Diversification and growth

Transforming mining land in the Hunter Valley

Lock the Gate Alliance

26 May 2022

Building a better working world

Release notice

Ernst & Young ("EY" or "we") was engaged on the instructions of Lock the Gate Alliance ("Client") to examine how the Hunter could repurpose mining land as coal mines in the region close over the next 20 years ("Project"), in accordance with the engagement agreement dated 15 November 2021 including the General Terms and Conditions ("the Engagement Agreement").

The results of EY's work, including the assumptions and qualifications made in preparing the report, are set out in EY's report dated 26 May 2022 ("Report"). The Report should be read in its entirety including the applicable scope of the work and any limitations or disclaimers. A reference to the Report includes any part of the Report. No further work has been undertaken by EY since the date of the Report to update it.

EY has prepared the Report for the benefit of the Client and has considered only the interests of the Client. EY has not been engaged to act, and has not acted, as advisor to any other party. Accordingly, EY makes no representations as to the appropriateness, accuracy or completeness of the Report for any other party's purposes.

In preparing this Report we have considered and relied upon information from a range of sources believed to be reliable and accurate. We have not been informed that any information supplied to us, or obtained from public sources, was false or that any material information has been withheld from us.

We do not imply and it should not be construed that we have verified any of the information provided to us, or that our enquiries could have identified any matter that a more extensive examination might disclose.

No reliance may be placed upon the Report or any of its contents by any party other than the Client ("Third Parties"). Any Third Party receiving a copy of the Report must make and rely on their own enquiries in relation to the issues to which the Report relates, the contents of the Report and all matters arising from or relating to or in any way connected with the Report or its contents.

This Report and its contents may not be quoted, referred to or shown to any other parties except as provided in the Agreement. EY disclaims all responsibility to any Third Parties for any loss or liability that the Third Parties may suffer or incur arising from or relating to or in any way connected with the contents of the Report, the provision of the Report to the Third Parties or the reliance upon the Report by the Third Parties.

No claim or demand or any actions or proceedings may be brought against EY arising from or connected with the contents of the Report or the provision of the Report to the Third Parties. EY will be released and forever discharged from any such claims, demands, actions or proceedings.

The work performed as part of our scope considers information provided to us and a number of combinations of input assumptions relating to future conditions, which may not necessarily represent actual or most likely future conditions. Additionally, modelling work performed as part of our scope inherently requires assumptions about future behaviours and market interactions, which may result in forecasts that deviate from future conditions. There will usually be differences between estimated and actual results, because events and circumstances frequently do not occur as expected, and those differences may be material. We take no responsibility that the projected outcomes will be achieved, if any.

We highlight that our analysis and Report do not constitute investment advice or a recommendation to you on a future course of action. We provide no assurance that the scenarios we have modelled will be accepted by any relevant authority or third party.

Our conclusions are based, in part, on the assumptions stated and on information provided by the Client and other information sources used during the course of the engagement. The modelled outcomes are contingent on the collection of assumptions as agreed with the Client and no consideration of other market events, announcements or other changing circumstances are reflected in this Report. Neither EY nor any member or employee thereof undertakes responsibility in any way whatsoever to any person in respect of errors in this Report arising from incorrect information provided by the Client or other information sources used.

EY have consented to the Report being published electronically on the Client's website for informational purposes only. EY have not consented to distribution or disclosure beyond this. The material contained in the Report, including the EY logo, is copyright. The copyright in the material contained in the Report itself, excluding EY logo, vests in the Client. The Report, including the EY logo, cannot be altered without prior written permission from EY.

EY's liability is limited by a scheme approved under Professional Standards Legislation.

Table of contents

Executive summary

The Hunter is Australia's largest regional economy, with strong foundations in mining, agriculture, defence and broad-based services. While the region has undergone significant structural change over the past three decades, it now faces another major adjustment as economies lower emissions and reduce their requirements for coal.

Across the Hunter, 17 mines are due to close over the next 20 years. These closures are likely to involve major economic challenges, with new industry developments and employment needing to be found.

This analysis examines the economic opportunities for the Hunter to reuse and revitalise the region's decommissioned coal mine sites as they become available, repurposing more than 130,000 hectares in total. In consultation with Lock the Gate Alliance (LTG), the following three development scenarios are assessed, each of which seek to leverage the region's strategic advantages and provide different economic restoration pathways for former mine sites.

1 Core transition pathway

The minimum legal standard mine owners must rehabilitate their mine owned land to.

2 Maximum conservation pathway

Increased conservation requirements on mine owners by extending rehabilitation requirements to the land surrounding the mine.

3 Renewable energy precincts

Repurposing existing mining infrastructure and utility connections for new renewable energy precincts.

The potential economic gains to the Hunter

Economic indicator	1 Core transition pathway	2 Maximum conservation pathway	3 Renewable energy precincts
New investment (Capital expenditure)	$12 million	$24 million	$1.3 billion
Industry output	$240 million	$500 million	$7.0 billion
Economic output (Gross regional product)	$95 million	$200 million	$3.7 billion
Average annual employment (FTE)	320	670	13,600

A high level assessment indicates the potential for concerted industry development and conservation (scenarios 2 and 3) to generate major economic gains for the Hunter. Under scenarios 2 and 3, regional economic activity could increase by around $105 million or $3.6 billion respectively on top of the current trajectory of the Hunter.

Both development scenarios also generate substantial job growth. Scenario 3, which involves investment into renewable industries, could increase annual employment by an additional 13,300 full time jobs.

Key areas for new industry growth are likely to involve:

- Forestry
- Livestock
- Manufacturing
- Construction
- Trade
- Transport
- Electricity
- Processed foods
- Services
- Green hydrogen

The values on this slide represent the Net Present Value (NPV) of the economic output over 25 years, using a 7% discount rate. Gross regional product, is the aggregate economic output for the Hunter region.


1
The context

New economic opportunities can emerge as Hunter coal mines close

Globally, there is a major transition from fossil fuels to renewable energy. Not only are governments facing increasing scrutiny to reduce carbon emissions, but businesses and capital markets are sharply focused on Environmental, Social and Governance (ESG) based investing to generate returns and lower their carbon footprint.

This global transition presents both opportunities and challenges for regions heavily reliant on fossil fuel industries for employment and growth. The Hunter is now confronting this change with 17 mines closing over the next 20 years, freeing up more than 130,000 hectares of land for repurposing.

For the Hunter, the phasing down of fossil fuel based industries creates several key vulnerabilities, especially managing the transition of its large industrial employment base. Crucially, new investment into alternative low emission industries has the potential to provide sustainable opportunities for employment. Key economic opportunities include:

- Energy production – investment into clean and renewable industries
- Agriculture – expanding the capacity of existing agriculture in the region
- Manufacturing – develop manufacturing capacity in high growth industries
- Conservation – land rehabilitation and ecological management to restore and foster the natural Hunter ecosystem

Origin Energy closes Eraring coal-fired power station

Origin Energy announces the closure of Eraring coal-fired power station seven years early. Shutting the Eraring coal-fired plant comes one week after AGL announced it was shutting down Bayswater and Loy Yang A coal power stations early.

Purpose of engagement

Lock the Gate Alliance (LTG) commissioned EY to examine how the Hunter could repurpose mining land as coal mines in the region close over the next 20 years, and the economic value of doing so.

This report forms part of the LTG's work within the Hunter Renewal Roadmap to support the transition to a low emission economy and demonstrate how this transition can benefit workers, develop local industry and continue to protect the environment. This report is structured in the following chapters:

- **Chapter 2** provides an overview of the Hunter region, including the regions economic and strategic priorities that will shape potential uses of released mine title land
- **Chapter 3** assesses three economic scenarios for mine land redevelopment, including:
  - A baseline scenario for the region, including planned mine closures and current requirements for rehabilitation and release, and two additional pro-investment and conservation scenarios
  - The amount of land used for repurposing, and the potential industry outcomes from different land uses and investment policies
  - An explanation of the possible uses in renewable energy precincts
- **Chapter 4** highlights the economic output of the three scenarios, including:
  - Key insights and potential actions to improve the transition to a low carbon future
  - How economic prospects can be harnessed going forward

Source: Power Technology

2 The Hunter region

The Hunter region is resource reliant

The Hunter region is Australia's largest regional economy, supporting nearly 322,000 jobs and generating economic output of around $43 billion. The Hunter has a population base covering the large metropolitan area of Newcastle, regional towns and remote farmland, accounting for 9% of NSW's population.

Geographically, the Hunter is diverse, home to Australia's oldest wine country, rich natural resources, and fertile farming lands. The Hunter is also in close proximity to the major population centre of Sydney and the Port of Newcastle.

Combining these natural advantages and its strategic location, employment within the Hunter covers mining, agriculture, business, tourism and other economic activities. By 2036, population in the Hunter region is set to grow to around 862,000 and create 61,500 new jobs. Supporting this economic growth are key strengths and emerging sectors:

Supply linkages

World class supply linkages enabled by an extensive rail system, highways, and the Port of Newcastle.

Wine making

The oldest wine making region in the country, with growing tourism and hospitality sectors.

Agribusiness

Agricultural industry accounts for over $460 million in output, including cattle, milk, poultry, eggs, hay and wool.

Mining in the Hunter

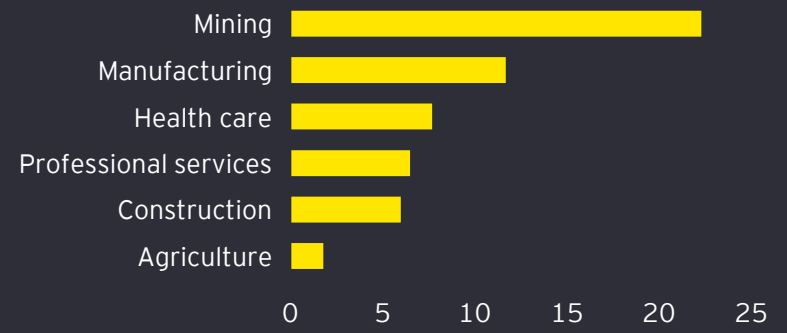
Mining has been a major source of economic activity and export revenue over the past century, reflecting the Hunter's coal resources. The Hunter holds nearly 40% of NSW coal deposits and the mining sector's influence continues to support a wide range of allied industries across the region.

Historically, the coal industry has provided significant opportunity for local employment, with 95% of Australia's thermal coal exports in 2009 coming from Hunter mines. While coal activity is set to continue for many years, the industry is commencing a global transition into renewable energy.

Other important aspects include its strategic position on the east coast, access to major ports and its established infrastructure and trade routes. This existing ecosystem, which historically has been focused on the mining industry, can be repurposed and reused for future businesses generating new employment opportunities.

Other industries within the Hunter

The economy is far more reliant on primary industries, for example mining, than it is on services. The Hunter region's economic contributions include a distribution of predominantly mining, manufacturing, and agriculture.



Source: EY analysis of ABS data

Source: NSW Department of Planning and Environment and NSW Department of Primary Resources

Repurposing coal mining sites provides new growth prospects

Closure and rehabilitation of mine land

The release of land as mines are scheduled to close, and the global shift from coal provides the Hunter with new opportunities to pivot its economic base, while leveraging its major workforce, industry and supply chain strengths. Transitioning into renewable energy, conservation, and other agricultural products can diversify the Hunter's economy, helping generate long term jobs.

With more than 130,000 hectares of mining land scheduled for release over the next 20 years, repurposing the land to new industries can ease the transition away from fossil fuel. Mining land is assumed to be available for restoration and active management five years after operations cease. Appendix A provides the schedule of mines set to close in the Hunter.

Under legal and licensing conditions, mining companies must rehabilitate mining land to a safe and stable condition. Statutory rehabilitation requirements include extensive woodland restoration across active mine land. Further improvement and ecological management on other mine owned land has the potential to significantly improve environmental outcomes. Rehabilitation is a continuous process and is essential for the land's future economic potential.

The Hunter is in a strategic position to take advantage of new sustainable industries, and should take proactive steps to capitalise on emerging opportunities and improve economic outcomes.

BHP ends domestic thermal coal sales

Thermal coal mined by BHP will no longer be burned to make electricity in Australia. BHP has started dismantling the 10 kilometre conveyor belt that fed coal from its Mt Arthur mine to AGL's Bayswater and Liddell power stations.

Possible future development scenarios

In consultation with LTG, this report looks at three future development scenarios, progressing from current rehabilitation requirements to increased conservation and finally renewable energy precincts.

The scenario assessment has adopted the following process:

- First, the report examines the mandatory restoration requirements of mine owners, providing the current economic trajectory of the Hunter over the next 25 years
- Next, the report looks at maximising conservation, where the Hunter would increase the area required to be rehabilitated to facilitate future agricultural and environmental industries
- Lastly, the report looks at a scenario which keeps the increased area used for rehabilitation, but focuses on additional development of renewable energy precincts on existing mining infrastructure sites, that cannot be rehabilitated into agriculture uses

Each scenario identifies future industries where potential economic prospects could be seen. The industries include:

- Forestry
- Livestock
- Manufacturing
- Construction
- Trade
- Transport
- Electricity
- Processed foods
- Services
- Green hydrogen

Source: Australian Financial Review and Lock the Gate Alliance

3 Economic development pathways

Three proposed land use scenarios to support the region's economy

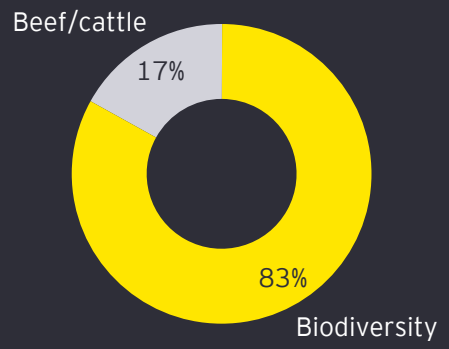
In consultation with LTG, three discrete scenarios of future land use and investment in the Hunter were developed and examined. The scenarios are additive, with each scenario building on the previous one to showcase the future economic potential of the region. Scenario 1 covers mine owner's current restoration requirements. Scenarios 2 and 3 are new policy initiatives which increase the level of land restoration and active management, extend the land conservation footprint, and make new capital investments.

1 Core transition pathway

This scenario is the current trajectory of the Hunter. It represents the minimum legal standard mine owners must rehabilitate the land to and repurposes the smallest amount of land.

With a total of $12 million of capital expenditure, industry output is expected to increase by

$240 million comprising:

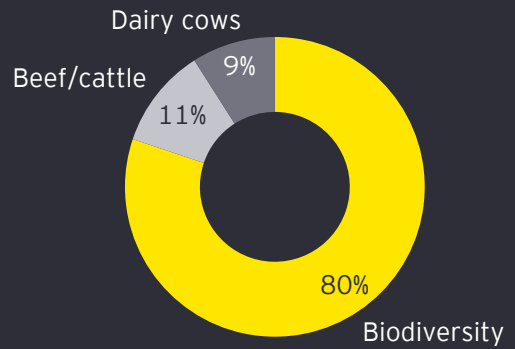


2 Maximum conservation pathway

This scenario increases conservation requirements on mine owners, and extends restoration and land management to the land surrounding the mine which is owned by the mine owners.

With a total of $24 million of capital expenditure, industry output is expected to increase by

$500 million comprising:

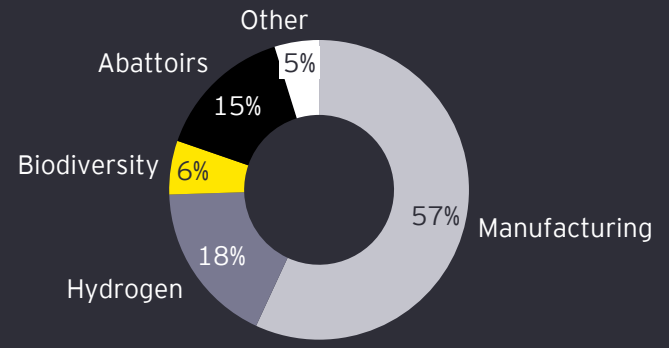


3 Renewable energy precincts

Building on the increased conservation requirements of scenario 2, scenario 3 involves repurposing existing mining infrastructure and utility connections for renewable energy precincts.

With a total of $1.3 billion of capital expenditure, industry output is expected to increase by

$7 billion comprising:



The values on this slide represent the Net Present Value (NPV) of the capital expenditure and the industry output over 25 years, using a 7% discount rate.

Each development scenario drives different industry growth and activity

Each scenario involves different forms and levels of capital investment. The table on the right provides a snapshot of the inputs for each scenario and compares their capital expenditure, economic output, and the land used for rehabilitation. Scenarios 2 and 3 involve a greater land size in comparison to scenario 1, essentially widening rehabilitation requirements on mine owners beyond their mine title land to surrounding mine owned land.

Industry sector outputs expand across scenarios

Scaling up capital expenditure and conservation on mining land expands the economic base of the region. For example, the core pathway increases output in the biodiversity and beef/cattle industries, but by increasing capital expenditure and rehabilitation requirements, the maximum conservation pathway sees the addition of the sheep and dairy cow industry to the employment base. Similarly, renewable energy precincts increases and focuses capital expenditure into renewable energy, increasing manufacturing, green hydrogen, abattoirs and solar energy.

Certain investments generate higher levels of income

Rebuilding and replenishing woodland forms part of a wider investment into conservation and land management activities. Conservation and land management investment generates increased levels of income which flow into the Hunter comparatively to market based outputs.

Other investments similar to woodland replenishment include dairy processing, manufacturing, green hydrogen and solar. On the other hand, investments into abattoirs and sheep produce more economic output to the industry then it costs to establish.

Total value	1 Core transition pathway	2 Maximum conservative pathway	3 Renewable energy precincts
Capital expenditure	$12.2 million	$24.0 million	$1,333.1 million
Where is the capital expenditure going?	56% woodland 30% beef/cattle 14% biodiversity	47% woodland 20% beef/cattle 18% dairy cows 14% biodiversity <1% sheep	50% manufacturing and renewables 25% green hydrogen 18% solar energy 5% abattoir 1% dairy processor <1% woodland <1% beef/cattle <1% biodiversity <1% dairy cows
Industry output	$239.7 million	$500.4 million	$6,968.5 million
Industry output by industry	83% biodiversity 17% beef/cattle	80% biodiversity 11% beef/cattle 9% dairy cows <1% sheep	57% manufacturing and renewables 18% green hydrogen 15% abattoir 6% biodiversity 2% dairy processor 2% solar energy <1% beef/cattle <1% dairy cows
Total area repurposed	79,716 hectares	130,609 hectares	132,239 hectares

The values on this slide represent the Net Present Value (NPV) of the capital expenditure and the industry output over 25 years, using a 7% discount rate.

Land release and investment profiles under the three development scenarios

As mines in the Hunter close, land becomes available to be repurposed. The three alternative land release investment profiles which have been developed based on public information, assumes mining land becomes available for redevelopment five years after the mine is scheduled to close. Capital expenditure levels reflect a similar pathway to the land released over the forecasting period.

The core transition pathway repurposes less land and at the lowest cost

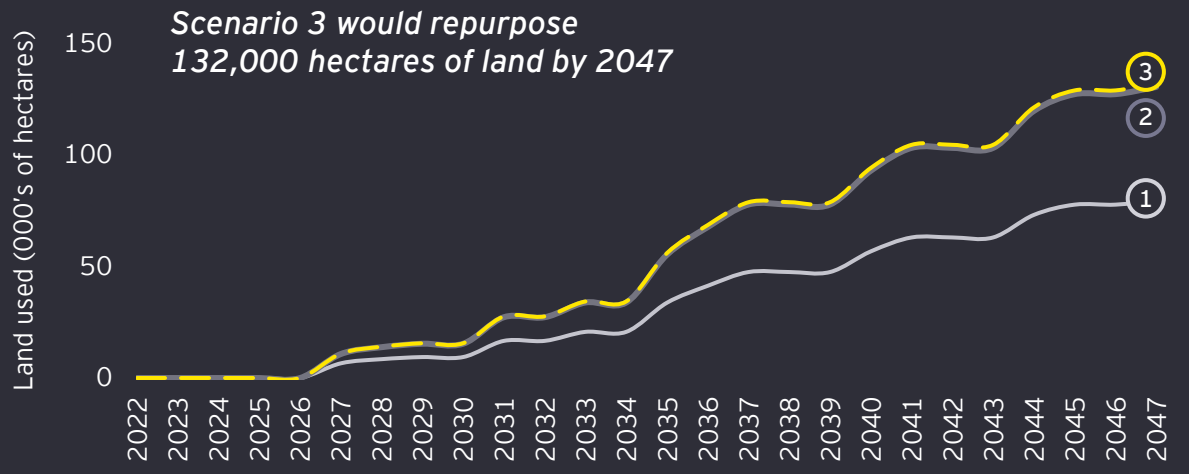
The core transition pathway only considers the rehabilitation of current mining titles, therefore repurposing less land and requiring less capital expenditure than scenarios 2 and 3.

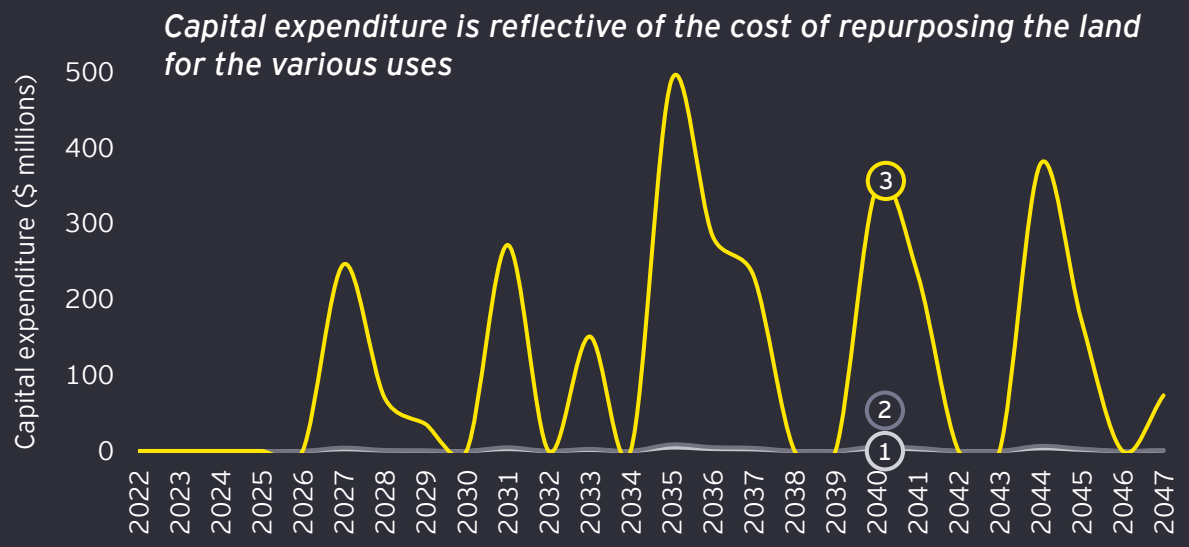
The maximum conservation pathway repurposes more land

The maximum conservation pathway requires mine owners to rehabilitate the mining title and restore surrounding mine owned land. Widening rehabilitation requirements increases land available for future use by over 50,000 hectares. Here, land is predominantly repurposed for agricultural industries, including grazing land, woodlands and biodiversity corridors. Agricultural industries require similar levels of capital expenditure to the core transition pathway.

The renewable energy precincts requires greater capital expenditure

Scenario 3 proposes to use an additional 1,630 hectares of land already confined to mining infrastructure areas, for the development of new renewable energy precincts. Despite only using a small amount of land, renewable energy precincts require higher levels of capital expenditure, relating to construction and purchasing equipment.





Source: Information provided by Lock the Gate Alliance.

1 Mine owners are legally required to rehabilitate their mine land

The core transition pathway follows current rehabilitation requirements for mine owners within the Hunter. Mine owners in NSW are obligated to conduct rehabilitation and environmental management activities on their mine owned land under the Mining Act including undergoing assessment, audits and site inspections.

The NSW government has oversight of mine rehabilitation

Prior to the commencement of any mining operation, mining companies work with multiple state government authorities to develop comprehensive rehabilitation plans. The following state authorities play a role in regulating mine rehabilitation for NSW:

- The Department of Planning and Environment
- The Resources Regulator
- Mining Exploration and Geosciences NSW

State government consent or approval in NSW requires mining companies to provide an annual progress report against their agreed rehabilitation plan.

The required activities aim to return the land to a safe condition

Land disturbed by mining activity is progressively rehabilitated throughout operation, with the objective of returning mining land to a safe and stable condition consistent with the surrounding landscape. Rehabilitation activities include:

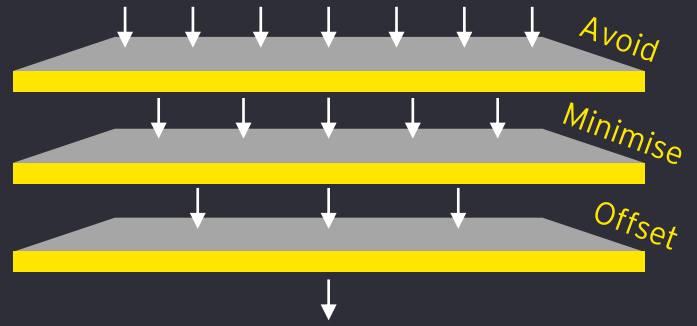
Revegetation

Water management

Hydrogeology

Rehabilitation Management Plans

A Rehabilitation Management Plan (RMP) outlines a mine's rehabilitation objectives, strategies and actions required over the cycle of the mine. RMPs have the objective of leaving a stable and functioning landscape after mining activity has ceased, along with outlining activities to avoid and minimise environmental harms.



Most Hunter mines have extensive woodland and other restoration requirements in their RMP. Some of this restoration is completed on nearby areas of land to offset the loss of biodiversity caused by the mine.

What if the mine owner does not meet the rehabilitation requirements?

State government authorities require mine owners to provide financial security to cover the costs of rehabilitating land if, for whatever reason, the mining company does not meet rehabilitation commitments and obligations.

While the size of the security is proportionate to the estimated cost of rehabilitating land to a minimum standard, the actual cost of rehabilitation in the case of non-compliance can exceed the security's value (sometimes by orders of magnitude). As such, taxpayers can still face substantial risks mitigating the costs from non-compliance.

Source: NSW Mining

2 The maximum conservation pathway restores more land and to a greater level of rehabilitation

The maximum conservation pathway builds on scenario 1 by increasing the level of rehabilitation and active management of the land, and extends these measures to the mine-owned 'buffer lands' surrounding the mine titles. Increasing conservation to surrounding land builds new opportunities for the Hunter and ensures more land is available for future use.

Under the core scenario, the rehabilitated mining land is used for cattle, biodiversity and woodland. Under the maximum conservation pathway, the land will additionally be used for dairy cows and sheep.

What is conservation and land management?

The Conservation and Land Management sector includes businesses and organisations that operate national parks, nature reserves, council reserves, indigenous protected areas, commonwealth lands, private land and botanical gardens, to preserve flora and fauna in their natural environment.

Organisations in this sector also provide support to farmers and fishers across Australia on best-practice sustainable agriculture. They are focused on expert management of natural assets such as soil, water and native vegetation. Caring for the land includes a range of activities, including:

- Sustainable farm practices
- Restoring native habitats and revegetation
- Controlling weeds and pests
- Developing and sharing local natural resource management skills and knowledge
- Threatened species management
- Sharing of cultural and management information

The principles of land conservation

- **Preservation** – lands and their natural resources should not be consumed by humans and should instead be maintained and transmitted to future generations
- **Restoration** – the process of returning ecosystems and communities to their original natural conditions
- **Remediation** – the process of improving the ecological function of an ecosystem in bush land through activities such as weeding, pest-management and erosion control
- **Mitigation** – the process of removing the damage done by contaminants and pollutants in waterways, soil and ecosystems through sustainable practices which do not cause further harm

What is forestry?

Australia's forests provide a range of benefits through wood, other forest products, and ecosystem services including water protection and supply, soil protection, carbon storage and sequestration, habitat for flora and fauna species, tourism and recreation, and cultural value for both non-Indigenous and Aboriginal and Torres Strait Islander peoples.

To meet the growing demand for wood and wood products, the Australian Government released the National Forest Industries Plan in 2018. The plan provides a vision supporting the forest industries' aspirational goal of planting a billion new trees over the period to 2030.

Reflecting that forestry is largely an environmental asset, the economic benefits from forestry development largely accrue through the investment process rather than market returns.

Source: Renew Method

Source: Department of Agriculture, Water and the Environment

3 The renewable energy precincts scenario increases economic opportunities

Scenario 3 incorporates slightly more land then scenario 2 and repurposes this additional 1,630 hectares for renewable energy precincts and industrial purposes. Renewable energy precincts include solar and battery manufacturers, food processing and green hydrogen factories, and other renewable energy industries. More details about these industries is discussed over the next three pages.

Solar

- Solar farms use large scale photovoltaic (PV) panels or other means of collecting solar energy to harvest solar power. They operate as power plants to generate energy on a commercial or utility scale.
- A solar farm requires around two to three hectares of relatively flat land per megawatt of power generated.
- Solar farms require a range of infrastructure, including inverters, energy and battery storage, substation or transmission for connecting to the grid, and access tracks for construction and maintenance.

Solar milestone as Australia passes 25GW mark

Australia has reached 25GW of installed capacity, resulting in Australia having the most PV per capita in the world. 2021 was a record breaking year for solar in Australia, with a total of 5.2GW of PV installed.

Employment in solar farms

There are four major sectors for solar jobs: manufacturing, system design, project development and installation/operations. Within these areas, there are a range of jobs, including:

- Engineers, manufacturers, technicians, installers, maintenance workers, trade and construction workers.

Battery

- Battery farms store renewable energy and are able to provide an alternate energy source to households in the event of a power outage.
- Batteries enable higher levels of renewable energy integration through energy arbitrage and replace the need for fossil fuel plants to substitute the grid at peak times of demand.

Tesla battery farms signals key change in Australia's green energy

Tesla's battery farm, located in South Australia, officially called the Hornsdale Power Reserve, was connected to the grid in December 2017. The farm was installed to improve the electrical grid after a storm disrupted stable power supply. The Hornsdale Power Reserve is used as an alternative power source to reduce the load from traditional power grids. The construction cost was $161 million, providing 100 megawatts of energy initially to thousands of South Australian properties.

Employment powered through battery farms

The Hornsdale Power Reserve provided 158 on site jobs and 898 indirect jobs while being built, and 6 on site jobs and 59 indirect jobs now that it is operating.

This employed people from a variety of backgrounds in the local area including battery technicians, energy storage engineers and battery installers.

Source: RenewEconomy

Source: Hornsdale Power Reserve

3 Repurposing land for renewable energy precincts brings opportunity for the Hunter region to host green hydrogen hubs

Green hydrogen

The Hunter region has access to existing energy infrastructure, sustainable water sources, ports and logistics capabilities as well as a future supply of cheap and reliable renewable energy, making it a good location for a green hydrogen hub.

- Green hydrogen is on the rise and is produced with renewable energy, emitting no greenhouse gasses
- Green hydrogen is a clean and renewable fuel that can be used in power supply, heating, transport and a range of industrial processes while producing no greenhouse gas emissions
- Green hydrogen can be transported and subsequently exported overseas, making it a tradable energy commodity

The Hunter region has access to renewable energy such as solar and wind, making the region a good location for a green hydrogen hub. A green hydrogen hub in the Hunter region will provide opportunities to innovate and diversify its industry.

The world needs clean, flexible, storable and safe fuels to support its future energy needs. Green hydrogen has all of these characteristics. As a fuel it produces no carbon emissions, only water. Green hydrogen can be used:

- To blend with, or replace, natural gas for homes, industry and cooking
- For fuel cells to generate electricity to power cars, trucks, buses and trains
- To store energy and generate electricity for remote communities
- As an industrial chemical feedstock for products such as ammonia, fertiliser and steel

The Hunter region will become home to one of NSW's first green hydrogen hubs

The new Hunter Valley green hydrogen hub will use and distribute green hydrogen, driving low carbon jobs and creating new infrastructure. Green hydrogen hubs align with the NSW Renewable Energy Zones planned under the Electricity Infrastructure Roadmap.

Employment growth through hydrogen

Using hydrogen requires new technologies and infrastructure. HyResearch, an Australian Hydrogen R&D Portal run by the CSIRO and the Australian Hydrogen Research Network (AHRN), was created to help focus research and innovation to solve the challenges to accelerate the development of Australia's domestic and export hydrogen industries.

The growth of the hydrogen industry could create new jobs, skills, education and training requirements that do not currently exist. Jobs that would be needed in the hydrogen industry which do currently exist include:

- Researchers, industrial equipment mechanics, electricians, technicians, engineers, trade and construction workers and transportation workers

The potential for jobs growth in the hydrogen industry has been highlighted in studies. For example, a 100 megawatt facility in the Tasmanian Renewable Hydrogen Action Plan is estimated to support around 200 megawatts of renewable energy investment and create an estimated 100 to 120 jobs during operations.

Source: Department of Industry, Science, Energy and Resources and Ammonia Energy Association

Source: NSW Government and Tasmanian Department of State Growth

3 Food processing is constantly growing and evolving

Further uses of the additional 1,630 hectares of land in scenario 3 include food processing activities.

Food Processing

- Food processing is any method of transforming food from its original form to food products sold at grocery stores
- The industry specialises in two main areas: food preparation and food packaging
- The industry is constantly growing, evolving and adapting as lifestyles and priorities change around the world

Abattoirs

- Abattoirs process animals into commercial meat products before distribution to butchers
- Some abattoirs have internal butcher facilities, while others sell their products to local butcheries
- There are currently 50 abattoirs operating in NSW with a total of 236 in Australia

Dairy Processing

- Dairy processing produces milk, cream, cheese, butter and other dairy products from dairy produce
- Dairy is a reliable consumer category with certain products increasing in popularity over the pandemic
- Australia exports 35% of its total milk production with exports valued at $3.2 billion in 2019

Employment in the food processing industry

Areas of work in food, dairy processing, and abattoirs include harvesting, cleaning, packaging and transport. More specifically, the industry employs:

- Chefs, production workers, maintenance staff, electricians, cleaners, food safety officers, machine operators, technicians, installers, truck drivers, livestock drivers, processing specialists, meat quality specialists and butchers

Dairy in Australia directly employs 46,200 people and is the fourth largest rural industry generating $4.4 billion in farm gate value.

Ferrero invested in finding a sustainable option for their packaging

Ferrero is collaborating with Milliken to find the right sustainable material for the Ferrero Rocher boxes. They landed on the right material - polypropylene (PP) – after testing over 20 different formulations. This has resulted in performance improvement through lower resource consumption and reduced greenhouse gas emissions.

The food processing market is likely to boom

With increasingly busy lifestyles, there is high demand for packaged food and food products, resulting in a high demand for innovative food processing techniques. Health and functional food is in high demand as well as meat, poultry, dairy, bakery and confectionery products. A rise in disposable income due to the pandemic has led many Australians to lean on convenience.

Source: Department of Agriculture, Water and the Environment

Source: Milliken and Refrigerated & Frozen Foods

4 Potential economic impacts

Economic returns are largest when land is used for renewable energy precincts

Through targeted repurposing of mine owned land, there is potential to stimulate considerable economic activity. Policy initiatives which increase and widen the level of rehabilitation on mine owners, requiring them to do more than the minimum legal standard, generates significant returns to the Hunter over the next 25 years.

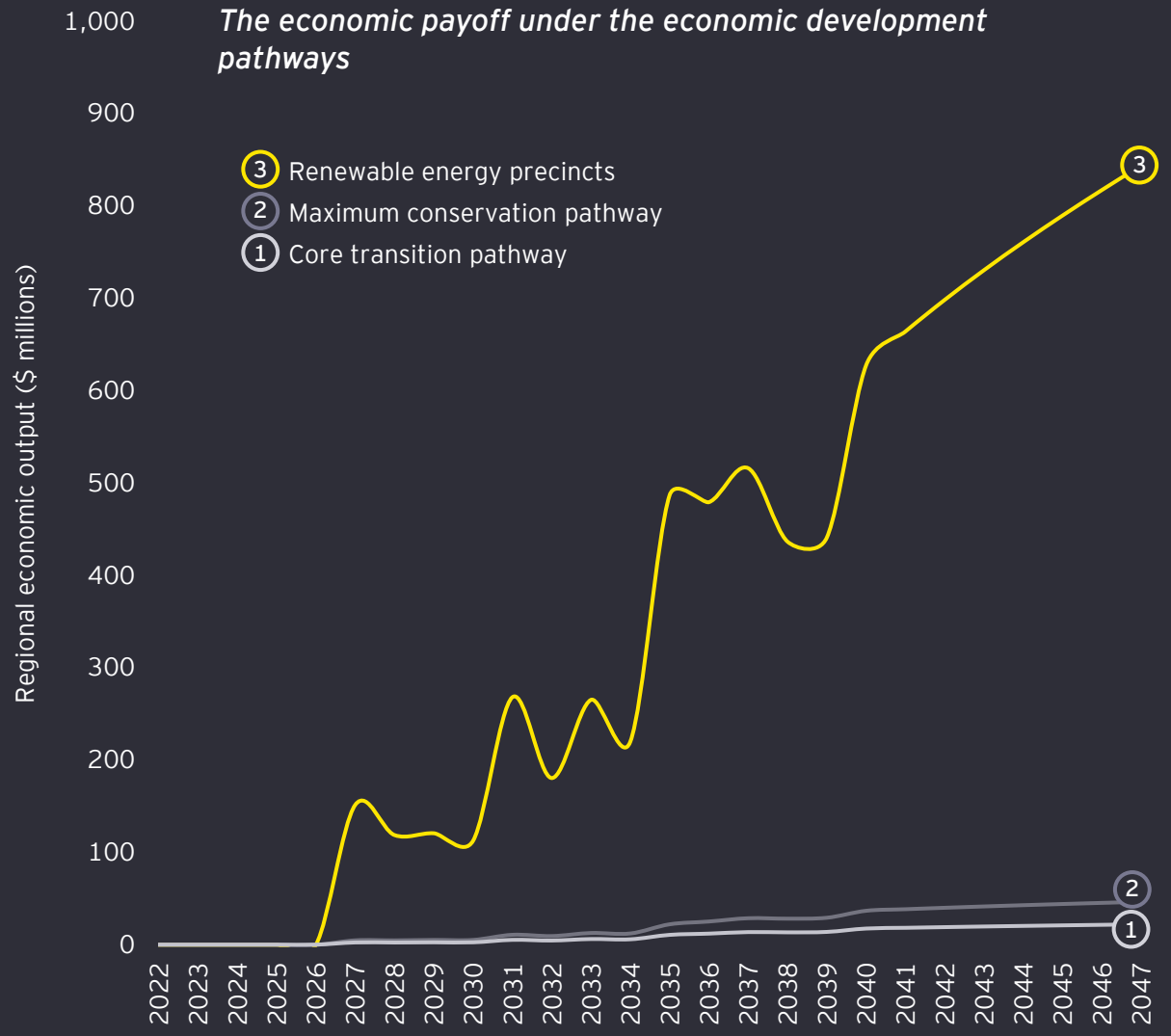
Increasing rehabilitation requirements increases economic growth

- The maximum conservation pathway, which repurposes mining land and surrounding mine owned land to conservation and land management activities, nearly doubles the economic output potential of the Hunter moving forward.
- The economic payoff in the Hunter region from repurposing previous mining land for renewable energy precincts could be over $520 million over the next decade.
- Both policies significantly increase the economic potential of the Hunter over the short and long term. Increasing conservation and capital investment could generate significant economic return for the Hunter.

The 25-year economic payoffs could be...

1	Core transition pathway	**$95 million**
2	Maximum conservation pathway	**$200 million**
3	Renewable energy precincts	**$3,700 million**

The economic payoff under the economic development pathways



The values on this slide represent the Net Present Value (NPV) of the economic output over 25 years, using a 7% discount rate.

The maximum conservation pathway increases incomes in the Hunter

The development pathways each involve significant levels of conservation and land management activities, in particular under scenarios 2 and 3. These activities can often involve income streams associated with carbon offsets and biodiversity payments. These income flows typically arise from outside the region including through federal and state environmental programs.

Increasing rehabilitation and capital expenditure significantly lifts income levels within the Hunter

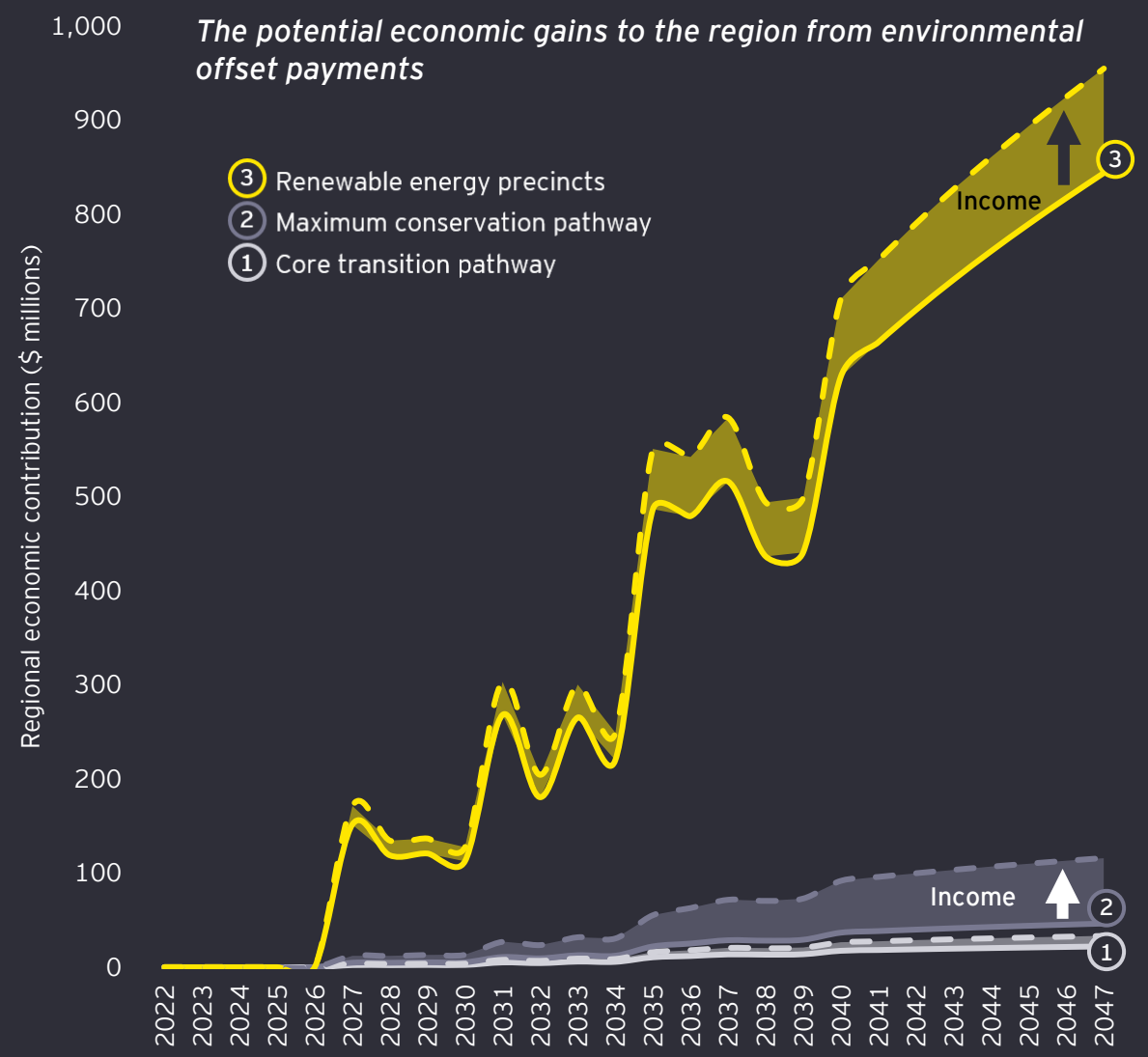
The shaded region on the graph represents the value of what conservation and land management activities could yield to the Hunter economy over the next 25 years through environmental based incomes.

- Both the maximum conservation and renewable energy precincts pathways could contribute an additional $10 million to Hunter incomes by the end of the decade.
- Over the next 25 years, increasing capital investment to repurpose mining land may contribute an additional $300 million to incomes in the Hunter.

Increased incomes from engaging in land management and conservation activities flow to small, medium and large businesses across the Hunter.

Increases to income reflect the high proportion of woodland and biodiversity inputs in the conservation pathways

- Woodland and biodiversity industries provide important environmental assets with benefits flowing throughout the economy.
- Government investment into environmental assets flow to the region's income rather than through direct economic output.



The values on this slide represent the Net Present Value (NPV) of the economic output over 25 years, using a 7% discount rate.

Economic gains flow throughout a variety of industries

Repurposing mining land has the potential to increase economic growth across 10 different industries. Supporting industries such as trade, transport and construction all grow in line with increased economic activity across both scenario 2 and 3.

Conservation and land management activities increase the economic potential of new agricultural industries

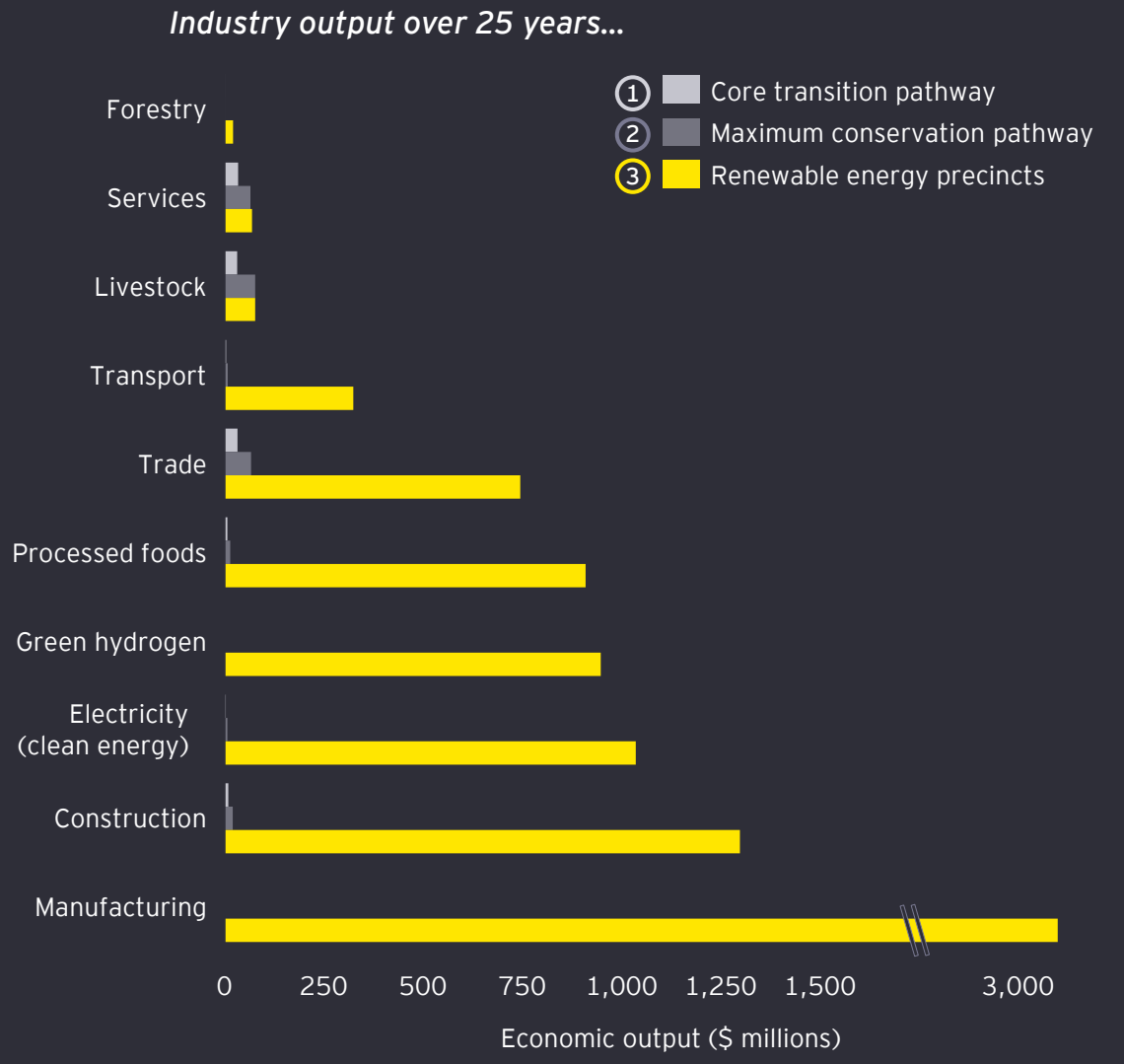
- The livestock industry could contribute approximately $77 million to the Hunter economy over the next 25 years.
- Increased economic output in the livestock industry will likely have flow on effects to the trade and the transport industry, which, under scenario 2, could generate approximately $67 million and $8 million in economic output respectively.

Capital investment into renewable energy precincts significantly bolsters clean energy production in the Hunter

- Manufacturing, which supports the renewable energy sectors, could grow by over $3 billion over the next 25 years.
- Clean energy and green hydrogen production from building new renewable energy precincts could collectively contribute nearly $2 billion in the Hunter region.

Services represents the investment into environmental assets and biodiversity offsets

- Under scenario 3, government investment into biodiversity offsets and environmental assets in combination with supporting professional services could generate approximately $70 million in economic output over 25 years.



The values on this slide represent the Net Present Value (NPV) of the economic output over 25 years, using a 7% discount rate.

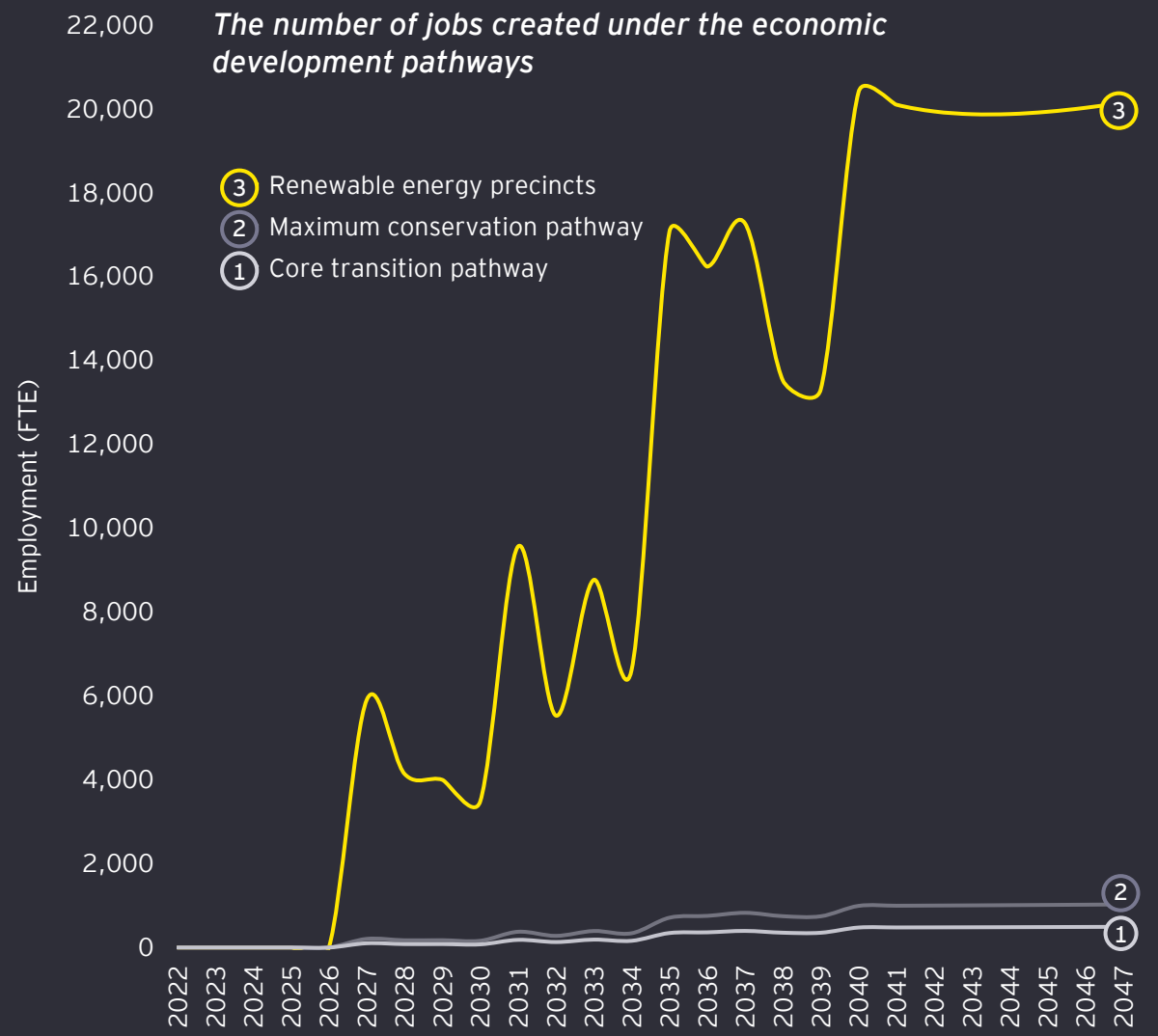
Employment in the Hunter has the potential to thrive when land is repurposed for renewable energy precincts

Industry activity takes up a relatively small part of the region's overall development footprint. As such, any new industrial activity is unlikely to displace any scaled up conservation and land management activities. It also has the potential to significantly increase jobs in the region.

Conservation and industry investment drives employment opportunities over the long term

- Increasing conservation and land management activities could provide significant levels of sustainable employment over the next 25 years.
- Industrial activity could increase employment within the Hunter, potentially adding on average of 13,600 jobs per year.
- Peak employment over the entire period could reach as high as 20,000 people employed as a result of implementing the renewable energy precincts scenario.
- The renewable energy precincts scenario provides the highest average level of employment due to the labour intensive nature of projects specific to this scenario during both construction and operations.

Annual employment over 25 years could		average...	peak at...
1	Core transition pathway	320	500
2	Maximum conservation pathway	670	1,000
3	Renewable energy precincts	13,600	20,000



Farmers, foresters and conservation scientists could be in high demand

Increasing the level of rehabilitation and the size of the conservation area provides additional employment opportunities within the Hunter. The graph to the right reflects the number of workers who could be employed in each industry across the three scenarios.

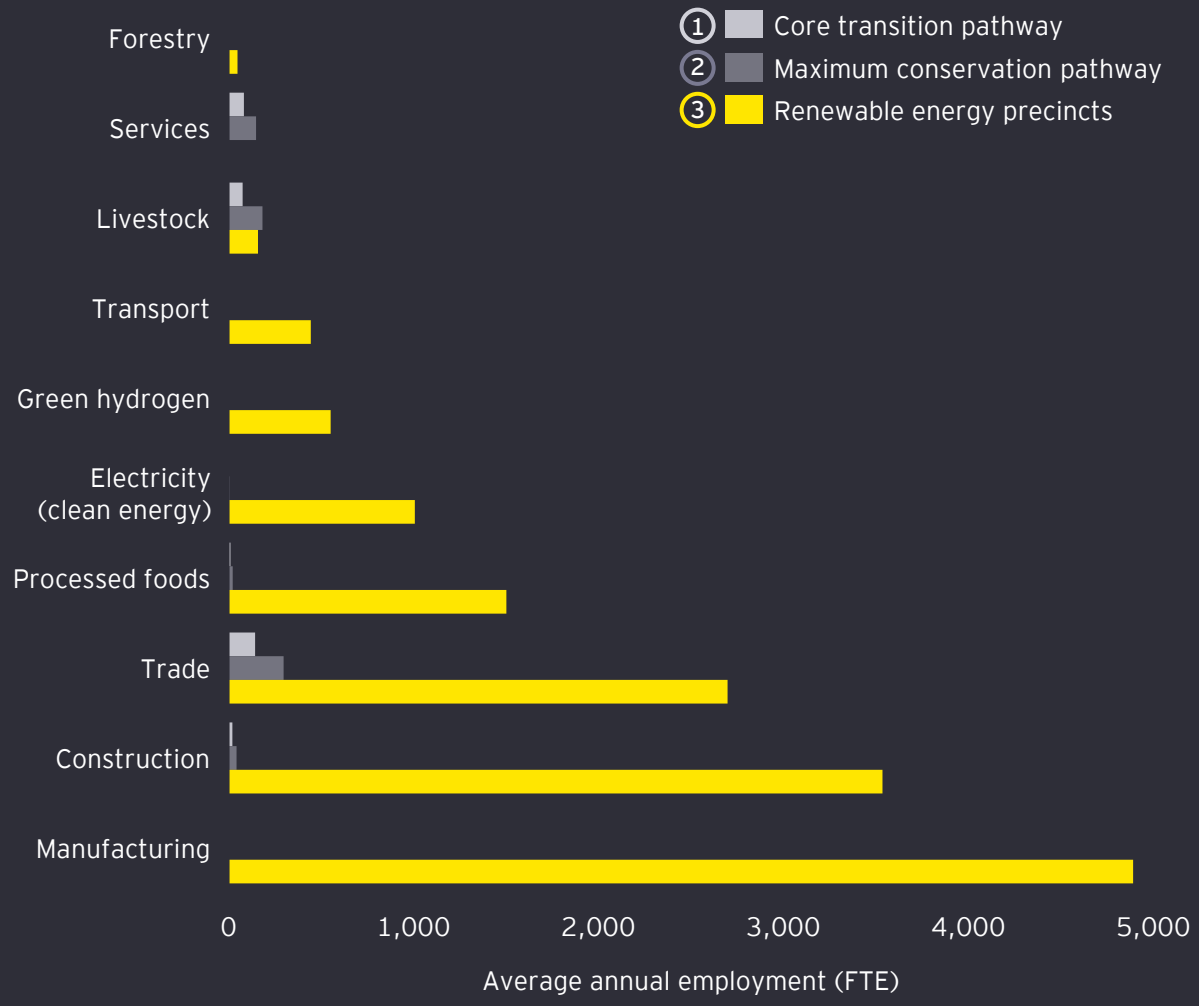
The renewable energy precincts scenario generates the greatest spread of employment across industries, with employment opportunities in 10 different industries. Building and operating new renewable energy precincts requires a number of trade-related roles leading to a jump in employment in these areas.

Both the core transition and maximum conservation pathways are agriculturally focused, with trade stemming from livestock products. Moreover, we see increased employment levels from services, forestry, and processed foods.

Specific jobs in each of these industries, as outlined in Chapter 3, include:

- Farmer
- Forest and Conservation Technician
- Conservation Scientist
- Forester
- Fabricator
- Warden
- Ranger
- Systems Engineer
- Estate Worker
- Chemical Engineer
- Electrician
- Carpenter
- Builder
- Boilermaker
- Mechanic

Average jobs created by industry over 25 years...



Harvesting the region's strategic advantages is expected to improve economic prospects

The Hunter region is currently heavily reliant on resource production. As mines begin to close, as they are scheduled to do, and global trends drive activity away from fossil fuel production, the region will need to further diversify its industrial base. The Hunter is a large and growing area and is strategically located being in close proximity to Sydney and the Port of Newcastle.

Our analysis shows the policy initiatives, which increase the level of rehabilitation and conservation on mine owners, generates higher levels of future economic output across both scenarios compared to what is currently being asked from mine owners. Increasing rehabilitation enables conservation industries to thrive, producing environmental assets and lifting household income across the Hunter. Alternatively, focusing new industries towards renewable energy requires a higher level of initial capital expenditure, however, offers significantly higher levels of employment through labour intensive industries.

Both conservation and renewable energy industries offer a green future for the Hunter. Ultimately, the choice between both policy initiatives must align with the strategic growth plan of the Hunter.

A strong renewable future for NSW

Renew Economy – 16 Feb 2022

The NSW Government has received over $100 billion dollars worth of proposals for new wind, solar and storage projects for the Hunter and the Central Coast of NSW. Applicants are wishing to participate in the next Renewable Energy Zone (REZ), with a combined generation capacity of 40GW across 80 projects.

Amongst the projects are 24 solar projects, 13 onshore and 7 offshore wind projects, 8 pumped hydro energy storage projects, and proposals for 35 big batteries. Electricity generation across all projects combines to deliver the equivalent of 10 coal-fired power stations.

Interest in the NSW REZ is similar to the projects being established by the Queensland government, which attracted 60GW worth of proposed projects.

> "These results show that energy investors see the Hunter and Central Coast as some of the best investment destinations anywhere in the country, which will translate into jobs and prosperity for the region. Renewable Energy Zones are vital to ensuring the future reliability and affordability of electricity in NSW as traditional coal-fired power stations close down over the coming decades."
>
> Matt Kean, NSW treasurer and energy minister

Appendix A

Mine closure schedule

Mine closure schedule

This slide provides an overview of the mines considered in this study, the closure period, the land which can be repurposed and the total area of the mine owned land as provided by Lock the Gate Alliance.

Mine closure dates are as listed on development consent as of August 2021.

The repurposed land is the amount of mine owned land which can be repurposed for future economic development.

Mine title	Closure period	Repurposed land (hectares)	Total area (hectares)
Ashton	2024	1,568	1,829
Bengalla	2039	3,026	3,530
Bulga	2035	9,805	11,439
Dartbrook	2022	4,654	5,429
Drayton	Already closed	2,505	2,922
Hunter Valley Operations	2030	16,569	19,329
Integra Underground	2023	3,108	3,625
Liddell	2028	6,694	7,809
Mangoola	2030	5,128	5,982
Mount Arthur	2026	12,044	14,051
Mount Owen	2031	12,573	14,668
Mount Pleasant	2035	5,573	6,501
Mount Thorley-Warkworth	2036	10,356	12,081
Muswellbrook	2022	3,754	4,380
Ravensworth	2039	13,773	16,067
Rix's Creek	2040	7,615	8,883
United Wambo	2042	3,252	3,794
Wambo Underground	2032	10,244	11,950
Total		**132,239**	**154,267**

Source: Lock the Gate Alliance

Appendix B

Modelling approach

Determining the future uses of the land

Lock the Gate undertook Geographic Information System (GIS) mapping of the Hunter region to determine the potential future uses of the land. This includes both land owned under the current mining titles, as well as additional mine owned land outside of the title. LTG provided the rehabilitation outcome maps and scheduled mine closures for all major mines in the region.

Potential future uses have been thematically presented as rehabilitation, revegetation and reuse. EY has performed desktop research to understand the potential capital expenditure and economic output of these potential uses.

EY has undertaken scenario development including different trajectories and compositions, with varied scope and timing. The scenarios explore the discrete themes of a core transition pathway, a maximum conservation pathway and a renewable energy precincts scenario.

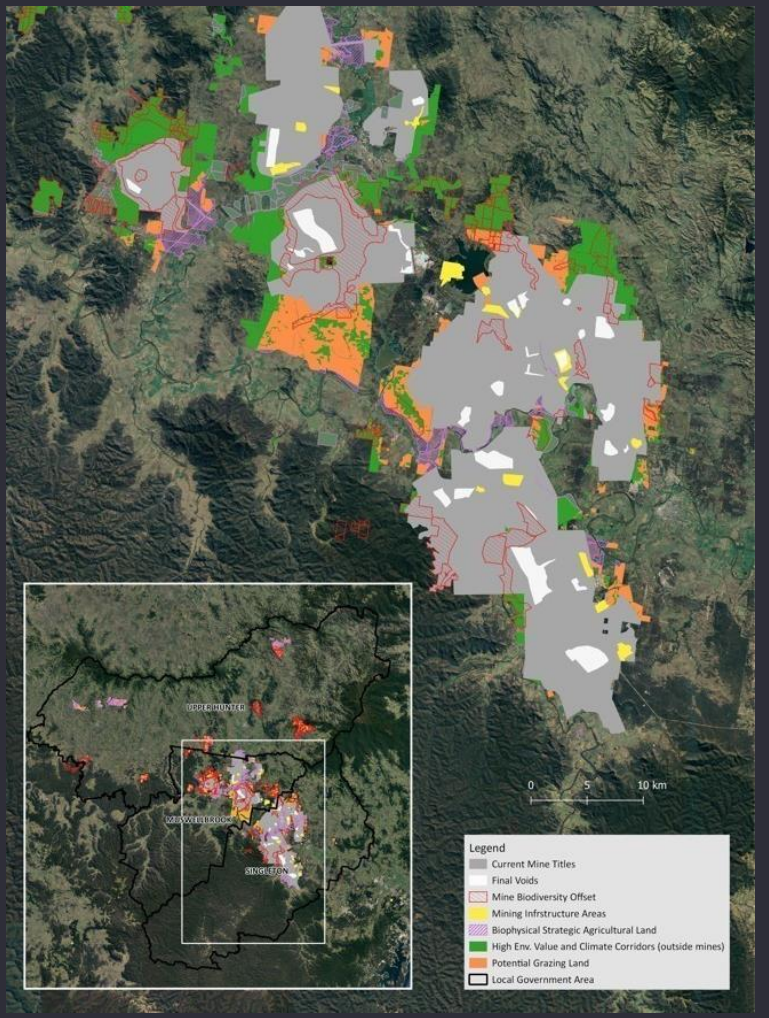
The research and scenario development formed the basis of the inputs for our economic modelling, using a Computable General Equilibrium (CGE) framework – see Appendix C for more details.
The mine rehabilitation plans were reviewed to estimate potential final land use, categorised by the following:

- Woodland
- Pasture
- Biodiversity offset area
- Final void
- Water management

All mining land must be repurposed when the mine closes. However, final voids and water management could not be modelled.

After determining the future uses of the land, the capital expenditure and the industry output for each industry that could be used on the repurposed land was calculated.

Vision for the Hunter region



Source: Lock the Gate Alliance

Calculating the economic impact of rehabilitating mines

This report utilises both qualitative and quantitative analysis to examine the potential economic impacts of different land use scenarios for future available mine land. This report draws its insights from a variety of data sets and economic modelling. A summary of our approach is outlined below:

1 Mapping and profiling

- Land currently affected by mining, and earmarked for rehabilitation
- Conservation and biodiversity lands
- Agricultural lands
- Potential industrial land

2 New land use opportunities

- Rehabilitation
- Revegetation
- Re-use

- Compliance with Rehabilitation Management Plans
- Capital holding costs
- Productivity and innovation losses
- Barriers to entry

- Profile the scale and scope of potential new land activities
- Potential rehabilitation and revegetation investments
- New industrial and energy opportunities
- Timing and development conditions for different land reuses
- Global and technology developments

3 Development scenarios

- Core transition pathway
- Maximum conservation pathway
- Renewable energy precincts

- Alternative development paths for the Hunter mine sites
- Examine land use options based on different technology and investment outcomes
- Short and long term impacts

4 Economic impact

- Economic output
- Jobs
- Sectoral performance
- Investment

- Explore transition issues and risks in a robust economic framework
- Industry uncertainties
- Structural outcomes for the Hunter region
- Broader economic and conservation impacts

Sources

- ACIL Allen Consulting, 2018, *Central Highlands Abattoir Feasibility Statement*, https://chdc.com.au/site/files/CHDC_AbattoirFeasabilitySummary_Oct18.pdf
- Ammonia Energy Association, 2020, *Hydrogen in Australia: investments and jobs*, https://www.ammoniaenergy.org/articles/hydrogen-in-australia-investments-and-jobs/
- Ammonia Energy Association, 2019, *The cost of hydrogen: Platts launches hydrogen price assessment*, https://www.ammoniaenergy.org/articles/the-cost-of-hydrogen-platts-launches-hydrogen-price-assessment/
- Australian Financial Review, 2020, *BHP ends domestic thermal coal sales*, https://www.afr.com/companies/mining/bhp-ends-domestic-thermal-coal-sales-20200924-p55ypu
- Australian National University, 2020, *Green hydrogen production costs in Australia: Implication of renewable energy and electrolysers costs*, http://iceds.anu.edu.au/files/2020%2009%2001%20-%20ZCEAP%20-%20CCEP%20Working%20Paper%20-%20Green%20hydrogen%20production%20costs.pdf
- BHPbilliton, 2017, Rehabilitation strategy, https://www.bhp.com/-/media/bhp/regulatory-information-media/coal/nswec/mt-arthur-coal/environmental-management-plans/post-mod-1-approved-rehab-strat--june-2017-from-secretary27s-documents.pdf
- Canstar Blue, 2022, *Average Electricity Cost per kWh*, https://www.canstarblue.com.au/electricity/electricity-costs-kwh/
- CSIRO, 2022, *Denham Hydrogen Demonstration Plant*, Denham Hydrogen Demonstration Plant – HyResource (csiro.au)
- Deloitte Access Economics, 2013, *Prospects and challenges for the Hunter region*, https://www2.deloitte.com/au/en/pages/economics/articles/prospects-challenges-for-hunter-region.html
- Department of Agriculture, Water and the Environment, 2018, *Wood – the ultimate renewable*, https://www.awe.gov.au/sites/default/files/sitecollectiondocuments/forestry/national-forest-industries-plan.pdf
- Department of Agriculture, Water and the Environment, 2022, *Dairy in Australia*, *https://www.awe.gov.au/agriculture-land/farm-food-drought/meat-wool-dairy/dairy*
- Department of Agriculture, Water and the Environment, 2022, *Forestry*, https://www.awe.gov.au/agriculture-land/forestry
- Department of Industry, Science, Energy and Resources, 2022, *Growing Australia's hydrogen industry*, https://www.industry.gov.au/policies-and-initiatives/growing-australias-hydrogen-industry
- Farm Transparency Project, 2022, *List of abattoirs/slaughterhouses in NSW Australia*, https://www.farmtransparency.org/facilities/food/abattoirs?state=NSW
- Food and Agriculture Organization of the United Nations, n.d., *Standard plans for a small abattoir and meat market*, https://www.fao.org/3/t0034e/T0034E01.htm
- Glencore, 2021, *Management plans*, https://www.glencore.com.au/operations-and-projects/coal/current-operations/liddell-coal-operations/management-plans
- Hornsdale Power Reserve, 2022, *South Australia's Big Battery* - https://hornsdalepowerreserve.com.au/
- MicroPowerGrids, 2022, *Commercial Solar Farms & Large Solar Arrays*, https://micropowergrids.com.au/_Solar_Generation/__Commercial.html#:~:text=A%20ballpark%20cost%20to%20build%20a%201MW%20%281%27000kW%29,usually%20solar%20farms%20are%20measures%20in%20MWh%20%281MW%3D1%27000kW%29.
- Milliken, 2022, *Sustainable packaging for Ferrero Rocher*, https://www.milliken.com/en-us/sustainability/blogs/sustainable-packaging-for-ferrero-rocher/7f474237-bb3e-40f1-9df5-223a9017ee00
- Milne, P. 2021, *Woodside eyes $1b gas and renewable hydrogen plant near Perth*, https://www.smh.com.au/business/companies/woodside-eyes-1b-gas-and-renewable-hydrogen-plant-near-perth-20211025-p592yq.html
- NSW Department of Planning and Environment, 2022, *Population*, https://www.planning.nsw.gov.au/Research-and-Demography/Population-projections
- NSW Department of Planning and Environment, 2017, *Beryl Solar Project*, https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=SSD-8183%2120190228T021215.119%20GMT
- NSW Department of Primary Resources, 2013, *Upper Hunter Region Agricultural Profile*, https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0018/471024/Upper-hunter-region-agricultural-profile.pdf

Sources

- NSW Government, 2021, *NSW's first hydrogen hub in Hunter region*, https://www.investregional.nsw.gov.au/news/federal-government-announces-nsws-first-hydrogen-hub/
- NSW Government, 2022, *Biodiversity Offsets Programs Outcomes*, *https://www.bct.nsw.gov.au/info/biodiversity-offsets-program-outcomes*
- NSW Mining, 2022, *Rehabilitation*, https://www.nswmining.com.au/rehabilitation
- National Bank for Agriculture and Rural Development, 2014, *Model Project on Milk Processing*, https://www.nabard.org/demo/auth/writereaddata/ModelBankProject/2009162729MILK_PROCESSING_10000_LPD.pdf
- Power Technology, 2022, *Origin Energy intends to shut 2.8GW coal-fired plant by 2025*, https://www.power-technology.com/news/origin-energy-coal-plant/#:~:text=Australian%20energy%20company%20Origin%20Energy,became%20fully%20operational%20in%201984
- PV Magazine, 2020, *Energy Renaissance Lithium-ion Gigafactory breaks ground in Tomago NSW*, https://www.pv-magazine-australia.com/2020/10/13/energy-renaissance-lithium-ion-gigafactory-breaks-ground-in-tomago-nsw/
- Queensland Country Life, 2021, *Ipswich's Churchill Abattoir on the market*, https://www.queenslandcountrylife.com.au/story/7399454/churchill-abattoir-on-the-market/
- Refrigerated & Frozen Foods, 2019, *Demand for ready-to-eat processed foods leads to growth in food processing equipment*, https://www.refrigeratedfrozenfood.com/articles/96231-demand-for-ready-to-eat-processed-foods-leads-to-growth-in-food-processing-equipment
- Renew Method, 2021, *Types of Land Conservation – A complete Guide*, https://www.renewmethod.com/post/types-of-land-conservation
- RenewEconomy, 2022, *Stunning solar milestone as Australia passes 26GW mark* - https://reneweconomy.com.au/stunning-solar-milestone-as-australia-passes-25gw-mark/
- ResearchGate, 2013, *The battery 10kWh: A financial analysis of mini manufacturing*, https://www.researchgate.net/publication/269307814_The_battery_10_kWh_A_financial_analysis_of_mini_manufacturing_plant
- Tapp, V. 2012, *Darwin abattoir doesn't deter Queensland shires*, Darwin abattoir doesn't deter Queensland shires - ABC News
- Tasmanian Department of State Growth, 2019, *Tasmanian Renewable Hydrogen Action Plan*, *https://www.stategrowth.tas.gov.au/__data/assets/pdf_file/0003/207705/Draft_Tasmanian_Hydrogen_Action_Plan_-_November_2019.pdf*
- The Bloomfield Group, 2021, *Mining Operations Plan*, https://www.bloomcoll.com.au/uploads/Mining-Operations-Plan-2021-2023.pdf
- Townsville City Council, 2021, *Eco – industrial precinct strides ahead with four new proponents signing on to Lansdown*, https://www.townsville.qld.gov.au/about-council/news-and-publications/media-releases/2021/december/eco-industrial-precinct-strides-ahead-with-four-new-proponents-signing-on-to-lansdown
- Victorian Department of Environment, Land, Water and Planning, 2018, *Southern Region Industrial Land*, https://www.planning.vic.gov.au/__data/assets/pdf_file/0035/459926/Southern_Region_Industrial_Land_Study_Stage_1_Report.pdf
- WA Government, 2020, *Oakajee Strategic Industrial Area – Renewable Hydrogen*, https://www.wa.gov.au/system/files/2020-09/OAKAJEE%20EOI%20DOCUMENT-We.pdf
- Yancoal Australia, 2020, *Mining operation plan*, https://insite.yancoal.com.au/document-library/mops
- YSG Solar, 2022, *How much money can a solar farm make in 2022?*, https://www.ysgsolar.com/blog/how-much-money-can-solar-farm-make-2022-ysg-solar

Picture credits

- Marissa Duena
- Stijn Strake
- Christopher Burns
- Appolinary Kalshnikova
- Ludwig Theodor Von Ruhm
- Febiyan
- Billy Clouse

Appendix C

Computable General Equilibrium modelling framework

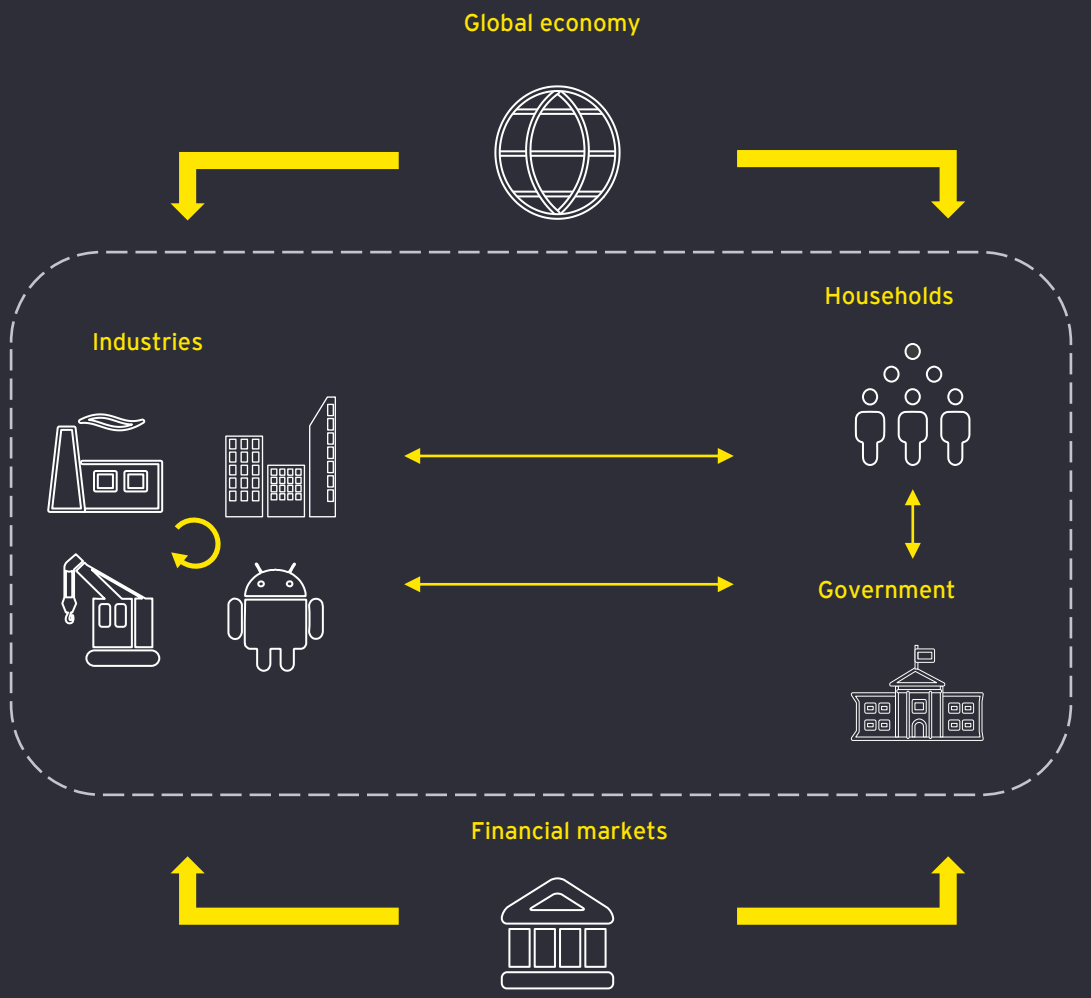
Our CGE model

EYGEM is EY's in-house, state of the art Computable General Equilibrium (CGE) model. It is a large scale, dynamic, multi-region, multi-commodity model of the global economy, with an explicit representation of the national and NSW and sub-state economies. This detail allows us to consider varying economic impacts across the construction and operational phases of the Project. EYGEM is based on a substantial body of accepted microeconomic theory.

The model provides a rich and realistic representation of how changes in one part of the economy flow through to other parts.

- **Comprehensive regional analysis** – The model contains 141 distinct regions, with the ability to disaggregate these into sub-national regions for highly granular economic analysis.
- **Rich sectoral detail** – All sectors of the economy are integrated into the model, with 65 discrete sectors. These can be further refined for specific industries.
- **Time dynamics** – Solving year-on-year over a flexible periods, the model can assess short term policy initiatives and decades-long reforms or investments.
- **Market tested and strong academic foundations** – A model has a lineage that has been applied globally across the public and private sector.

EYGEM is dynamic and is solved on a year-by-year basis over a prescribed period of time. This will allow us to consider the forward-looking nature of investments in the Project as well as test a range of different scenarios related to the Project. In practical terms, the modelling is based on defining a counterfactual, or baseline scenario, which is then compared with a scenario under which the Project goes ahead. The difference between the two scenarios provides us with a measure of the economic net benefits of the Project.



EY | Building a better working world

EY exists to build a better working world, helping to create long-term value for clients, people and society and build trust in the capital markets.

Enabled by data and technology, diverse EY teams in over 150 countries provide trust through assurance and help clients grow, transform and operate.

Working across assurance, consulting, law, strategy, tax and transactions, EY teams ask better questions to find new answers for the complex issues facing our world today.

ey.com