Localised Energy in Regions
Project Report

ENERGY CONSUMERS AUSTRALIA

QFF QUEENSLAND FARMERS' FEDERATION

This report was produced by the Queensland Farmers' Federation

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List of Acronyms

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
CER	Consumer Energy Resource
DEPW	Department of Energy and Public Works (QLD Gov)
DER	Distributed Energy Resource
ECA	Energy Consumers Australia
EQL	Energy Queensland
LGA	Local Government Area
LGAQ	Local Government Association of Queensland
QFF	Queensland Farmers' Federation
QREZ	Queensland Renewable Energy Zone
REZ	Renewable Energy Zone
VPP	Virtual Power Plant

Contents

Executive Summary

Rationale

Rising energy costs and an accelerating energy transition presents regional consumers and communities with an opportunity to consider consumer-owned energy resources as a solution to their evolving energy needs. Queensland Farmers' Federation's Microgrid in Agriculture study is just one of 36 Commonwealth funded feasibility projects that identified multiple technical and economic viability of microgrid scenarios across regional and remote Australia.

Furthermore, the development of utility scale investments in Renewable Energy Zones and the public ownership of community batteries surges ahead while regulation for grid connected, mid-scale, consumer owned projects face considerable regulatory and investment roadblocks. As larger energy consumers in regions can increasingly financially justify adopting a microgrid, community battery, or VPP regional grids can expect to face significant augmentation in the near future.

A dearth of data regarding the drivers and scale of an emerging appetite and market in regional Queensland. This Energy Consumers Australia (ECA) supported project presents an opportunity to close the data gap, share learnings across the energy ecosystem, and advocate for an inclusive and democratised modernisation of Queensland's regional grids.

Aim

The Queensland Farmers' Federation conducted market research to investigate the emerging interest and potential impact of decentralised consumer-owned energy resources (CERs) on regional electricity networks. The bottom-up study aimed to identify local appetite for CERs across Queensland's estimated Renewable Energy Zones (QREZ) and insights that could improve planning, utilisation, and affordability of integrating CERs on regional grids.

Method

A literature review was conducted, informing the design of a 45 minute phone survey for the sampling of 9 participants across geographic (north QREZ, central QREZ, and south QREZ) and consumer segments (agricultural producer, regional business, and LGA). Sampling learnings informed the development of a shorter 20 minute phone survey which a market research firm then applied to a lead list provided by QFF resulting in 94 valid respondents. Quantitative and qualitative data was gathered and analysed predominately by the market research firm using tabular and thematic analysis, with some content and thematic analysis conducted by QFF.

Key Findings

A market for CERs exists and is growing in regional Queensland: From 103 respondents 20 implemented projects were identified with an additional 26 respondents likely to pursue a CER in the next 2-5 years. Local councils also reported an increased interest in community energy projects and project developers unanimously reported an increase in requests for CERs. Microgrids were the preferred technology with most respondents seeking grid-connected arrangements. All but 4 of the implemented projects were privately funded. Trends were similar across consumer groups and geographies.

Respondents see CERs as opportunities for local benefit: Agricultural producers and regional businesses see CERs as an opportunity to improve energy productivity, via cost reductions or improved power of choice. Some agricultural respondents are actively considering microgrids and VPPs with collocated ag producers while

regional businesses have identified the competitive advantage renewable CERs offer. Regional councils seek opportunity for reduced energy costs for constituents if located near a REZ or community energy projects.

Improving energy literacy will increase appetite for CERs: The top 2 reasons for a reluctance to adopt a CER were financial performance and a lack of knowledge about the technology. Councils explained education of the opportunities CERs can unlock locally is both desirable and likely to increase the appetite for mid-scale local energy projects, both consumer and community owned.

First Nations communities report energy vulnerability and inequities*:* Climate vulnerabilities, underserved existing infrastructure, expensive and unreliable energy resilience countermeasures, and public housing regulatory complexities drive Aboriginal councils' energy decision making. While there was interest, councils indicated CER adoption is unlikely due to the pressures of skills availability and other urgent community issues.

Regulation, financial performance, and local skills are key risks*:* Project developers unanimously see regulatory uncertainty as the key risk to projects. Consumers are similarly concerned about regulatory uncertainty, after the financial performance of a project; the former frequently disadvantages the latter. Councils are especially concerned about the access to expertise in regional communities to not only develop CERs, but affordably operate and maintain over the project life.

Key Recommendations

Based on the findings of the Project recommendations across stakeholder groups were made. Key recommendations include:

- A local power strategy should be included in the Net Zero Transition Authority and REZ remits to enable inclusion of regional CERs in investment, system design, and regulatory processes at the distribution network level
- Regulators toplan for robust communications infrastructure, clear regulatory pathways, and fit for future purpose energy products and services to de-risk the market and enable and onboard the democratisation of energy in regions.
- Regulatory innovation mechanisms like regulatory sandboxes or trial programs need to move alongside and quicker than the current Tariff Structure Statement process. More widespread and customer-led tariff trials under the AER mechanism should be advanced.
- A skills transition for regional communities is necessary to sustain equitable participation in energy transition. It is also recommended that a skills transition occur within regulatory bodies to ensure staff have the capacity to respond to innovative enquiries and proposals.
- Clear pathways for social housing and rental properties to access the benefits of renewable energy are needed, especially in low socio-economic communities.
- Proposed follow-on work includes a) an energy literacy campaign targeting local councils, regional communities, and business and ag consumers, and b) research into the opportunities for energy trading and benefit sharing within and between local councils.

Outputs

Key project outputs include:

- **Survey data:** 103 completed consumer surveys across regional Queensland,
- **Market map:** Development of a public interactive market map tool with anonymised survey data,
- **Final report:** A final report and supplementary resources with findings, analysis, recommendations, and suggested follow-on work, and;
- **Knowledge sharing:** Findings and intersecting policy and advocacy interests presented across the wider stakeholder ecosystem.

Introduction

Brief and rationale

With the funding support of Energy Consumers Australia (ECA) and in-kind support from LGAQ and project partners, Queensland Farmers' Federation (QFF) researched the emerging appetite, potential impacts, and drivers for the adoption of consumer-owned energy resources (CERs) in regional Queensland.

The Project was motivated by the observed increasing accessibility of smart and decentralised energy resources[1], QFF's successful on-farm microgrid feasibility studies under the Commonwealth's Regional and Remote Communities and Reliability Fund program from 2020-22[2], and the growing political coordination across governments and departments to meaningfully strategise for Australia's energy transition[3].

In February 2023 Energy Queensland's Chief Engineer, Peter Price, recognised the need for a transition to a Smart Distribution Network stating that "all market participants must be able to install batteries and contract with other parties to optimise outcomes for customers", including customer adoption of new technologies.[4]

Despite the progress of transition policies and the creation of Renewable Energy Zones (REZs) to house much of the planned utility-scale renewable investments, the integration of consumer-owned, sub-utility scale projects (specifically microgrids, community batteries, and virtual power plants) onto Queensland's regional grid is not being equitably represented in the funding, regulatory, system performance, and strategic priorities of energy institutions. To date, remote and urban southeast Queensland communities have taken strategic priority while enabling strategies for regional communities are comparatively immature.

There is little existing data on the sub-utility scale adoption of these technologies and comparatively little research undertaken to understand the ability of regional consumers to participate in and benefit from this energy transition, equitably. As such the potential size and impact of a regional grid transformation and the emerging market needs are not sufficiently accounted for.

Scope

The project scope was to conduct phone surveys with 100 farmers, businesses, and councils (including First Nations councils) across regional Queensland; a small sample of CER project developers was also captured in the original sample size. The respondent segments were further divided by North, Central, and South 'REZs', a geographic estimation according to the Queensland Government's early REZ considerations. Nine long surveys were completed during participant sampling and 94 short surveys were conducted in the primary surveying phase for a total of 103 valid respondents out of a required 100 surveys.

The key purpose of the phone surveys was to identify:

- the energy literacy of regional consumers regarding smart energy innovations and the energy transition,
- the drivers of current and future energy consumption,
- implemented CER projects,
- the appetite for consumer-owned microgrids, VPPs, and community batteries, and;
- the perceived risks and uncertainty of adopting CER projects.

The anonymised data then helped form a publicly available map of the emerging market for CERs and further analysis and findings via supplementary resources.

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[1] International Energy Agency. (2023). "Digitalisation and Energy". Retrieved from https://www.iea.org/reports/digitalisation-and-energy
[2] Queensland Farmers' Federation. (2023). "Microgrids". Retrieved from https://www.qff.org.au/projects/microgrids/
[3] Department of Climate Change, Energy, the Environment and Water. (2023). "Australia's Energy Strategies and Frameworks". Retrieved from https://www.energy.gov.au/government-priorities/australias-energy-strategies-and-frameworks
[4] Energy Queensland. (2022). "Strategic Forecasting Annual Report 2022". Retrieved from https://www.energyq.com.au/__data/assets/pdf_file/0005/962564/Strategic-Forecasting-Annual-Report-2022.pdf

Background

The feasibility of on-farm microgrids

The global shift towards consumer-owned Distributed Energy Resources (DER) is evident, with Queensland being a focal point. This transformation is fuelled by the demand for sustainable energy and the integration of consumer-driven generators. DERs, encompassing rooftop solar photovoltaic (PVs), batteries, electric vehicles (EVs), and demand response, are now integral to the electricity system.

On-farm microgrids have proven their worth through various feasibility studies. The Queensland Farmers' Federation's microgrid feasibility studies revealed potential for these microgrids, especially if they remain grid-connected and cater to around 80% of the farm's energy needs[5]. These microgrids offer energy reliability, especially in remote areas, and can contribute to the broader energy market.

Queensland's energy transition is characterised by the rise of consumer-owned energy resources. Factors including government incentives, environmental awareness, economic benefits, and grid resilience have accelerated this shift. The Queensland Farmers' Federation's research aims to understand the potential of DERs in Queensland's Renewable Energy Zones (QREZ) and the integration of consumer-driven DERs.

Consumer-owned energy resources in Queensland's energy transition

In recent years, Queensland has been at the forefront of a significant energy transition, moving away from traditional fossil fuels towards more sustainable and renewable energy sources. A pivotal aspect of this shift has been the rise of consumer-owned energy resources.

Consumer-owned energy resources allow consumers to generate, store, and even sell electricity back to the grid. Notably, Queensland boasts one of the world's highest penetrations of rooftop solar, and has the highest number of household rooftop solar installations in Australia, with one in three homes having a solar setup.

Several factors have contributed to this surge in CERs in Queensland. The Queensland government has supported the uptake of renewable energy technologies by rolling out various incentives and rebates. This financial support has enticed a significant number of consumers to delve into personal energy solutions. At the same time, there is a growing environmental awareness among Queenslanders. They are keenly aware of the negative impacts of traditional energy methods and are thus leaning more towards minimising their carbon emissions and opting for cleaner energy options. This commitment is evident in the setting of renewable energy targets and the backing of major renewable energy projects. From an economic standpoint, the decreasing costs of renewable technologies means that producing one's own electricity is becoming a more attractive option for many. This not only leads to savings on energy bills but also offers a chance to profit by selling excess energy back to the grid. Additionally, the resilience of the energy grid is enhanced by resources owned by consumers; by distributing energy production, the grid is less prone to large disruptions. The integration of Distributed Energy Resources (DERs) in Queensland has led to a significant renewable energy capacity exceeding 9,000MW, which has been crucial in bringing down electricity prices.

In a move to further understand and harness the potential of DERs, the Queensland Farmers' Federation is conducting market research to investigate the potential impact of decentralised and dispatchable energy resources on regional electricity networks. This study aims to identify the local appetite for DERs in Queensland's Renewable Energy Zones (QREZ) and improve planning, utilisation, and affordability of integrating consumer-owned DERs on regional grids.

Furthermore, the *Queensland Energy and Jobs Plan* emphasizes "empowered households and businesses." This focus area aims to effectively integrate rooftop solar, home batteries, and electric vehicles into the electricity

[5] Queensland Farmers' Federation. (2022). Feasibility Studies on On-Farm Microgrids. Queensland, Australia

network. Beyond individual households, DERs in the form of microgrids and other smart energy systems hold significant potential. They can contribute to a reliable and secure energy supply, enable energy trading, and provide ancillary services to the grid [6].

As Queensland continues its journey towards a more sustainable energy future, consumer-owned resources, backed by strategic initiatives and research, will undoubtedly play a crucial role. By empowering individuals and businesses to take control of their energy production and consumption, Queensland is setting a precedent for how regions can effectively transition to a decentralised energy landscape.

International examples

Internationally, the DER market is seeing substantial growth. For instance, the United States Armed Forces were an early adopter of microgrids for resilience on select bases domestically and internationally[7]. They have since committed to decarbonisation goals that include a microgrid on every base by 2035. These projects include independent and grid-tied installations. American universities are similarly seeking resilience and cost reduction alternatives to energy challenges. Universities that have transitioned to standalone or hybrid microgrid energy systems include Princeton University, University of California San Diego, Wesleyan University in Connecticut, and University of Texas in Austin[8][9][10][11].

The global distributed energy generation market size was valued at $190.0 billion in 2020, and is projected to reach $573.7 billion by 2030, growing at a CAGR of 14.2% from 2021 to 2030[12]. These international examples demonstrate the potential for growth and development in the DER market, including in Queensland.

However, the integration strategy for consumer-owned DERs is comparatively nascent. Emerging challenges to grid operators include grid congestion and intermittency, lack of visibility and control over individual DERs, unpredictable consumption patterns, asset and system modernisation, and cybersecurity and data privacy issues.

The market research aims to answer questions such as the potential market size for DERs in QREZs, emerging opportunities and challenges for regional Queensland presented by DERs in regions, consumer drivers, needs, and barriers to adoption of DERs, and capacity building required to inform and engage consumers and stakeholders to adopt and integrate DERs in a way that retains consumer benefits.

In conclusion, the DER market, particularly in the context of on-farm microgrids and consumer-owned energy resources, presents a significant opportunity for Queensland and beyond. With the right strategies and policies in place, these resources can contribute to a sustainable, reliable, and affordable energy future.

Methodology

The literature review was commenced during project initiation from September 2022 where a desk study was conducted, including engagement with the Project Board and project advisors. Interview questions for sampling were then developed in consultation with the Project Board and advisors.

[6] Queensland Energy and Jobs Plan. (2022). Empowered Households and Businesses. Queensland, Australia.
[7] United States Military. (2022). Microgrids for Resiliency. United States.
[8] Princeton University. (2022). Standalone Microgrid Energy System. New Jersey, United States.
[9] University of California San Diego. (2022). Hybrid Microgrid Energy System. California, United States.
[10] Wesleyan University. (2022). Standalone Microgrid Energy System. Connecticut, United States.
[11] University of Texas in Austin. (2022). Standalone Microgrid Energy System. Texas, United States.
[12] Allied Market Research. (2022). Distributed Energy Generation Market Size. Global.

Participant sampling

QFF and LGAQ hosted an introductory webinar about CERs and the project, including a Q and A, on October 25, 2022. Recruitment then commenced with an EOI form advertised across QFF, QFF members, and LGAQ's channels. Participation was advertised as a 45 minute survey via Microsoft Teams or phone with a $100 gift card for participation or a $100 donation to QFF's charity of choice should the respondent be unable or choose not to accept. QFF conducted the interviews, recording and transcribing them in compliance with a data agreement stated prior to commencement of the surveys. QFF chose to conduct sampling to best ascertain the literacy levels of respondents, the efficacy of the questions, and what support or adjustments were needed to achieve the survey's goals.

Participant sampling was conducted with 9 respondents:

- 3 Agricultural producers (2 north, 1 central)
- 2 Regional businesses (1 north, 1 south)
- 4 Regional councils (1 central, 2 south, 1 first nations)

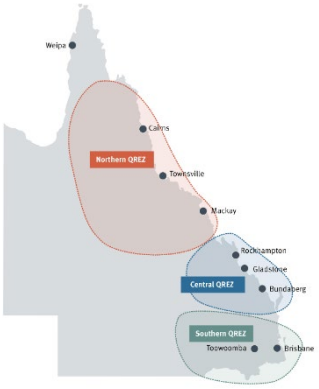

Figure 1: QREZ Map, Jan 2023.

Recruitment was first aimed at consumer segments outside of the southeast Queensland energy service region. Geography was then broken up into estimated REZs: north, central, and south. At the time of sampling Queensland had not defined the geographic regions of their REZs. The image right shows the general allocation of zoning which then informed, in part, the demarcation used by the Project team.[13] Finally, agricultural producers, regional businesses, and councils were selected as consumer segments due to the considerable impact each consumer type's behaviour has on their local, regional grid. From project initiation it was decided that a proportionate sample of First Nationals councils should identified during recruitment with at least one First Nations council per QREZ.

After sampling it was also decided that a small number of CER project developers be recruited for the wider survey to increase the yield of implemented project data and include perspectives of higher energy literacy and active market experience. The remaining quota was set to be evenly distributed across geographic and original consumer segments.

Recruitment occurred over the Christmas break resulting in extra QFF staff time spent on recruitment and as a result some delays in survey completion and then reporting. The Project team mitigated some timeline delays by preparing resources in anticipation of data availability.

Survey Protocol

Survey questions were redrafted with learnings from sampling and adjusted for a 20 minute phone call scenario. Some additional development was conducted with Kynetec, a market research firm specialising in agriculture markets, to produce the full interview protocol which is available in Appendix A. QFF developed the lead list, finalised the survey protocol, and handed over surveying to Kynetec.

The survey was segmented into 6 sections:

- Section 1: Profiling and Classification, questions establishing the consumer profile
- Section 2: Energy Literacy, questions determining the level of literacy of modern energy technologies and markets
- Section 3: Key Drivers, questions identifying energy consumer drivers and satisfaction with current energy services
- Section 4: Technology Adoption (Agricultural producers, regional businesses, and councils only), questions identifying implemented CERs or the appetite to implement in the future
- Section 5: Technology Adoption (Project developers only), questions identifying implemented CERs or the appetite of clients to implement in the future

[13] https://www.epw.qld.gov.au/about/initiatives/renewable-energy-zones

- Section 6: Conclusion

Participants

Kynetec's research team completed 94 valid surveys for a total of 103 surveys conducted across the Project. Below is a brief breakdown of participants.

Participant segmentation

Sampling Surveys	**TOTAL**	**North QLD**	**Central QLD**	**South QLD**
Agricultural producer	**3**	2	1	0
Regional business	**2**	1	0	1
Council / Local Government	**4**	0	2	2
Project Developer	**n/a**	n/a	n/a	n/a
Sampling survey n	**9**	**3**	**3**	**3**
Short Surveys	**TOTAL**	**North QLD**	**Central QLD**	**South QLD**
Agricultural producer	**23**	6	7	10
Regional business	**33**	9	13	11
Council / Local Government	**33**	11	12	10
Project Developer	**5**	1	2	2
Short survey n	**94**	**27**	**34**	**33**
TOTAL n	**103**	**30**	**37**	**36**

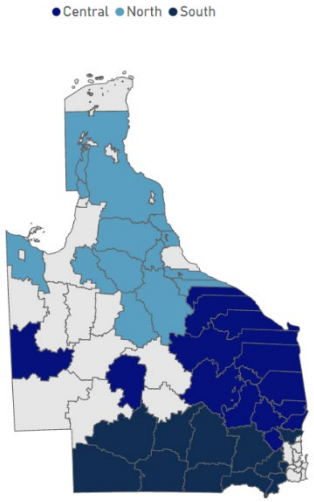

Figure 2: Market map screengrab showing LGAs surveyed by QREZ

The Project team experienced lowest engagement from north Queensland and agricultural respondents. A total of 4 First Nations councils were surveyed, 1 during sampling and 3 during short surveys; all 3 QREZs were captured.

Agricultural producers captured included aquaculture, sugar, eggs, horticulture, dairy, nurseries, pork, and grazing from small to commercial scale.

Regional businesses included agribusinesses, feedlots, food processing, manufacturing, materials processing, transport, distilleries, non-profit service, data centre, business parks, and various commercial enterprises.

Council responses were accepted as the view of the individual and not the council itself. Council participants sought were ideally CEOs, Mayors, and sustainability or similar managers. The participants were ultimately staff who were available and deemed most appropriate at the time.

A total of 20 Implemented Projects

Consumer	REZ	Technology	Off/on grid	Funding	Size
LGA	Central	Microgrid	Off	Public	<500kW
LGA	Central	Microgrid	On	Unsure	Unsure
LGA	South	Microgrid	On	Public	<500kW
Business	North	Microgrid	Off	Private	500-999kW
Ag Producer	South	Microgrid	On	Private	<500kW
Ag Producer	South	Microgrid	On	Private	<500kW
Ag Producer	North	Microgrid	On	Private	<500kW
Business	Central	Microgrid	On	Private	<500kW
Business	South	Microgrid	On	Private	Unsure
Ag Producer	South	VPP	On	Private	<500kW
Business	Central	VPP	On	Private	<500kW
LGA	North	VPP	On	PPP	Unsure
Business	North	Microgrid, VPP	On	Private	<500kW
Ag Producer	Central	Microgrid, VPP	On	Private	500-999 x2
Business	South	Microgrid, VPP, Comm Batt	On	Private	<500 x3
Business	South	Microgrid	On	Private	1-5 MW
Developer	North	Microgrid	On	Private	<500kW
Developer	North	Microgrid	Off	Private	<500kW
Developer	North	VPP	Off	Private	<500kW
Developer	North	Microgrid	Off	Private	1-5 MW

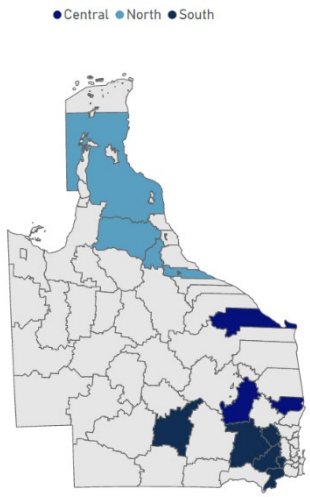

Figure 4 Market map screengrab showing implemented CERs across LGAs & QREZs

It should be noted that respondents are likely to have differing definitions of a microgrid, VPP, or community battery when identifying implemented projects. Regardless of the varied definitions of a technology type they are identifying a consumer owned energy resource that is deferring, removing, or otherwise augmenting load on the network. Consequently, it was decided that this was not a limitation to the validity of the data set.

Analysis

Quantitative and qualitative data was gathered and analysed predominately by the market research firm, Kynetec. Upon completion of data collection, the research team initiated the analysis phase to distil key findings and insights. Two primary methods were employed: tabular and thematic analysis. Tabular analysis involved presenting the data in tables to simplify understanding and interpretation. For instance, data on respondents' current energy usage was tabulated, showing the percentage of respondents using each type of DER. This approach facilitated the identification of patterns and trends, such as the most common energy sources or barriers to adopting DERs. Thematic analysis was also utilised, particularly for qualitative data such as responses to open ended survey questions. This process involved familiarisation with the data, initial code generation, theme searching, theme reviewing, theme defining and naming, and report production. A recurring theme identified was the cost, which was frequently mentioned as a barrier to adopting DERs. Both tabular and thematic analysis proved essential in understanding the survey data and meeting the research objectives. The results of the analysis were clearly presented and explained in the research report, with key findings prominently highlighted.

Outputs

The project's anticipated outputs included:

- 100 completed surveys,
- A public market map tool,

- A final report, and;
- Knowledge sharing.

The project completed 9 long surveys and 94 short surveys for a total of 103 valid surveys.

The public market map tool was developed and launched to the public July X, 2023 along side this final report.

Knowledge sharing for the project included a number of public presentations and will include adding a summary report and recommendations to the QFF Project web page. Some knowledge sharing opportunities that have occurred to date include the following presentations:

1. Presentation at Energy Research Institutes Council for Australia's State of Energy Research Conference in January 2023
2. Energy Queensland's Agriculture Energy Forum in March 2023
3. The Energy Charter's Energy Taskforce in March 2023
4. Renewables in Agriculture Conference Dubbo in June 2023 (mention during a session chair opening remarks).

Further activities will be included on the QFF Project web page here: Localised Energy in Regions - Queensland Farmers' Federation (qff.org.au).

Findings

CER adoption is already under way in regional Queensland.

From the 94 respondents the survey identified 20 implemented CER projects.

- Projects identified were implemented across all 3 consumer types and all 3 QREZs,
- Only 4 implemented projects are off grid,
- 16 projects were privately funded, the remaining 4 utilised public funding or a Public Private Partnership.

These results signal that change is already underway in regional Queensland and that both a desire and need exist for grid connected products and services from energy regulators and utilities.

It should also be noted that there is some difficulty determining how respondents personally define microgrids, VPPs, and community batteries despite the preceding energy literacy section in the survey. Still, installed systems are likely to augment grid demand and therefore remain a valid consideration in this study.

Nearly a quarter of respondents are likely to pursue CER adoption in the next 2-5 years.

A growing market is evident with 26 respondents indicating they were likely or extremely likely to pursue adopting a microgrid, VPP, or community battery in the next 2-5 years.

- An additional 52 respondents indicated an average likelihood of pursuing adopting a CER in the next 2-5 years
- A profound change in regional consumption behaviour is then to be expected in the near future
- Top decision drivers: affordability, reliability, need for more information, and resilience
- The leading 2 reasons for respondent reluctance to CER adoption was a lack of knowledge and that they were considered "too expensive"

The scale of appetite suggests that it is unlikely current tariff roadmaps and 5 year tariff schedules, Renewable Energy Zone planning, existing regulatory processes, and policy mandates are moving fast enough or are sufficiently inclusive to meet existing and oncoming demand.

Regional councils report a growing appetite for community energy technologies.

Nearly half of QLD regional councils surveyed reported a high to very high appetite among constituents for community energy technologies.

- More than 50% of councils in CQ and 40% in SQ scored high to very high community appetite,
- 36% of NQ councils reported a high to very high appetite and 36% reported average interest,
- First Nations councils reported a considerably lower appetite for community energy, explained further below

One council stated that while their community appetite is average, "anything that offers an alternative could be considered due to the price increases we're facing".

Councils reported dissatisfaction with the current focus on utility scale renewable projects at the exclusion of local energy projects from the energy transition conversation. This is reinforced by EQL's current prioritisation of trialling grid tied CERs and smart energy systems in urban and isolated communities.[14]

Another council respondent stated that a precedent exists for resource and asset sharing between councils such as water quotas and waste treatment facilities. The suggestion was then made by the respondent that energy is another resource that could and should be traded between co-located councils.

> "In terms of grid modernisation…it's all talk from a big business point of view, but no one's talking about it for our little community around climate change…, affordability, cost of living. You know, sometimes that dialogues gotta come down a bit."

Project developers report an increase in client demand for all 3 technologies.

Developers unanimously reported an increase in a desire for CERs stating that "clients are looking for ways to solve QLD's energy problem."

Existing clients are requesting projects that drive consumer autonomy and favourable payback periods. Project developers also unanimously identified 'regulatory uncertainty' as the greatest risk to project success.

Developers surveyed demonstrated experience on projects from <500kW up to 5MW in size, off and on grid, and largely privately funded. Respondents worked across all 3 geographic segments including, in some cases, interstate.

"Appetite grows with the sustenance of information." - Appetite is there but energy literacy needs improvement.

Respondents were surveyed on their literacy of existing energy consumption habits and services:

- Only 26 respondents didn't know their average energy spend
- 59% of respondents didn't know what tariff/s they were on

The lack of knowledge on energy spend could be attributed to the respondent being an employee without access to that information.

[14] Energy Queensland, "Towards an Electric Life 2030," 2023. [Online]. Available: https://www.energyq.com.au/__data/assets/pdf_file/0006/1039281/Towards-an-Electric-Life-2030.pdf

The lack of knowledge of tariffs reflects the findings of an ECA funded study conducted by Queensland Farmers' Federation and the University of Queensland, *Charting Farmers' Experience of Tariff Switching*.[15] The study found that complexity of tariffs, dispersed information and lack of accessibility of resources from the DNSP or retailer were barriers to agricultural consumer literacy.

Respondents were surveyed on their literacy of modern or smart energy technologies and the energy transition:

- Respondents rated their knowledge of modern energy technologies an average of 2/5 or 'poor'
- Only 4 respondents were able to accurately define a distributed energy resource of DER,
- 42 could correctly define grid modernisation and 40 people could define the energy transition
- Businesses and ag producers in SQ, and council respondents had the highest literacy of modern energy technologies like microgrids, VPPs, community batteries, and hydrogen for fertiliser production
- The majority of respondents demonstrated low to very low literacy of energy markets

Respondents were also asked how energy literacy influenced decision making:

- *Lack of information* was a top 3 key driver of uncertainty in respondent's appetite for adopting a microgrid
- Similarly, further understanding of how a VPP functioned was a top 2 decision driver for respondents interested in the specific technology type

Multiple council respondents indicated that more could and should be done to educate consumers on the real risks and opportunities of CERs in the energy transition. One respondent explicitly indicated that the community appetite for CER's would inevitably increase with a deepening of literacy.

> *"Appetite grows with the sustenance of information and understanding and knowing what you're consuming."*

First Nations Councils report energy vulnerability as the biggest driver of their local energy strategy.

Queensland has 17 First Nations councils with 15 residing in the NQ zone, 1 in CQ, and 1 in SQ. Over the course of the study 4 First Nations councils were surveyed, 2 in NQ, 1 CQ, and 1 SQ.

Respondents identified a skew of pressures, specific to the First Nations council segment, that largely created an energy vulnerability or insecurity oriented response to existing and future energy planning.

- Reliability was unanimously the key concern/driver; 1 council reported 6 outages in less than a year with 48 hours the longest and not uncommon outage duration
- Energy insecurities were exacerbated by climate vulnerabilities, underserved existing infrastructure, local planning challenges (eg. state government directed social housing expansion), and regulatory roadblocks
- Energy independence, decarbonisation, and EV adoption scored low as drivers for consumption behaviour

When asked to consider modern energy technologies First Nations council respondents had some knowledge (similar to the wider sample) but limited interest in pursuing CERs. This was due to several factors:

- CER were perceived as low priority due to high CAPEX, lack of local access to skills or expertise to develop and maintain, lack of education of the opportunities and challenges, and the priority of other critical community issues

[15] Queensland Farmers' Federation and the University of Queensland, "Charting Farmers' Experience of Tariff Switching," 2023. [Pg 13, Online]. Available: https://eecs.uq.edu.au/project/charting-farmers-experience-tariff-switching.

- Wet season restricted access to community resources including fuel to run diesel generators and affordable skilled labour
- Public housing regulation limits and inefficient housing design undermined DER or CER adoption eg. no clear regulatory pathway for rooftop solar PV on social housing
- More social housing being built meaning greater pressures on existing burdened or aging infrastructure and services
- "Clunky" relationship with EQL meant repeatedly requiring ombudsman intervention to resolve existing products and service issues
- Poor or culturally inappropriate communication from service providers about planned interruptions, system changes and their impacts ("we learn through the grapevine") resulted in high costs to council to hire and run generators during EQL's planned outages.

Despite these factors diminishing the priority of grid modernisation and decarbonisation, respondents suggested that by implementing literacy campaigns and stakeholders connecting the energy transition to the cultural, community, and social impacts and benefits, community appetite would likely increase.

> "I just think the overall language…we don't tie it to the environmental aspects well enough. [Y]ou're talking to a house..you bring an electrician and you set it up, you put a pole in the ground…But there's that other cultural paradigm side around energy from the land"

Microgrids are respondents' preferred technology.

~60% Respondents had heard of microgrids and community batteries compared to 30% for VPPs. The majority of respondents preferred projects to be grid connected with private financing.

Microgrids

55% of respondents reported little knowledge of microgrid technology. Despite that, it made up more than 65% of the implemented projects and 46% of projects likely to be implemented in the next 2-5 years. Similarly, it was the technology respondents were least likely to say there was no potential in adopting.

Community Batteries and VPPs

Only 1 implemented community battery was identified in the total data set. This is likely due in part to EQL's ownership of a considerable number of community battery projects in QLD and a lack of products and services to offer financial inclusion of these technologies in regional Queensland's energy market. More specifically underdeveloped tariffs and ancillary services failing to value potential grid support offered by grid tied CERs increase the market risk of these technologies.

Implemented and potential projects could have a network impact of up to 25 MW .

Regardless of how favourable financial, regulatory, and technical expertise requirements are to all potential projects identified in the survey, QLD regional grids are poised to experience meaningful augmentation in the next 5 years due to changing appetites for CERs.

The 46 implemented and potential projects identified in the survey could impact up to ~25MW of current load on the grid. The impact scenarios would look like a sliding scale of augmentation from grid integration to grid defection. The degree of integration is primarily dependent on policy and technical constraints.

Where financial, regulatory, and technical expertise requirements for adoption are not favourable, it cannot be assumed all respondents will remain 'business as usual'.

Where consumers are driven by energy affordability as it relates to energy productivity or decarbonisation demands, like ESG obligations, are increasingly underserved by existing utility services a rise in partial or total grid defection should be expected.

Widely speaking, it would not be unreasonable to anticipate that some grid defecting behaviour will occur and potentially escalate as energy affordability decreases without enabling CER integration.

Affordability, reliability, and resilience are leading drivers for consumers' consumption.

Eight categories were used to measure consumer drivers: Affordability, reliability, independence, resilience, decarbonisation, increased consumption, optimising existing assets, energy sharing, and EV adoption.

Respondents scored drivers from 1-5 (low to high importance) finding that on average across all segments:

- Drivers of high importance or scored 5 included affordability, reliability, and resilience
- Drivers considered important or scored 4 included independence, decarbonisation, increased consumption, and optimising local assets
- Drivers considered important or scored 3 included Energy sharing and EV adoption averaging 1-2

Resilience was presented as distinct from reliability but was largely left up to the respondent to self define. Some respondents considered reliability a function of resilience including whole of system resilience to extreme climate events or a CER as part of a business resilience strategy that reduces operational vulnerabilities to network outages or high costs.

Consumers reported 'average' satisfaction with current energy services; project developer respondents trended a whole point lower on nearly every indicator.

Agricultural producers, regional businesses, and regional council segments were asked about existing service satisfaction as consumers, reporting the following:

- Respondents were least satisfied with their ability to share energy and the existing support for the adoption of EV
- Respondents agreed that their energy was reliable with an average score of 4/5
- Respondents were neither satisfied or dissatisfied with the affordability, independence, decarbonisation, future increased consumption, resilience, and local asset optimisation of their existing energy services reporting an average score of 3/5.

Project developer respondents were asked about their satisfaction with existing energy services from the perspective of industry stakeholders. Overall they scored a point less than the other consumer segments on almost every indicator reporting the following:

- Project developers disagreed that current energy consumption was affordable, addressing decarbonisation, able to meet future energy needs, or resilient scoring an average 2/5
- They strongly disagreed that energy sharing and EV adoption were currently supported, with an average score of 1/5
- Project developers scored energy independence (same score as the wider data set) and indicators scored 1 (also scored 1).

Some agricultural and regional business respondents see the energy transition as an "opportunity not a pressure".

Segmentation of consumer drivers indicated an elevated consideration for energy productivity by regional businesses and agricultural respondents. Energy innovation as it supports productivity was seen as an opportunity across a variety of respondents:

- 58%of regional businesses identified *independence* as an important to very important factor in their energy consumption strategy. This was much higher than Ag (65%) and LGAs (47%).
- Respondents also identified *consumer choice of energy supplier* as an important consumption driver with explicit reference to regulated vs. unregulated energy services.
- Agricultural producers host highly variable load profiles, depending on the commodity and seasonality. CERs were seen as an opportunity to build resilience to high energy costs, optimise existing renewables assets on farm, and optimise consumption and productivity.
- Agricultural respondents reported that project developers are approaching co-located farms and ag supply chain businesses to participate in a microgrid or other CER system with the aim to balancing loads between agribusinesses and smoothing a collection of peaky loads. Farmers indicated degrees of curiosity and interest in participating, motivated largely by a desire for improved affordability and flexibility of consumption. Ultimately, regulation was signalled as a considerable and ultimately prohibitive roadblock to successful project development.
- Business parks are entertaining net zero strategies to develop a competitive advantage that attracts lessors with ESG obligations. Respondents considered microgrids and other CERs as an enabler of or solution to achieving that strategy.
- Data centres were identified as a business type with high performance requirements for resilience and redundancies, already implementing internal microgrids due to network vulnerabilities.
- Regional councils located near declared REZs reported aspirations to create opportunities from agreements with utility developers that could result in reduced local energy costs for agribusinesses.

Surveying revealed pressures underlying decision making by consumers and communities to consider CERs as an opportunity:

- The rising cost of energy for regional and agricultural businesses not only has business but wider local economic development impacts.
- The intensity of the role irrigation plays on a farming business informed the likelihood of adopting a CER on farm given the high energy costs of irrigation intensive commodities.
- Regional communities with coal and gas led economies are under pressure to find opportunities to transition local workforces and economy.

Financial performance, regulatory uncertainty, and access to local expertise are the biggest perceived risks to respondents.

Respondents reluctant to implement or adopt a CER considered the key risks to be a lack of certainty about the financial performance of a project, regulatory uncertainty translating into market risk, and a lack of local expertise to operate and maintain innovative CERs.

Financial

Some respondents indicated that a simple lack of knowledge about the financial performance of CER projects was the depth of perceived financial risk. High initial capital outlay (including requirements to purchase, build, or transfer high voltage infrastructure to utilities), payback durations, and the inability to secure income for exporting excess energy also posed challenges to various respondents' risk appetites.

Regulatory uncertainty

As previously identified, project developers unanimously signalled regulatory uncertainty as the primary risk to their development of CER projects. Other respondent segments similarly identified uncertainty in their ability to export to the grid, access a VPP on the regulated network, receive approval to connect their CER to the grid, or access consumer data from their retailer to ensure good CER performance. The cumulative regulatory uncertainty functionality translates into demonstrable market risk for CER projects in Queensland.

Skills

Remote respondents defined skills access to include inaccessibility to sites during wet season. Regional respondents identified uncertainty in their ability to attract and retain a skilled workforce as the risk.

These challenges are well aligned with the high-level remit of the Queensland Government's Energy and Jobs Plan and reinforces the need for the Net Zero Transition authority to co-ordinate regulatory, financial, and technical standards, performance requirements, and innovations across national, state, and local level government and industry to de-risk the energy transition.

Recommendations

1. **Future work opportunity 1: Smart energy literacy campaign**
   This study has clearly identified energy literacy as a key opportunity for follow on work. Closing the knowledge gap for regional consumers will help increase consumer power of choice, their empowered participation in the energy transition, and the larger democratisation of energy.

   A successful campaign should engage resources from an ecosystem of stakeholders to educate regional consumers about the modernisation of technology and consumption in the energy transition. This would be a bottom-up focus as opposed to the usual prioritisation of utility scale energy transition interventions. Large regional consumers like councils, industry, and community consumer groups would be the ideal audience but not at the exclusion of other regional consumers.

   Relevant stakeholders: Queensland State Government, Energy Queensland, QFF, LGAQ, QCOSS, ECA, Chambers of Commerce

2. **Future work opportunity 2: Research and trial regulatory pathways for councils and community owned energy trading**
   Council respondents have indicated precedent for sharing resources with sister or co-located councils including water entitlements and treatment facilities. There is clear opportunity for LGAQ, or other council stakeholders to research and trial opportunities for local energy and benefit sharing.

   Some suggested solutions from respondents include community REZ or utility scale renewables negotiations for lower costs based on geography, VPPs or PPAs between councils, or rates reduction for participants in a council-owned local energy system. However a wider scope of exploration and research is recommended.

   Relevant stakeholders: AER, Queensland State Government, Energy Queensland, QFF, LGAQ, ECA, universities

3. **Government and utilities must accelerate the inclusion of regional CERs in grid transformation strategies to avoid unnecessary consumer defection and prevent equity concerns**
   Regional consumers are lower priority for DNSP CER and grid modernisation strategies compared to isolated and urban networks. Presently REZs are the most significant intervention regional consumers will experience with uncertain consumer affordability improvements or wider community benefit over the project life.

Large energy consumers on regional networks have a present and growing motivation to augment their consumption behaviours and interaction with grid energy services. With affordability impacting energy productivity and resilience more businesses are motivated to adopt CERs, defecting part or all of their energy load from the grid.

That defection will only occur if regulators do not accommodate CERs in their systems planning and integration strategies. Consumers are largely interested in remaining grid connected and see value in increased consumer choice including sharing energy. Significant defection on the regional grid is avoidable, unnecessary, and ultimately a lost opportunity for efficient local energy systems.

Defection on regional grids will also present equity issues for those consumers who cannot afford to participate in CERs and other cost and emissions reducing technologies and schemes. This would likely result in an expansion of the CSO when the appropriate integration of CERs presents an opportunity for the reduction of losses on regional grids and therefore a reduced reliance on subsidisation.

Regulation that incentivises interventions reducing energy costs and increasing energy productivity also offer flow-on benefits to the economic development of regional economies. Regional councils are motivated to find solutions that share resources locally and bolster their economies. Local energy strategies can help unlock that potential.

Relevant stakeholders: Queensland State Government, Energy Queensland, Powerlink, QCOSS, Smart Energy Council, Climate Council, Energy Charter

4. **An equitable Net Zero Transition Authority remit should include CERs**

The Net Zero Transition Authority, a newly mandated entity, has an opportunity to align federal, state, and local regulatory, financial, and technical mandates for the transition with the equitable inclusion of community and consumer energy projects.

Co-ordinated and optimised energy transition planning should include equitable access to investment (eg. ARENA, CEFC, and state government programs), regulatory pathways for CER-grid interoperability (eg. AER's regulatory sandbox), and grid performance design considerations and standards (eg. Integrated System Plan and National Energy Performance Strategy), each with CER provisions in mind.

In doing so, the market would be considerably de-risked, system performance requirements could be met efficiently, and investments in new infrastructure could be streamlined avoiding 'gold plating' assets.

Relevant stakeholders: Net Zero Transition Authority, Department of Climate Change, Energy, the Environment and Water, AEMO, AER, AEMC, ARENA, CEFC, Queensland State Government, Powerlink, Energy Queensland, LGAQ, Climate Council, Energy Charter

5. **A federally sponsored local or community power strategy**

The Net Zero Transition Authority's CER inclusion should be defined and guided by a federally sponsored community or local energy strategy. This would not be dissimilar to the United Kingdom's inaugural community energy strategy developed in 2014 which was eventually absorbed into an evolving national strategy for decentralised and flexible grid transition.

An Australian strategy should include functions for regulatory innovation, access to financing, regional skills and capacity building, community benefit and participation models in REZ and other utility scale projects, an ombudsman or similar authority, and design standards and best practices. Again, all at the local scale.

In 2020 Member for Indi Dr Helen Haines MP proposed the Local Power Plan, providing a solid base for conceptualising an appropriate strategy.[16]

Relevant stakeholders: Department of Climate Change, Energy, the Environment and Water, AEMO, AER, AEMC, Smart Energy Council, Climate Council, Energy Charter

6. **Regulatory innovation mechanisms that move faster than existing tariff schedules should be formed**
The AER's Regulatory Sandbox is a designated mechanism to speed up the trial and reform of regulation for the transition. However, due to the complexity of energy regulations a single trial may require exemptions from federal and state entities as well as T/DNSP's.

   This report recommends that state and territory governments establish a reciprocal program for regulatory innovation that enables consumers and project developers to take advantage of the opportunity a regulatory sandbox enables and simultaneously de-risk the market.

   While utilities are mandated to maintain 5 year tariff schedules, a second stream for piloting trials could help future proof utilities, de-risk and enable their transition to Distribution System Operators, and inform governments of the resource and knowledge gaps needed to be bridged.

   Relevant stakeholders: AER, Queensland State Government, Energy Queensland, Powerlink

7. **Skills and training for regional communities and utilities is necessary to support transition**
Regional councils have signalled the critical risk of access to skills and expertise for CER projects. Similarly councils in mining economies are concerned about the job and economic opportunities their communities can offer in the coming years.

   The Queensland State Government's Energy and Jobs Plan does have skills and training inclusions like regional training hubs, which this study endorses. However while this does offer workforce transition opportunities in two regional economies, this primarily serves transmission scale jobs and training largely for Powerlink. An extension of this concept for the broader ecosystem would help ensure a just transition across regions. For example, if limiting training to transmission skills remote or islanded communities are unlikely to have improved access to skills and expertise to operate and maintain upgraded energy systems.

   Skills and training is also needed at utility and regulator levels to expose workers to innovative and cutting edge technical and regulatory solutions while also building institutional capacity. Rapid upskilling is broadly needed to ensure products, services, and processes are developed with the expertise and maturity necessary to assess and integrate innovative projects that fulfil evolving consumer needs.

   Relevant stakeholders: Queensland State Government, Electrical Trade Union, Powerlink, Energy Queensland, LGAQ

8. **Clear pathways for social housing and rentals to access clean and affordable local energy resources**
State and federal housing and indigenous affairs programs need to prioritise clearing the regulatory roadblocks for rooftop solar and residential battery systems on public housing. Residents in social housing are typically more vulnerable to energy price hikes, often experiencing follow-on social, health, and economic impacts. The reduction of energy costs via behind the meter DERs or participation in CERs is a tangible opportunity to improve cost of living affordability for vulnerable populations and help alleviate associated wellbeing pressures.

[16] Local Power Plan, 2023. [Online]. Available: https://www.localpowerplan.com/.

Similarly, renters across Australia have high barriers to accessing the benefits of renewable energy. This is further exacerbated in regulated energy markets like regional Queensland. Regulation that incentivises homeowners to install rooftop solar and batteries is recommended to ensure equitable access to the renewable energy transition while improving cost of living.

Relevant stakeholders: Department of Social Services, National Indigenous Australians Agency, Queensland State Government, Aboriginal and Torres Strait Islander land trusts, Energy Queensland, QCOSS, Climate Council, Energy Charter

9. **Local councils should comprehensively assess the benefits of adopting local energy strategies**
   Local councils should assess the feasibility of and identify opportunities for adopting local energy systems to help advocate for their role in the energy transition among state and federal institutions.

   Many councils are still considering preliminary energy efficiency interventions and are racing to meet decarbonisation targets. LGAQ or partner organisations should develop tools and resources in collaboration with regional councils to assess the opportunities, risks, barriers, and benefits of attracting or adopting sub-utility scale renewable energy projects.

   Suggested benefits to councils include:
   - Local energy systems as drivers of local productivity and economic development
   - Mitigating and adaptive climate actions of remote and climate vulnerable communities' by factoring CERs into design and planning
   - Local infrastructure resilience to outages (eg. water treatment plant), especially if located far from a DNSP service centre
   - ESG and other emissions reduction targets met

   Relevant stakeholders: LGAQ

10. **Ensure supporting infrastructure, including regulatory, is made robust and fit for purpose**
    The transition to a flexible smart grid that operates as a platform for the democratisation of energy requires robust supplementary infrastructure including:
    - telecommunication infrastructure for use of smart energy devices in regions,
    - novel and innovative grid connection schemes eg. broadened categories of connection and performance types and processes at appropriate cost and time thresholds
    - data access and privacy regulations made robust and fit for consumer needs eg. third party access to consumer data for CER controllers, real time data access etc.

    Relevant stakeholders: AER, AEMC, Queensland State Government, Telstra, Powerlink, Energy Queensland

Conclusion

The study sought to fill a data gap in Queensland's energy landscape; regional consumers' role in the energy transition. It successfully yielded foundational insights from a valid data set that included a variety of significant consumer types across regional Queensland and its provisional REZs. The study has played a role in beginning to close the larger knowledge gap of smart energy adoption in regional Queensland.

Ultimately the study was able to clearly identify a present and growing appetite for consumer owned energy resources across all consumer segments. Affordability, reliability, and resilience remain the critical drivers for consumer decision making, however independence, energy sharing, decarbonisation, and other more flexible drivers for energy consumption are rising in importance for

regional consumers. Consumers also indicated a lack of knowledge of the opportunities CERs offer while expressing a desire to improve their understanding.

From the research conducted it is clear that there is a need for top-down actions that enable the integration of CERs onto the grid. The integration of CERs into federal, state, local, and utility strategies for the energy transition must be intentionally aligned and co-ordinated; the Net Zero Authority is well positioned to play that role.

Similarly, bottom-up consumers and stakeholders need to investigate opportunities relevant to their community and advocate for their position in the energy transition. An energy literacy campaign, trialling council and community energy trading models, and research into community and consumer benefit opportunities are all future works that stakeholders can undergo to reinforce their advocacy. Consumers and stakeholders should also consider pursuing demonstration pilots to contribute to knowledge sharing and de-risking of nascent smart energy technologies in regional Queensland.

The consequences of a continued "business as usual" approach by energy regulators and utilities is the risk of grid defecting interventions by consumers. As energy prices rise, those who can afford to adopt CERs to alleviate energy affordability and improve energy productivity will do so. This presents an equity issue for regional consumers who cannot afford to defect their consumption from the grid, resulting in a smaller population accountable to the financial viability of state energy assets. Should grid connection of CERs be allowed by poorly coordinated, significant grid augmentation and insecurity should be expected.

Across the broader ecosystem of the transition this study has identified additional opportunities that align with existing literature. Specifically, regulatory innovation, skills and workforce transitions, equitable inclusion of vulnerable consumer groups, and telecommunications investment are all required to ensure a sustainable and just energy transition.

As previously mentioned, the scope of this study is relatively modest and serves to fill a foundational data gap. While it has done so it also points to a window of opportunity for the future grids in regional Queensland.

Australia's energy transition is an opportunity to not only reduce emissions but to reform the energy market and the roles regulators, utilities, and consumers play, as enabled by smart technology. The future grid as a platform with utilities transitioning from Network to System Operators enables consumers, prosumers, and generators to not only access clean, reliable, and affordable energy, but engage a flexible, democratised and distributed energy system. Ensuring inclusion and equitable practices today provides regional consumers choice for their role in the future.

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