THE UNIVERSITY OF QUEENSLAND AUSTRALIA

CREATE CHANGE

Rural Economies Centre of Excellence

Maximising the Value of the Energy Transition for Rural Communities

1 May 2022

Cristyn Meath, Belinda Wade, John Mangan, Anna Fueldner, Spencer Tong, Ben Lyons.

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This report provides an outlook of the energy transition in Queensland and its impact on rural communities.

The global transition to net zero economies is accelerating, driven both by improvements in technology allowing price competitive decarbonisation of energy systems at scale, and the recognition of the severity and increased pace of climate change and its resulting impacts. While individual nations outline their ambitions to reduce carbon emissions and make commitments to do so through international agreements such as at the recent United Nations Climate Change Conference (COP 26), we also see non-government actors driving the transition. A key driver of the rapid investment in renewables in Australia has been companies and organisations entering the large-scale renewables market seeking to provide electricity cost security, meet investor or community expectations to reduce carbon emissions, or to secure long-term investment returns through shifting funds to low carbon assets.

> *The result, particularly in Queensland, is an energy transition characterised by more diverse energy generation sources and ownership as well as a broader geographic spread of power generation assets.*

The scale of investment required world-wide to transition energy systems is truly immense and offers significant potential to deliver benefits to rural and regional communities. Realising such benefits, however, requires an understanding of the impacts of the energy transition specific to rural and regional communities and the implementation of strategies to support delivering and maximising benefits while reducing or managing negative impacts.

A suite of studies has been undertaken to identify such impacts and inform the development of strategies to promote greater outcomes for rural communities. Importantly, these studies sought to identify social and ecological as well as economic impacts, each critical to the well-being of people and communities, and the planet we rely on. In addition to identifying positive and negative impacts of the energy transition on rural and regional communities, the studies investigated the factors influencing the degree of impacts experienced by communities and provides insights from experts into what the future energy transition may deliver. To provide more holistic information about impacts of the energy transition to support decision making, we also worked to extend a traditional economic modelling tool, incorporating social and ecological impacts where possible and to set a future research agenda to deliver greater support.

While the energy transition in Queensland is driven by global phenomena, the impacts for rural and regional communities are complex and highly context specific. Important factors influencing the experience of rural and regional communities, characterised by tensions or trade-offs include:

- **impacts realised to date in the short-term versus potential future impacts over the long-term,**
- **visibility or tangibility of benefits, and**
- **distribution of benefits between various stakeholders**

Consideration of such insights to inform the design and implementation of new energy generation assets including payments to landowners, strengthened and integrated policy, technology advancements and experimentation, and clear communication about future opportunities and transition pathways for communities may support the realisation of greater value to rural and regional communities.

Finally, while the project supports an improvement in the evidence base for decision making including important advances in economic modelling to reflect more holistic impacts to communities and the environment, additional research including in-depth case studies and greater integration of non-traditional economic metrics will provide further critical contributions for academia, practice and government.

1. Introduction

1.1 State of the energy transition

The diversification of Queensland's energy system started more than 40 years ago with the introduction of hydro power in North Queensland. The last decade has witnessed a rapid increase in the rate of change in the energy system due to improvements in the cost-competitiveness of technologies including solar and wind power, in addition to global efforts to decarbonise economies to avoid severe impacts associated with climate change. When discussing the energy transition in Queensland, one point to note is the distinction between the transition of the energy grid in Queensland which supplies our homes and businesses with energy and the impact of our trading partners decarbonising which is leading to a reduction in future demand for coal mined in Queensland. As the transition progresses insights are appearing as to the nature and potential possibilities of the energy system that will take Queensland into the future. While residential solar has occurred across the country, large-scale renewables projects are located in regional and rural areas. The ability for communities to take advantage of this significant investment in the coming decades and realise the potential opportunities requires an understanding of the impacts, both positive and negative, associated with the energy transition thereby providing an evidence base to inform stakeholder decision making.

Figure 1 below highlights the state of the energy transition in Queensland which has been occurring for more than 40 years with the existence of hydro power in the north prior to 1980, followed by expansion into bioenergy, pumped hydro and wind prior to 2000, and the addition of large-scale solar and battery prior to 2020. The maps also reflect the rate of change in terms of the number of new energy sites across Queensland between 2000 and 2010 (both renewable and non-renewable), as well as the type of energy generation with the period between 2010 and 2020 seeing a significant number of solar projects across the state and the emergence of large-scale battery. Such changes reflect not only the transition to renewables, but also the geographic dispersion of energy generation across the state. Ownership of the various energy assets is another key characteristic of the energy transition with not just a significant increase in the number of assets and geographic spread, but also ownership by government owned corporations, domestic and international investors, and private organisations seeking to ensure electricity price security and to meet organisational decarbonisation targets.

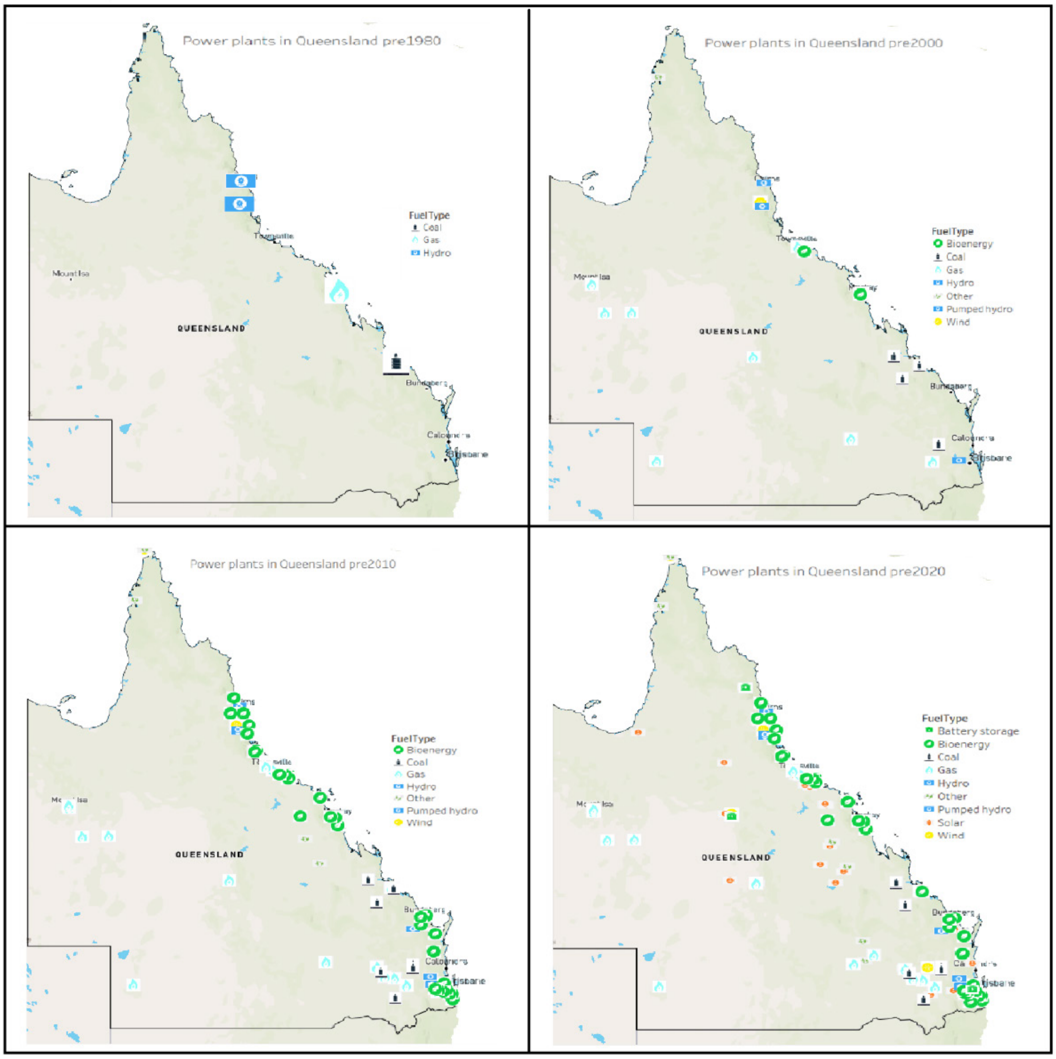

Figure 1. Energy generation sources in Queensland by type and location (pre-1980, pre-2000, pre-2010, pre-2020)

The extent to which the diversification of energy generation sources actually decarbonised the Queensland energy sector can be seen in Figure 2. Generation from renewables already contributing to the grid prior to 1980 made up eight percent of total generation. A significant increase in gas in the coming decades (1981-2010) reduced the role of coal and despite an increased amount of generation from renewables, the percentage of the total energy generation by renewables remained similar due to an increase in the total quantity of generation. Reflecting an immense increase in the rate of large-scale renewables, particularly solar, between 2011 and 2020, Queensland's energy generation now consists of approximately 25% from renewable sources. Projections indicate this sharp acceleration will continue to 2030, with a further increase to potentially 70% generation from renewables, with coal and gas continuing to provide 20% and 11% of generation respectively.

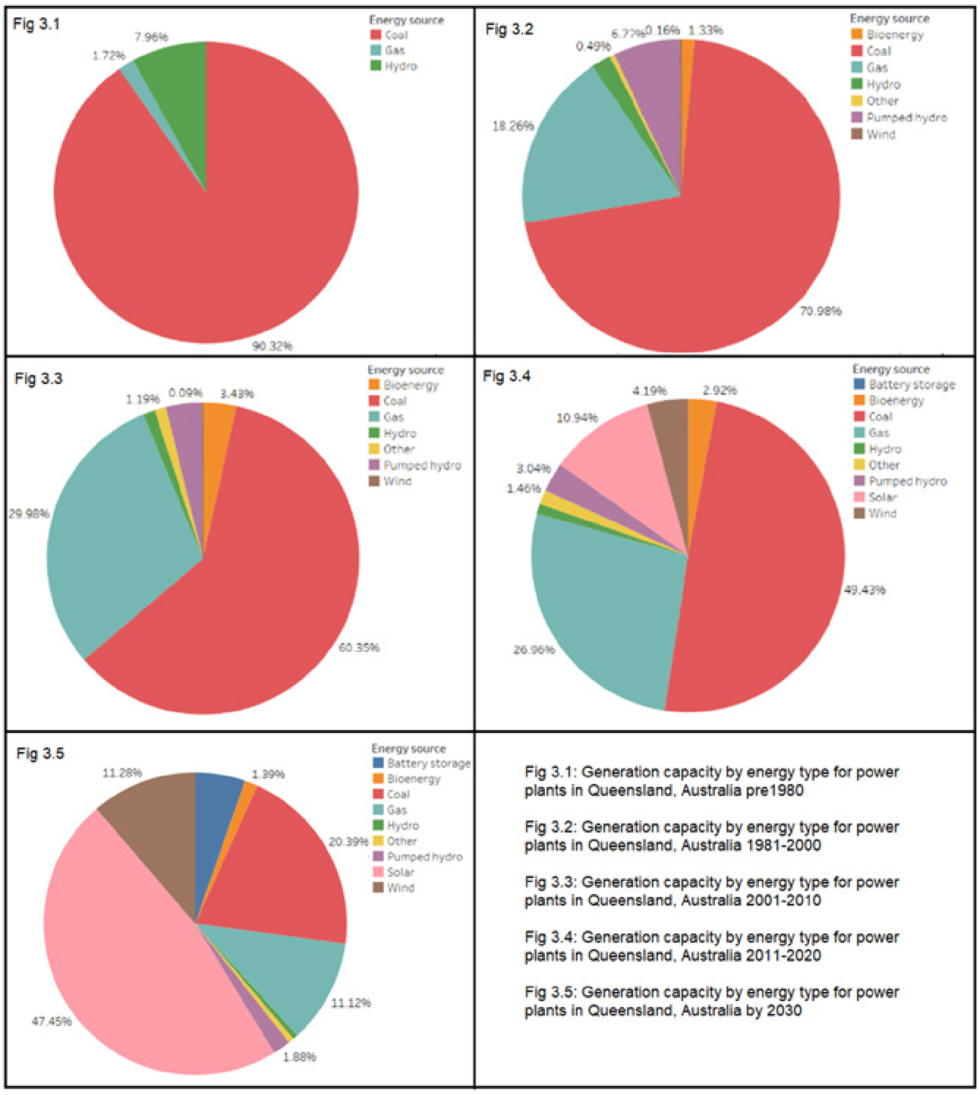

Figure 2. Generation capacity by energy type for power plants in Queensland (pre-1980, 1981-2000, 2001-2010, 2011-2020, by 2030)

1.2 Overview of research

To maximise the impact of the energy transition in Queensland on rural and regional communities, our major research aim was to identify economic, environmental and social impacts on communities where the energy projects are situated, including to understand which factors effect these impacts, the challenges different stakeholders are experiencing and what can be done, based on these research findings, to maximise the value for all stakeholders. In addition to improving our understanding of the impacts associated with the energy transition, this project sought to, where possible, quantify impacts to provide support for decision makers. To do so the following four main steps were undertaken:

1) **First, a literature review examining the economic, environmental and social impacts of the energy transition in Australia.**
2) **Second, a systematic analysis of energy and climate policy documents from Federal (Australian) and State (QLD) Government sources was conducted to understand the challenges, issues, and opportunities the policy context provides for the transition.**
3) **Third, interviews were conducted with industry experts from the energy sector. In these interviews participants were asked about their experiences of the transition. A particular focus was placed on investigating the benefits and challenges our interviewees observed for rural areas and regional towns and communities.**
4) **Fourth, a traditional Multi-Regional Input-Output model was adapted through the specification of a renewables sector and inclusion of a number of social and ecological impacts currently not featured in the economic model.**

Examining the results of the four study components, the complexity of the interactions of the energy transition with rural communities is clear with tensions and trade-offs embedded in investment decisions. These tensions can be seen within temporal aspects e.g., short-term versus long-term impacts, and the distribution of benefits between various stakeholders of the energy transition. Considering the current energy transition occurring in Queensland, moderating factors such as policies and actions of local governments and project developers are identified which influence the extent to which impacts will be felt both now and in the future. Within the following sections these results will be presented in detail before recommendations for stakeholders of the energy transition are provided and a future research agenda outlined.

2. Background literature

Academic literature related to impacts of the energy transition in Australia highlights an initial focus on ecological aspects with an increase in research seeking to understand economic impacts. While we categorise the research into economic, ecological and social aspects, there is a dearth of literature investigating impacts of the energy transition holistically across the various effects.

2.1 Economic impact

Literature identified a range of impacts categorised as economic including energy costs and employment effects. In recent years there has been a growing interest investigating economic impacts of the transition on regions in Australia (Burke et al., 2019; Fleming-Munoz, 2019; Arceo et al., 2019). However, the number of studies is still small and therefore a limitation of the current state of the literature to inform decision making on the impacts. Furthermore, there are few articles specifically related to Queensland and the current energy transition, again limiting the applicability of findings. For example, there is a lack of empirical evidence confirming changes in rental prices or property values by the presence of wind farms in Australia and internationally, studies argue contrasting findings in relation to impacts on property prices (Gibbons, 2015; Laposa & Mueller, 2010; Heintzelman & Tuttle, 2012; Hoen et al., 2011)

An increasing number of studies assess impacts of using hybrid renewable energy systems (Arceo et al., 2019; Balaji et al., 2019; Das et Al., 2021) rather than single diesel generators in remote areas in Australia. From an economic perspective the research identifies the realisation of lower energy costs (Arceo et al., 2019; Balaji et al., 2019) as a main benefit when using hybrid systems.

Another economic impact of the transition discussed in the literature is employment effects in regional areas (Burke, 2019; Fleming-Munoz et al., 2020; Middelhoff et al.,2021). Burke et al. (2019) conducted a regional economic analysis examining the impact of closing coal-fired power stations on employment, finding an average 0.7 percent increase in local unemployment after closures. Based on Burke's findings, Fleming-Munoz (2020) specifically investigated the economic impacts of the transition towards a low-emission economy on regional Queensland, discussing aspects such as closing coal-fired power stations. Fleming-Munoz (2020) concluded that a growing number of decarbonised industrial activities would lead to a very high latent vulnerability for 3-6% of regional Queensland. However, the "latent economic vulnerability to emission reduction" (LEVER) index of this study did not include employment opportunities through an increase in renewable energy projects. Heihsel et al. (2020) quantified environmental, social and economic attributes of seawater desalination depending on different electricity mixes and found that a higher renewable energy share has a positive impact on employment and negative impact on gross added value. The study particularly outlined the increase of employment inland, including central and western Australia. Findings suggest that the higher share of renewables would lead to diversification of economic activities in regions (Heihsel, 2020).

Furthermore, the literature identifies economic impacts of different energy types (gas, biofuel) on agricultural production. One study by Marinoni & Garcia (2016) proposed the development of large-scale Coal Seam Gas (CSG) projects would have a direct negative impact on the productivity and fertility of the soil, which is directly correlated with agricultural production. This impact on soil fertility is difficult to be estimated due to the spatial and temporal complexity of infrastructure.

Moreover, several studies have confirmed the positive impact of biofuel production on regional activity highlighting the need for a systems perspective of the energy transition. Bryan (2010) found an expected increase in agricultural profit of 30% if farming in the Lower Murray region (Southern Australia) was focused on biofuel crops.

2.2 Social impact

Social impacts can be linked to economic and ecological impacts. The literature review identified impacts including community cohesion and disaster resilience. Again, it is important to note the current limitations of the research. In the social impacts research there is a dominance of articles related to wind farms and the findings must be considered in light of this point. One article (Mey et al. 2016) presented four themes commonly covered in surveys, to determine the level of wind farm acceptance by the rural communities. These themes, focusing on trust, place attachment, distributional and procedural justice, potentially provide a guideline for researchers and policy makers to evaluate the existing and future deployment of wind farms. Furthermore, Hall et al. (2013) argued that increasing investment in the consultation process would be helpful to increase social acceptance of wind farms. Visual impacts of renewable energy projects on the landscape have been reported to concern residents (Harvey et al. 2017; Botterill & Cockfield 2016). This visual concern may be overcome utilising a 3D model based on geographic information system (GIS) data which may be used as a communication tool for overcoming these concerns prior to launching the project (Bishop & Stock, 2010). Furthermore, Read et al. (2013) suggested that past oppositional behaviour was the reason local residents resisted wind farms rather than the visual impact of wind farms.

Empirical studies have also been conducted to estimate the acceptance level of geothermal technology in Australia and the results revealed the majority of participants agreed with or accepted geothermal projects after deployment, where sufficient information was released to the public in advance (Carr-Cornishh & Romanach, 2014; Dowd et al., 2011). Community value and cohesion were frequently mentioned by the participants of surveys conducted in the current literature. The displeasure caused by the construction and operation of wind power projects was found to undermine the cohesion among community members (Botterill & Cockfield, 2016; Colvin et al., 2016; Everingham et al., 2016; Phelan et al., 2017). These projects may affect individuals very differently, for example, it is argued wind energy projects can divide community members into three groups-winners, losers and the rest. As a result, Gross (2007) proposed a community fairness framework to ensure that benefits are fairly distributed to the whole community to solve conflicts and avoid damage to social cohesion within the community.

One positive impact projected to support rural communities in the future is that of disaster resilience. Research suggests current large-grid energy infrastructure has a limited capacity to adapt to extreme events in outside urban areas in Australia, which may amplify the socio-economic loss of natural disasters (Freeman & Hancock, 2017). During catastrophes, power outage and communication disconnection impedes the process of emergency services and community recovery. Smart micro-grid renewable energy generation is a potential alternative to mitigate the negative impact of disasters because it can be installed in individual buildings or houses across the region.

One paper (Hunt et al., 2021) examined how the transition to renewable energy can provide value to indigenous people in North Australia and how they can participate and benefit from renewable energy. Although there is some support of Aboriginal communities through renewable off-grid systems, such as small-scale standalone off grid application (Hunt et al., 2021), it cannot be assumed that developing renewable energy projects benefit Aboriginals living in remote areas. However, the authors (2021) highlight that including Aboriginal decision making into the development process of renewable energy projects could lead to a better outcome.

2.3 Ecological impact

Impacts identified under the ecological category predominantly relate to the reduced carbon emissions of renewables as a source of energy, as well as research related to the embodied carbon emissions of the construction phase and materials used and impacts on biodiversity and water in both construction and operation. Most of the studies in the literature have given much attention to the emission of greenhouse gases and their associated consequences on climate change.

> *A large group of studies have assessed the potential of renewable energy projects such as wind farms, solar thermal, solar photovoltaic, biomass and wave power for implementation in an Australian context with results showing an economically feasible transition to renewable energy*

(Prasad et al., 2017; Clifton & Boruff, 2010; Yu & Halog, 2015; Bryan et al., 2008; Flocard et al., 2016). Given the scale of carbon emission reporting at the company, state and federal government levels, such studies are limited in terms of rural or

regional impacts. However, recent studies examine impacts of hybrid-renewable-energy-diesel systems for regional and remote areas (Arceo et al., 2019; Balaji & Gurgenci, 2019). Balaji & Gurgenci (2019) researched the ideal mix of technologies for hybrid systems for remote (off-grid) areas and concluded that CST-PV-diesel hybrid systems are an excellent solution to be deployed in off-grid (therefore remote) locations in Australia and have environmental and economic advantages over conventional diesel supply. Arceo et al. (2019) in contrast looked at a wind-diesel hybrid models to supply remote areas in Western Australia and examined how to improve their eco-efficiency. Installing rooftop solar PV on residential houses (Arceo et al., 2019) next to other strategies has the potential to minimise CO2 emissions by 9% and reduce the depletion of fossil fuels by 11%.

Recent studies have mentioned the concern of community members regarding the bird and bat fatality caused by wind farms across Australia (Botterill & Cockfield, 2016; Colvin et al., 2016; Harvey et al., 2017). However, little evidence has been observed on rare or endangered birds and bats species (Jessup, 2010). Similarly, the potential for wave energy projects to negatively impact fisheries has been reported but this impact has, to date, not been well-studied (Flocard et al., 2016). Moreover, waste disposal of solar panels is still an issue and there is a lack of social mechanisms in place to manage solar panel waste (Mathur et al., 2021).

> *Water availability and quality are pivotal to the survival of rural communities and while the energy transition is impacting on water, the nature of these impacts is dependent upon the specific type and location of energy generation or mining.*

For example, impacts on water quality caused by coal seam gas extraction and geothermal energy (Phelan et al., 2017; Carr-Cornish & Romanach, 2014; Dowd et al., 2011). have been found to be a concern for rural communities. Solar tower and concentrated solar thermal power (CSP) are also found to require significant use of water for cooling and cleaning (Clifton & Boruff 2010; Dawson & Schlyter, 2012). However, positive impacts on water consumption have been found when using renewable energy systems for seawater desalination (Heihsel et al., 2020). A multi-regional input-output model developed to compare social, economic and environmental factors of different electricity mixes for seawater desalination found that desalination uses 20% less water and emits 90% less greenhouse gases but leads to 17% higher land use under a 100% renewable energy system (Heihsel et al., 2020).

3.0 Method

This study follows a four-stage approach to examine the energy transition within rural communities. This approach consists of an initial literature review; a review of the Queensland State and Australian Federal Governments' policy landscape; a qualitative study containing semi-structured interviews with key individuals impacted by or knowledgeable in the energy transition; and the development of an economic model specific to renewables and including social and ecological impacts where possible. An overview of the methodology followed within each step will be provided below.

Academic literature review: Initially a thorough literature review was conducted seeking past research on the impact areas from major infrastructure developments in rural communities internationally. The review sought to understand key areas of impact connected to the natural environment, society as well as the more well known financial impacts. Key findings from this process are provided within section 2 of this report. This initial stage provided information on key areas to be incorporated into the modified economic model.

Policy documents analysis: Following from the literature it was considered essential that a review be conducted of the state and federal policy environment as these policies will have a direct impact on the development of energy related projects in the regions. A systematic process was adopted to locate applicable policy documents from government and council websites. The final compilation of documents included policies, strategies, whitepapers and plans which were compiled within an NVivo database. Using a mix of predefined and inductive coding the documents were analysed with information developed into an academic paper and informing the interview process.

Interviews with key stakeholders: Interviews with key stakeholders in the energy transition were considered a critical area of data collection within this project allowing the project team to understand the impacts and the state of the energy transition through the individuals who had experienced it first hand. Ethical clearance was obtained through the University of Queensland prior to the execution of qualitative data collection. A total of thirteen interviews were conducted with stakeholders including interviewees from within local councils; government; energy developers; and impacted residents. Interviews took place between February 2021 and September 2021 and were between 30-90minutes in duration. Once the interviews were complete, they were fully transcribed and incorporated into an NVivo database for analysis. The analysis was based on both pre-defined and emergent themes including impact areas and moderating factors. Results from the qualitative interview analysis were then used to further inform the economic modelling including identifying areas for potential future development.

Economic model adaptation: Specification of a renewables sector was undertaken within a traditional Multi-Regional Input-Output model to allow the identification of individual renewable energy project impacts across economic, social and ecological aspects. Impacts identified in the literature review were used to prioritise social and ecological impacts for inclusion in the model. The primary data source used to construct input-output tables was the Australian National Accounts: Input-Output tables 2018-2019 for a static model and further extended to a time series data covers period from 2004 to 2019. Darling Downs East was used for the initial modelling for the purposes of this study.

4.0 Results

This section will provide an overview the results from the key areas under which research has been undertaken. Initially the key themes established through the qualitative analysis of interviews with key stakeholders in the energy transition will be presented. Secondly an overview of the policy landscape will be provided followed by a final section outlining the adaption of the economic model to include environmental and social impacts.

4.1 Experience of the energy transition from within rural communities

The key stakeholders interviewed within this research provided insights into the existing and potential future impacts of the energy transition in rural communities beyond what was reported within prior academic literature. This research contributes both a broader range of impacts and greater depth to our understanding. Identifying relevant trends influencing the energy transition also allows a forward looking approach to inform efforts to maximise outcomes for communities into the future. Social, environmental, and economic impacts are presented along with moderating factors identified by interviewees.

4.1.1 Impacts

Economic — diversifying income for landowners, businesses and councils

Investment into regions

A major impact of the energy transition is the capital flow into regional and rural Queensland, particularly during the construction phase of renewable energy projects. Investments into regions, towns and communities occur on multiple levels and benefit different stakeholder groups. Investments come both from industry and government. Some investments during renewable energy projects go towards infrastructure for example roads.

> *"The other positive impacts of these projects is ....obviously in the construction phase, there's a lot of stimulus just from money flowing in a rural community."*

Other investments flow directly into the community. Additional money in the form of wages to be spent in the region, for example, going towards housing and local stores, make a major difference, particularly in small towns. The flow of these investments can be measured and tracked over time.

> *"So when you work on a project, you'll have someone on the job during construction phase. You know, that individual alone, is probably putting between $700 to $1,000 a week into that community. And that's through rent to going to the pub. And okay, they might not be there every weekend, but they are there most weekends. Multiply that by 300 or 400 staff for three years."*

Rate payments to council

Another stakeholder group benefitting from renewable projects are local councils, who receive rates from companies conducting these projects as well as the usual source of revenue from existing business and residential premises in the area. These rate payments provide councils with the ability to maintain and develop new infrastructure needed by the rural communities.

> *"The other one is to be honest, it's rates. So you know, all councils, they need rates. And the further west you are, the more you need rates. Because of the length of the roads you have to maintain and (…) all of that.* ***So every windfarm, and every solar farm that goes in, pays rates to council, which means that we can provide better facilities and opportunities for the people who live here…But the rate, the rate base that these assets will provide to the council over a period of time will be very important in maintaining the quality of lifestyle in rural areas****".*

Additional income for Landowners

Often solar and wind farms are built on private properties with the landowners paid a leasing fee to compensate for situation of the assets on the property. These fees are highly beneficial allowing for the landholder to diversify their income stream. Often, however, the main benefit from a farm will go to one or two land holders who are directly impacted.

> *"I think there's probably some good benefits where, you know, a farmer in [town] has leased out a bit of land that was unproductive to put a solar farm on it. He also gets a bit of income because, he gets paid to clean the glass and maintain it. So those people like that that there is good local benefits, and then he's got more money than he then spends in [town]."*

Benefit sharing from renewable generation was identified in the interviews as this is done differently for each project. Interviewees mentioned different examples for the distribution of benefit payments. These included direct payments to the landholder solely, payments to the landholders and to the landholder of surrounding farms, and provision of practical benefits for the surrounding land holders in the form of new solar PVs for their dwellings. Other distribution mechanisms include community funds.

> *"More frequently, particularly between farms, they're introducing neighbourhood agreements, where immediate neighbours are getting compensated as well. So that's positive."*

Diversifying regions

The energy transition provides an opportunity for rural areas to diversify their economies, a point that is particularly important in areas that will have current employment reduced through a move away from fossil fuel extraction or use. Currently many rural towns in Queensland rely mainly on agriculture and coal mining as the two major income streams. The global transition to decarbonise economies is resulting in not only a reduction in future demand for coal for energy generation in Queensland, but also future demand for coal from Queensland's trading partners who are also pledging to transition to net zero, many within the next ten to thirty years. The reliance of some rural and regional towns on coal mining and agriculture is, therefore, of great concern to many and the opportunity to secure jobs which will be sustainable beyond the end of coal mining through renewables projects construction and operation is seen as critically important to maintain these towns. Furthermore, as agricultural producers are already experiencing challenges associated with extreme weather events, projected to increase in frequency and severity due to climate change, diversification of income streams for both individual farms and landowners, as well as the towns and businesses their income supports, is another significant benefit.

> *"I just see it as jobs and investment for those rural communities and in providing support for those communities, through the range of seasons, is just a diversification of their income stream."*

Investment and diversification can also promote potential for innovation in practices and processes within existing industry areas with further benefits for the region and community as well as young people who may otherwise move to larger towns or cities.

> *"Because you can't just you know, if rural areas that are solely reliant on agriculture, have one thing in common no matter where they are in the world, and that is the decline in population and, and opportunity for young people. And so you've got to find other industries."*

Social — dynamic towns and new infrastructure and services

The analysis of the interviews provided two main themes across social impacts which are heavily linked to economic factors. These themes are dynamic towns, and infrastructure and services. Interactions can be identified within key impact areas highlighting the systems existing within rural communities which can act to magnify positive (or negative) impacts of new initiatives within the regions. For example, the creation of jobs in a town has the potential to bring new families into the region, increasing local spend and growing the towns. Growth in a town may lead to increased rates paid to the council providing funds which can be spent on local infrastructure such as roads and facilities providing a community benefit.

Dynamic towns — Retention of youth, growing populations and changing identities

Renewable energy projects have the potential to enhance a regional area that may have been considered in an economic and social decline leading to not only direct financial benefits but also benefits in wellbeing within the community. The issue of job creation and retention is a core concern within rural communities and was discussed in many of the interviews. Renewable energy projects have the potential to create jobs in rural and regional Queensland where companies work to award contracts to local companies and have employees relocate rather than work FIFO positions. Most companies setting up their projects utilise local labour and create a localised workforce.

Impacts on communities are nuanced and context specific. While renewables may require lower levels of staff to mining, the renewable sites are geographically disperse, providing job opportunities across the state. The ability to employ locals depends on the existing skills of the community. For some communities the addition of a small number of ongoing staff is significantly more valuable than large numbers of staff, particularly FIFO workers.

> *"So that, the project between [towns] is going to be really instructive. ...... It's a $2 billion project. It'll employ 400 people during construction phase, probably four years. And it will probably have 30 to 40 full time employees. And they will all live between [towns]"*

It is during the two-to-three year construction phase of solar and wind farms that the majority of jobs are being created. Some projects reported employing hundreds of individuals in the construction phase offering opportunities to those in the local area, including to local contractors and indigenous employees. Jobs in the construction phase include electrical and mechanical fitters as well as general construction trades and where possible go to local contractors. A secondary benefit of awarding contracts to local companies is the building of capacity in these companies contributing to them building their ability to assist in the energy transition and potentially investing in new manufacturing (or other) facilities.

> *"They have the capability there already due to being industrial towns, and enables us to utilise local suppliers and then build further advanced manufacturing capabilities, we get access to people and the general setup of the area"*

A potential area for increasing positive impacts on the local area is in the opportunity to add training and apprenticeships for local youth through the projects. While there is some concern related to the wages of future jobs in the energy sector it is important to acknowledge the distinction between energy generation jobs for Queensland and mining jobs related to exporting, for example, high paid coal mining jobs.

In addition to employing locals, setting up renewable projects also requires the employment of a specialised workforce from outside the region. These individuals may move to regional and rural areas with their families for the time of the construction phase if incentivised by the conditions placed through local council or the companies directly. The interviewees highlighted the benefit of this migration to small towns in terms of the benefits to regions and rural communities.

> *"It makes a big difference, because those people move into that area with families. And, you know, can sustain those towns that otherwise would disappear. And so that's one of the significant advantages."*

It was identified that this influx of new workers is especially important where communities are experiencing a reduction in population numbers consistent with the global urbanisation trend.

> *"Towns like [town named] were dead. They were dying rural towns. And you know, there'd be 50 or 60 jobs in that town now just from renewables. And they wouldn't exist. And each job that's created, obviously flows through those economies, supports staff, teachers, police, nurses, the entire community benefits from that, that uplift."*

The families who move with the workforce benefit the community in many ways from increasing school student numbers and, therefore, teacher allocation and resourcing, to increased participation in weekend sports and social occasions.

These flow on social effects on the local community are valuable impacts of renewable energy projects in rural areas.

Infrastructure and services

Other impacts can include increased investment in infrastructure upgrades such as roads, facilities and network upgrades. The rates paid by businesses to local councils to execute projects add value to these towns.

> *"So every wind farm and every solar farm that goes in pays rates to council, which means that we can provide better facilities and opportunities for the people who live here. So, they contribute to the social good in that way."*

One example mentioned in the interviews raises the issue of what is tangible to rural communities, implying the importance of visibility of benefits.

> *"So for me, having been involved within the last few years with some road construction, like the investment in terms of the community, so the community could sort of touch and feel to some extent the investment that the government made in terms of roads."*

Despite renewables projects providing significant new infrastructure and generation of a critical input for households and businesses (energy) in and of itself, the interviews highlight the communities don't actually see benefits directly related to energy supply or price. Although renewable energy projects are built in regional Queensland, it does not necessarily lead to cheaper energy for communities in these regions or greater energy security.

> *"And then the way our market works at the moment is that the power from the utility scale developments kinda get sold into the network and sold into the National Energy Market. People locally don't get (…) all of those direct benefits from those. So there's no opportunity to say, if you live within 10 Ks of this, you'll get a discount because you only need to use this much network."*

There is, however, an argued opportunity for agricultural producers to work together to achieve greater energy price and security benefits through localised energy sharing.

> *"So I got this longer term view that energy can be utilised to improve farming techniques, one of the biggest things for intensive farming is energy. Energy cost limits that, because intensive farming uses less water, less space. So therefore, what that can do is utilise that land, you know almost like its own generator, it's own producer, while also reforesting"*

Environmental — Full environmental impact and competition for land

Environmental impact

Clearly, building new renewable energy generation assets is required to decarbonise economies and reduce future impacts associated with climate change. This environmental benefit may not be directly seen by the rural communities. One clear benefit though is the lower environmental footprint and pollution of renewable energy projects in comparison to coal mining.

> *Obviously, the renewables projects are much lighter touch on, you know, in terms of the environmental impacts than a coal mine, or even gas wells. So, the impacts on the ground are minor, and they're pretty easy to remediate."*

Yet in terms of measuring environmental impacts we must also look at embodied carbon, i.e. the carbon emissions associated with the production of materials to build the renewable energy projects including concrete, steel and other materials. Some of these impacts may not be experienced in Australia due to international supply chains.

> *"No development (...) comes without any impacts at all. (...) Everything has to be made from something. You know, wind towers aren't made of fairy floss, they are made of steel and a lot of concrete, (...) and all of it has been mined somewhere."*

Another challenge that interviewees identified is uncertainty when it comes to end-of-life of solar farms and wind turbines once they have reached their life span.

> *"(...) but there's 500 tonnes concrete in the base of every turbine. In 30 years' time when they supposedly done their dash, I don't know what they do with them."*

While water and biodiversity have been raised as impacts associated with renewables projects in other studies, these themes were not evident in the interviews.

Land use

One impact raised by interviewees is relevant both from both an environmental and economic perspective. As the last decade has witnessed a dramatic increase in the number of renewables projects across the state, built by a diversity of owners and investors, concerns have been raised relating to competition for land use and the challenge for rural and regional Queensland to efficiently use land. While solar and wind farms provide an excellent opportunity to use land that is not suitable for agriculture, it simultaneously creates the challenge to classify high quality agricultural land, a point which is further complicated by issues of scale in agriculture where high quality land may not be cost effective for agricultural operations.

> *"It's about making sure as we grow, we want it, we want these energy businesses coming into our region, but also to make sure that our core business, which is agriculture, that really top-quality land (...) doesn't have that footprint put on it."*

As agriculture and carbon farming initiatives evolve in Queensland this point may increase in prominence for rural communities. The role of policy was raised as a means of guiding investments and land-use to maximise efficient land-use. The interrelated nature of policy is also evident as many renewables projects have been built primarily due to geographical proximity to points in the network capable of accepting new, intermittent energy generation assets, rather than the most appropriate land. Further work from government categorising and defining the quality of agricultural land is argued by some interviewees to support efforts towards land selection.

4.1.2 Moderating factors

"We know the economic lives of our coal fired generation fleet, we've got a huge amount of willingness to invest in not just generation but demand management and systems and other technologies to improve energy and productivity. And I think we just need to probably speed up the way we allow the transition to happen to fully take advantage of it."

Technology, policy and communicating the transition

Insights from the interviews also highlights the significant role of technology, policy and communication in how the energy transition is currently being experienced and will be experienced by rural communities in the future.

Policy — Stability, jobs transitions, and strategic and equitable benefits

Interviewees had different perspectives on the extent of the role of government required to support the energy transition, yet it was clear interviewees view a lack of policy hindering the efficiency of the transition and potential for greater equity of benefits. Key points for policy included strengthening the network, strategic selection of land, benefits to communities, transitioning workers from fossil fuel jobs to future sustainable jobs, stable climate change policy to ensure certainty for investment, and integration across federal and state policy as well as across energy, climate and related policy for example electric vehicles and future development policies.

In addition to the critical role of government and policy, a clear message emerging during the research was how market driven the transition is. Many businesses operating in Australia have recognised the global shift towards renewables and their investments reflect this acknowledgement. This research has clearly shown the significant investments into renewable energy in Queensland, however, many of the proposed projects do not reach completion. It is argued, policy and the state of Australia's energy network, are major factors limiting the transition.

Communication

A major concern by interviewees is the shift in employment related to the energy transition and communication, or lack thereof, on the labour transition. While it is important to distinguish between jobs related to Queensland energy generation and jobs in the fossil fuel industry more broadly, particularly mining for export, for this study investigating the energy transition in Queensland, all jobs related to fossil fuels will experience a transition as the global economy decarbonises. These industries have been shaping communities and providing job security for many years. Fear of unemployment is one of many concerns' local communities, particularly in mining towns, are facing. Interviewees argue State and Federal Governments as well as fossil fuel companies and the media have a role to play in communicating the true state of the energy transition and plans for job transitions in regional and rural areas.

> *"I think the big elephant in the room is no one is talking about the orderly retirement of the coal generators."*

While governments and power stations have discussed renewable energy targets to varying extents, they were not viewed as sufficiently addressing the future of coal fired power stations, creating concerns in communities. Although the government has not put a fossil fuel strategy in place, some coal fired power stations are expected to close in the next 10 years. The Callide B PowerStation in central Queensland for example is likely to close in 2028 due to its expected technical life span. There is concern about communication specifically relating to transitioning jobs and acknowledgement that fossil fuels will end despite coal fired power stations closing in as little as seven years.

> *"**Those people have got all the right skills to be employed in renewables. And that region is going to be a big centre for renewables in the future**. There's little doubt about that. So all those guys are really worried about their jobs and their families and their futures. And seven years is not a long time. A lot of them won't be retired in seven years. But if we're having adult conversations about how they can be deployed in that region. Because it's obvious to me that those people are going to have long secure futures in the areas where they currently live. But no one's talking about it".*

One initiative raised in the interviews which did seek to not only communicate the job transition for communities, but also to have conversations to identify how the communities would like to direct their future in a decarbonised world was the Queensland Government's Just Transition program. The program was applauded for its efforts yet the complexity of achieving the aims of this particular program, and the differences between communities was raised.

Technology

Technology has a tremendous role to play in the transition. While technology is continuously improving, there are still technical limitations slowing down the transition.

> *Key issues addressed by interviewees were battery storage, grid connectivity, and security and reliability of the network.*

Battery storage is a major constraint and pivotal component for the success of renewable energy projects. In contrast to fossil fuels, renewable energy needs to be stored after it has been generated to guarantee supply. Hence batteries are crucial to load shift and store the energy. Although batteries are continuously improving, there is still a need to further explore and enhance different forms of storage.

Secondly, there are numerous issues regarding grid connectivity causing problems for different stakeholders. For example, not all renewable projects that are approved and executed, can be connected to the grid due to the current market setup and capacity issues. Moreover, approval for grid connection can take months. Consequently, many renewable projects "die in the ditch", leading to negative implications for businesses who are willing to invest, but the outcome may not be economical.

The energy supply generated by renewable energy facilities such as solar farm, is usually integrated into the main, centralised grid. Some interviewees outlined the potential of micro connected distribution networks for rural and remote areas. Micro-grids and battery storage in communities and individual households could hold benefits such as fostering self-contained communities.

4.2 Policy context of the energy transition

"We know it's going to happen, but we don't know how to get from here to there."

As the pressure to transition to net zero continues in Queensland and Australia, the proportion of renewables in Australia's energy mix will continue to increase. Despite a continual increase in rooftop solar investments by businesses and private households, incentivised by the Large Renewable Energy Target (LRET) and Small-scale Renewable Energy Scheme (SRET), renewable energy generation and use remains relatively low in Queensland (Department of Industry, Science, Energy and Resources, 2020). Many interviewees of the qualitative study featured in this project argue the critical role of Federal and Queensland State Governments' policy to not only accelerate the transition to a net zero energy system, but to manage impacts associated with the transition on the various stakeholders. To understand the policy context of the energy transition we analysed policy documents related to the energy transition. The analysis highlights key insights including the emergence of the Queensland State Government in terms of climate and energy policy in response to the lack of coherent Federal Government energy policy, limitations in terms of vertical and horizontal policy integration and the continued inclusion of fossil fuels for the energy mix or export rather than clear plans for retirement of fossil fuel assets.

4.2.1 Federal Government

The analysis highlights a lack of guidance for stakeholders related to the energy transition in form of clear energy and climate policies. International agreements such as the Paris agreement and the recent COP26 are driving a global shift towards low carbon economies and encourage countries to implement ambitious targets. Currently 130 countries worldwide have considered or committed to implementing a net zero target (United Nations, 2021). These reduction targets will set a significant statement for industry and drive clean energy investments. Australia, however, lags behind in setting aspirational targets. Having achieved its Renewable Energy Target of 20% of electricity generation coming from renewable resources by 2020, the Federal Government has not committed to extending or renewing it. Moreover, Australia's Emission Reduction Target, (26-28% below 2005 levels by 2030; Paris Agreement) as well as RET are relatively low. While pressure associated with the Glasgow COP26 Summit resulted in the Federal Government committing in October 2021 to a net zero emission target, as yet there is no detailed plan to achieve such an emissions reduction or to phase out fossil fuels. So far, the "Long-term Emissions Reduction plan" to move towards net zero (Department of Industry, Science, Energy and Resources, 2021) is entirely based on low emission technologies.

Another major problem for Australia's energy market is the lack of a cohesive, long-term and detailed national energy strategy. A significant statement could have come from the National Energy Guarantee (NEG) which was finalised in 2018, however, was abandoned following a change in political leadership in the same year (see Table 1).

Table 1 Abandoned, rejected and repealed policy tools, mechanisms and schemes

Policy Instrument	Context	Author
National Energy Guarantee (2018)	Abandoned in October 2018 by the Australian Government; causing lack of long-term energy policy affecting investments.	COAG Energy Council - Energy Security Board; Department of the Environment and Energy
Carbon Pricing Mechanism (2014)	Repealed; emission trading scheme that put price on carbon pollution of Australia's biggest emitters; covered approx. 60% of carbon emissions, including stationary energy.	Clean Energy Regulator; Clean Energy Act 2011
Carbon Pollution Reduction Scheme (2008/2009/2010)	Not proceeding/rejected; emission trading scheme and carbon cap and trade system to mitigate climate change.	The Parliament of the Commonwealth of Australia

Moreover, policy schemes or mechanisms that put a price on carbon seem to be avoided. Policy instruments, for example tax or subsidies on fossil fuels and emissions, that have proven to be successful in other countries, are not applied. The Carbon Pricing Mechanisms and Carbon Pollution Reduction Schemes were repealed and rejected (see Table 1) after political contestation. Instead, the federal government focuses on energy efficiency and enabling investments (see Figure 3) to reduce emissions.

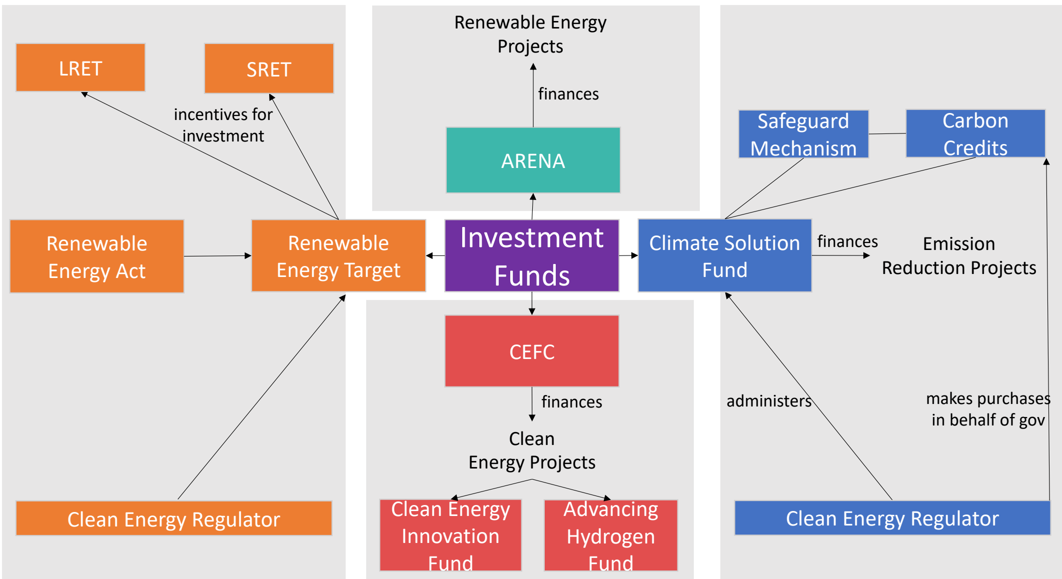

Figure 3 Federal government investment funds and agencies for renewable energy and emission reductions

Another concern is the lack of policies to address a future fossil fuel (phase out) strategy. In general, it was found that coal and other fossil fuels were not discussed in strategic documents, with some policy documents actually referring to the ongoing importance of coal and its role for Australian exports.

Despite these limits to climate and energy policy, some positive developments can be seen. The Australian government has implemented a detailed Hydrogen Strategy (2019). Moreover, a growing number of Investment Agencies and Funds are supporting the transition by investing in reduction emission technologies and renewable energy projects (see Figure 3). The primary investment funds and agencies established by the government to support the transition are ARENA (Australian Renewable Energy Agency), CEFC (Clean Energy Finance Corporation), the Climate Solution Fund (former Emission Reduction Fund) and the RET (Renewable Energy Target). ARENA, established in 2012, is supporting renewable energy projects with a focus on innovation and new technologies, while the CEFC (Clean Energy Finance Corporation) is aiming to cut emissions across different sectors (e.g. infrastructure and agriculture) through a 10 billion $ investment fund, with two (sub) funds particularly financing clean energy projects: The Clean Energy Innovation Fund and Advancing Hydrogen Fund (CEFC, 2021).

Another positive development is the implementation of a Low Technology Investment Roadmap (2020) to reduce emissions. Moreover, in 2021 the government released a Future Fuel discussion paper (2021) with a focus on creating infrastructure supporting electric vehicles which could greatly benefit Australia's electric vehicle uptake.

4.2.2 Queensland

The analysis revealed the Queensland Government has stepped in to provide energy and climate policy in response to the absence of Federal Government policy, an emerging trend among Australian State Governments. Queensland has set ambitious targets to move towards a lower carbon economy (see Table 2) by aiming to reach 50% renewables by 2030 and having a net zero emission target in place (Queensland Government, 2017). These long-term goals create more certainty for industry investments.

Table 2 Federal and Queensland targets

	Context	Author
Renewable Energy Target	20% renewable energy by 2020	50% renewable energy by 2030
Emission Reduction Target	26-28% emissions reduction below 2005 levels by 2030 (Paris Agreement)	30% emissions reduction below 2005 levels by 2030
Net Zero Emission Target	Newly established in October 2021 (no concrete plan)	Zero net emissions by 2050
Energy Efficiency Target	40% improvement of energy productivity by 2030 (NEPP)	-

Having analysed and compared both Federal and Queensland State Government policy documents, it is clear Queensland is more ambitious and further progressed than the Federal Government in terms of strategy implementation and execution. Queensland for example has implemented a detailed Electric Vehicle Strategy in 2017 and has its own Hydrogen Strategy (2019) in place. The Powering Queensland Plan (2017) states clear actions to achieve a cleaner and more secure energy supply. It focusses for example on stabilising electricity prices and investing in transmission infrastructure.

While Queensland's energy and climate change policies are mostly independent from the federal government, the state does utilise federal government schemes such as the Large-Scale Renewable Energy Target (LRET) and Small-Scale Renewable Energy Scheme (SRET). Additionally, the state government benefits from government investment agencies and funds it can access. However, the Queensland Government states in its policy documents that the uncertainty of policy guidance on a federal level is an obstacle to the transition occurring on a state level (Queensland Government, 2017).

A controversial factor is the continuous support of coal and gas developments. Neither the Federal nor the State Government have a coal or fossil fuel strategy in place. Both do not address the future of coal in their energy and climate policy documents. What is noticeable, particularly on a state level, is a mention of coal related to export and growth. Queensland acknowledges the continuous role coal fired power stations will play for its electricity mix in its policy documents. The qualitative study identified a lack of addressing ageing coal fired power stations or the future of fossil fuels, as creating uncertainty within some communities. The only document we found suggesting a potential fossil fuel phase out to lower emissions was the "Credible pathways to a 50% renewable energy target for Queensland" conducted by a Renewable Energy Expert panel. While the Powering Queensland document outlines significant investments into renewables, it simultaneously supports land release for the Surat Basin for gas development. Using gas powered stations is supported and encouraged due to the high energy demand in Queensland and increasing electricity prices (Queensland Government, 2017).

4.3 A new tool to assess the value of renewables infrastructure

4.3.1 Measuring economic, social and ecological impacts of renewables

The final study undertaken investigated the ability of social and ecological impacts to be incorporated into traditional economic modelling, a means of 'valuing' these impacts. Doing so allows a more holistic understanding to be developed of the value to be derived from the construction of a renewable energy asset, for example a wind or solar farm, to be considered by decision makers rather than simply economic factors. This supports the research project's aim of understanding impacts and maximising benefits across social, ecological and economic aspects associated with the energy transition for rural communities.

Economic modelling depends upon quantification through price, quantity, revenue and costs. For the most part this constraint precludes the direct incorporation of ecological and other social costs into economic models. Often this limitation is catered for by the use of shadow pricing. In this study, attempts to more formally model the full impacts of renewables (direct and externalities) are undertaken through the specification of a renewables sector and its inclusion into a Multi-Regional Input-Output model. Furthermore, the study involves the inclusion of various social and ecological impacts of renewable energy projects. The first selected region analysed is Darling Downs East, defined by Queensland statistical areas, level 3 (SA3). Full incorporation will still require some form of shadow or hedonic pricing to fully account for externalities, but this extension of the traditional model allows for far greater quantification of the real economic value of a renewables project.

4.3.2 Data

The primary data source used to construct the input-output table is the Australian National Accounts: Input-Output tables 2018-2019 for a static model and further extended to a time series data covers period from 2004 to 2019. According to the impacts identified in the academic literature, additional data sources have been incorporated to assemble the MRIO table and are summarised below.

Table 3. Data Sources

Impacts	Category	Data source	Notes adjustments
Employment	Economic	National I-O Table 20 National Regional Profile	Default variables in MRIO model with 114 sectors, have been aggregated to 19 sectors
Regional product	Economic	National I-O Table 2	
Tourism	Economic	National I-O Table 5 & 8	Defined as aggregate impact of Accommodation, food & beverage services retail and sports and recreation
Energy consumption	Economic	Australian Energy Statistics 2020 Table A2 & E4	9 sectors have been split into 19 sectors with assumptions
Electricity price	Economic	Australian Energy Regulator electricity spot prices QLD	Annual volume weighted average price
Carbon emissions	Ecological	National Green Gas Account 2019 F3	9 sectors have been split into 19 sectors with assumptions
Land use	Ecological	ABS Land Account Queensland Table 1.1	4 sectors plus 15 sectors aggregated in one other sectors.
Water use	Ecological	ABS Water Account Table 1.1 & 5.1	
Biodiversity	Ecological	Queensland Government Environmental Offset Calculator	Calculation of offset depends on project specific EIA report
Health	Social	National I-O Table 5 & 8	Defined as health care sector in the I-O table

4.3.3 Limitations

The MRIO table itself has limitations of obtaining all information within an economy mainly due to missing data. Since not all additional information is available for 114 sectors, aggregation/decomposition of industries might be problematic as it is not computed based on real data but relied on assumptions widely used in the literature. Furthermore, the long-term impact of renewables is not captured in the MRIO model because of the substitution effect of renewable energy and possible redistribution of energy supply and use.

4.3.4 Outcomes

While economists continue to improve modelling of social and ecological impacts, enabled by further research and improved relevant data, this project provides an understanding of what's currently possible. Decision makers can use the model to gain a more holistic perspective on the value and types of impacts, monetized to allow for a level of comparability of impacts. The development of a renewables sector also allows industry specific modelling and insights. The data sources and pricing methods to measure and monetize social and ecological impacts may also be transferable to other industries seeking to extend their current modelling.

5.0 Discussion

As the energy transition in Australia has accelerated over the last 10-20 years, changes have occurred, not only in the source of energy generation, but also in the number of assets, locations, geographic spread and ownership of generation assets. In addition to technological challenges arising related to the integration of a new mix of intermittent power generation, so too have impacts associated with energy assets appearing across the State of Queensland, predominantly experienced by the rural and regional communities in which they are located. With continued pressure globally to decarbonise and net zero targets at the Federal (Australian) Government and Queensland State Government levels, the opportunity to increase positive outcomes for rural communities and manage negative impacts will need to be addressed as soon as possible. This project has focused on rural and regional communities in Queensland, identifying impacts experienced related to the energy transition and their moderating factors, as well as progressing efforts to measure and quantify impacts where possible.

The current academic literature is limited in its investigation of holistic impacts of the energy transition (across social, ecological and economic aspects combined). A lack of conclusive evidence related to impacts or studies targeted at different geographic regions within Australia, restricts the ability of decision makers including policy to address such impacts and improve outcomes for communities. This project worked to clarify these impacts and provide information relevant to decision making through the completion of a suite of studies. A qualitative research study discovered not only common themes evident in the experience of rural communities and stakeholders, it also provided depth in understanding of what currently influences such impacts and how current trends are likely to impact communities in the future. A systematic policy analysis provided important evidence of the current state of energy and related policy at both the Queensland State level and the Australian Federal level, identifying areas for improvement. Finally, an economic modelling study identified impacts which can be measured and monetised for inclusion in traditional economic modelling, as well as creating an economic modelling approach specific to renewable energy in Queensland.

Integration of the findings of these studies provides valuable contribution to the current knowledge base from which to direct future efforts to support outcomes for rural communities. Insights from the policy analysis are supported by statements from interviewees, often with examples of the real impact created due to deficiencies, or innovative government programs, as well as suggestions for areas to improve, and are often not featured in the academic literature. The project, therefore, not only identifies the need for development of policy, it also provides depth of insights to guide future policy efforts to address specific impacts raised. Interviews also identified a variety of impacts specific to Queensland communities not currently reflected in literature. While such insights can support various interventions, the economic modelling study featured in this project highlights the ability to incorporate all impacts raised is currently limited due to data constraints or the maturity of methods for valuing such impacts. Further research will promote their future inclusion and the research to do so will also provide valuable insights on these important topics to support communities through the energy transition.

6.0 Recommendations and implications for industry and government

Based on the results of the research presented in this report the following recommendations are made:

6.1 Strengthening the network and improving resilience

- Strengthening the energy network to support the acceleration of the energy transition, including capacity to connect increased numbers of renewables projects, reducing curtailment of existing and future renewables projects, providing more equitable opportunities for renewables, and reducing wastage and sub-optimal land selection in the industry caused by technical limitations of the network is a key issue to be addressed.

- Improving the evidence base to understand the potential of micro-connected distribution networks for rural and remote areas, including micro-grids and battery storage shared among households and businesses will assist in identifying new options to support strengthening the network and improving resilience of energy security and, therefore, communities, particularly in light of extreme weather events.

- Planning for end of life of renewables infrastructure (upgrades, recycling etc.) will support long-term sustainability and resilience of the network beyond initial planned life of projects.

- Policy at all levels of government should be clear and integrated to ensure confidence of industry and communities as to the future of their investments, jobs and livelihoods. This includes stable and integrated policy across climate change, emissions reductions across various industries and their workforce transitions, as well as policy supporting new industries for decarbonised economies such as electric vehicles. Local council policies should be used to influence project processes for optimised local social and environmental outcomes.

6.2 Improving measurement to support decision making

- The development of further metrics is required to understand the value (positive or negative) created through developments in rural communities. Establishing metrics in key areas of environmental and social impact will provide the ability to make informed decisions on developments in rural communities, to compare projects and to measure progress.

- Case studies and models should also be expanded to improve understanding of the impacts of other energy developments for example microgrids and new industries.

- Tools developed for local government use to assist decision making and management of renewable energy developments will assist in maximising value and minimising negative impacts on their communities. These may include process guidance and negative impact avoidance for example relating to site placement (value of land), workforce requirements and location, or payments to landholders which the local government decision maker can optimise to their region's conditions.

- Baseline measures of social and environmental factors such as land quality, water quality, biodiversity, population, employment levels, skill level etc. can assist decision making related to development placement as well as optimisation and execution of developments.

6.3 A workforce to benefit local communities

- Consideration should be given for the creation of local training /employment programs within developments to benefit the local communities. Planning should also account for transition employment and reskilling from jobs linked to emission intensive (scopes 1 & 3) industries.

- Planning should incorporate strategies designed to encourage the workforce to contribute to local communities including residing in the rural community. Local policies six-day work weeks may assist in this process by promoting greater integration into the local communities.

6.4 Knowledge and engagement of communities

- While each rural communities experiences the energy transition differently, some communities, particularly those previously dependent on fossil fuel related jobs, may feel significant uncertainty about the future. Clear and honest conversations with these communities about how the energy transition may impact both positively and negatively should be consistent and commence well in advance to support communities.

- Communities at the centre of these renewable development regions are seeking greater levels of consultation and education on the potential changes to their region's future. They require the mechanisms that allow them to make decisions and be an active participant in the energy transition.

Information to support communities should include details such as time frames, new industries, numbers and types of jobs and their potential income, footprint of renewables/hydrogen developments and associated impacts flowing through communities such as strategies implemented to support local community interests and cohesion.

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The University of Queensland
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Centre of Excellence

Contact details

Dr Cristyn Meath
E: cristynmeath@business.uq.edu.au

Dr Belinda Wade
E: b.wade@business.uq.edu.au

T: +61 7 3446 8162

E: enquiries@aibe.uq.edu.au

W: aibe.uq.edu.au

A: Level 5, Sir Llew Edwards Building (14)
The University of Queensland
St Lucia QLD 4072, Australia