outage	**$125.9**
2 Day Outage	**$37.3**
12 Hour Outage	**$18.1**
Internet	
3 Day Outage	**$9.10**

While research on telecommunications outages is less comprehensive than that of power outages, the increasingly digital and internet dependent nature of Australian and Wheatbelt economies means that telecommunication outages still have a significant economic impact. Conservative estimates put the impact on economic output of the internet being down in the NEWROC for 3 days at $799,000. This equates to over $9m in lost economic activity over 20 years (at a 7% discount rate) based on annual 3 day outages.

Combined this means that a 6 day power outage AND a 3 day internet outage each year over 20 years would cost the NEWROC economy approximately $136m in lost economic output (at a 7% discount rate).

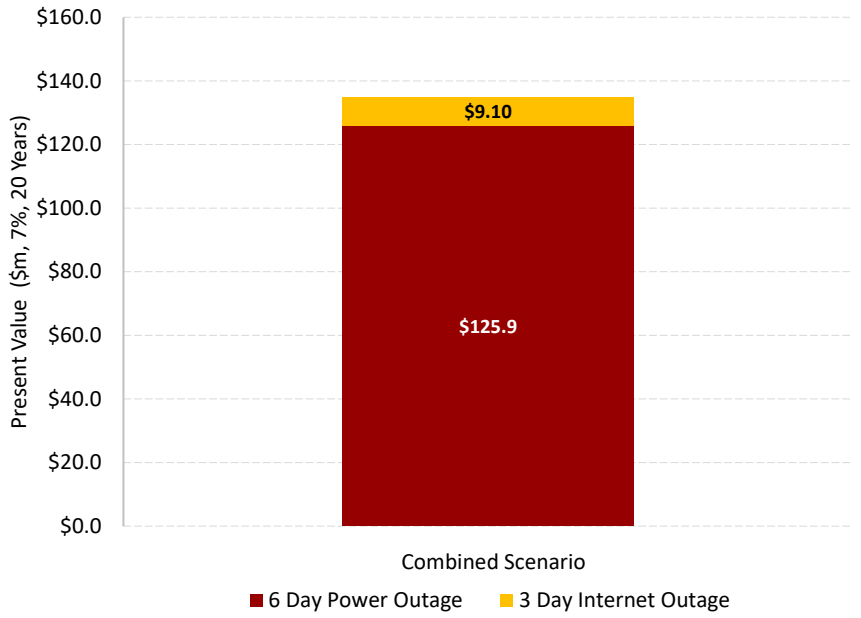

Figure 12 Present Value of Power and Internet Outage, Economic Output Impacts, 7% Discount Rate over 20 Years, NEWROC

The scale and significance of the loss of economic activity and output from NEWROC from both power and telecommunications outputs each year highlights the critical need for investment in the critical utilities and infrastructure of the region.

The cost of doing nothing or attempting simply to respond to an increased frequency of major natural disasters and calamities on the power and telecommunication networks, is too great.

Instead, concerted effort is required to improve and enhance the resilience of both power and telecommunication networks in the NEWROC region to ensure that recent examples of substantial and structural economic loss to the region and State are not regularly replicated into the future.

ECONISIS

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