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Final Report

Charting Farmers' Experience of Tariff Switching

Prepared in collaboration with Queensland Farmers Federation for Energy Consumers Australia

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List of Acronyms

Acronym	Definition
UQ	University of Queensland
QFF	Queensland Farmers' Federation
QCA	Queensland Competition Authority
SME	Small Medium Enterprise
VSD	Variable Speed Drive (type of water pump)

Contents

Executive Summary

RATIONALE: Agriculture is in the top four most energy intensive industries in Australia. Yet electricity does not feature prominently in efforts to improve the sustainability of agriculture. Electricity can be a key resource input to agriculture, yet farmers are under-represented in studies of energy literacy, energy tariffs, and energy saving, relative to urban/residential customers. The July 2021 Queensland tariff reforms represent an ideal juncture to understand the impacts of electricity tariffs on farmers' operations and how farmers understand and navigate possible tariff options.

AIM: This study aimed to understand: (a) the process of changing tariffs, including aspects of the decision-making process such as the sources of information farmers utilised to inform their switch, (b) the impact of tariff switching on farmers' operations, e.g. whether and how farmers feel better/worse off on their new tariffs, (c) additional non-tariff related barriers to on-farm energy efficiency, and (d) farmers' ideas for future energy systems. From the results we intended to provide additional web resources to assist in tariff selection.

METHOD: Following a desktop review of relevant literature, semi-structured interviews were undertaken with 35 predominantly Queensland-based farmers from the industries of cotton, sugarcane, cereal crops, horticulture, livestock and dairy. Quantitative and qualitative data was gathered and analysed separately, utilising simple statistical analysis, content analysis and thematic analysis.

KEY INSIGHTS:

Farmers are a unique electricity user group: Farmers in the sample managed on average five separate electricity accounts and -unlike almost any other industry sector- may be required to navigate tariffs across all three tariff suites (residential, small business, and large business).

Infrequent tariff changes, incomplete understanding: Unless initiated by their electricity retailer, many farmers had not assessed tariff options for over four years. Tariffs were described as complex, with limited usability of online sources. The perceived small cost savings from detailed investigations fostered complacency from some farmers towards undertaking more detailed tariff analyses.

Small-customer/large customer tightrope: The sometimes-unexpected redesignation of an electricity account to "large customer" status (caused by consuming > 100 megawatt hours (MWh)/year on a meter) meant losing all solar feed-in revenue and paying far higher supply charges. Farmers described going to extreme lengths to avoid re-designation, including installing additional meters, solar, and supplementing pumping with diesel. Incomplete understanding of the retailer's re-designation process was a source of frustration.

Unexpected environmental outcomes: Tariff reform has the potential to drive poorer environmental outcomes, including reduced water use efficiency and increased diesel use. The retirement of "night" tariffs 62 and 65 removed an incentive to water at night, which despite positive outcomes for wellbeing such as reducing evenings spent working, caused some farmers to report watering during the day when evaporation is higher. Separately, the increasing price of electricity, avoidance of the large customer threshold, and end of drought declaration in certain LGA's (ending subsidised supply charges) all acted as catalysts for farmers to begin (or consider) powering water pumps with diesel rather than electricity.

Taking advantage of controlled load with smart tech: Smart technology allowing the auto-restart of pumps was cited as a means of enabling farmers to take advantage of the lower kWh charge of Tariff 34 (controlled load), which the network operator can switch on and off without warning. This tariff remained unsuitable for "flood irrigators" however, i.e. those who need to harvest water continually during a flood event.

"Forgotten" flood irrigators: Irrigators who utilised high capacity pumps to extract water from rivers during flow events were particularly disadvantaged by current electricity tariff structures. The high peak drawn from large capacity pumps meant these farmers paid high kW rates on demand tariffs. Controlled use tariffs were not

viable, because of the need to pump 24/7 during flow events; solar was not typically a viable option due to low self-consumption from infrequent pump use and small feed-in tariff; while daily supply charges were felt to be "wasted" given the pumps may be used less than 10 days per year.

IMPLICATIONS

Based on the findings of the project, several implications for advocacy and policy are suggested. These include:

- Consolidate information and improve the usability and accessibility of web-based resources for farmers to assist in decision making over tariffs and the process of tariff switching Towards this, we have prepared the Agricultural Electricity Tariffs pages to be hosted on QFF's website.
- Increase ease of access to smart metered data to assessing tariff options. Section 7.8.2 of the National Energy Market rules could be updated to incorporate a provision to allow customers greater access data from meters on their premises in real time.
- Increase the 100 MWh/year threshold for large customer designation AND/OR fund subsidised "Energy Savers" style efficiency and demand management programs to assist customers in reducing their consumption to remain below the 100 MWh/year threshold.
- Review of existing regulatory barriers to peer-to-peer trading within a farm to enable sharing solar generation between meters. Enabling peer-to-peer trading between meters may assist in removing existing barriers to upgrading/installing solar and decrease the complexity of electricity tariffs by consolidating multiple accounts on the one property.
- Increase flexibility of supply charge AND/OR enable remote switch on/off of meters that run infrequently used pumps (e.g. floor irrigators) to avoid "wasted" electricity supply charges and to decrease the incentive for farmers in this situation to transition pumps to diesel.
- Impacts of electricity tariffs on farmers may be minimised by a more pro-active (rather than re-active) stakeholder consultation by QCA when tariff setting.
- Advocate and advertise smart technology as a potential facilitator to unlocking cost savings for farmers by automatically re-starting water pumps connected to Tariff 34 after network disconnection events.
- Review existing obligations for farmers regarding use of water for firefighting and (if necessary), update regulations or provide information to farmers considering controlled load tariffs for water pumping that controlled load may not be suitable for use on pumps that may be enlisted in firefighting activities.

OUTPUTS

Key project outputs include:

- **Final report:** This final report which details the desktop literature review, methods, findings, implications and outcomes of this research.
- **Agricultural Electricity Tariffs website:** A substantive web resource hosted on QFF's website: "Agricultural Electricity Tariffs" which consolidates a substantial amount of publicly available information on tariffs and tariff selection as well as providing an overview of the key findings of this research, links to further reading on each topic and space for farmers to "Share your own story".
- **Chaptered webinars:** with Ergon Energy Retail and QFF's Policy Adviser, seeking their respective input and feedback on key issues facing farmers identified in this research.

Introduction

Brief and rationale

With the support of Energy Consumers Australia (ECA), funding was secured to research the experience of farmers when navigating, understanding and switching electricity tariffs, and to better understand the impact of tariff reforms on farmers' operations.

The research was inspired by three factors: (1) the Ergon Energy small medium enterprise (SME) tariff reforms of July 2021 which resulted in the expiry of certain SME tariffs and an automatic movement of customers to alternative tariffs if they did not move themselves prior, (2) The Queensland Farmers' Federation (QFF) Energy Savers Program which identified multiple energy saving opportunities for participating farmers, but also found that farmers themselves may not have the time or money to identify these opportunities without assistance, and (3) academic literature which suggests that farmers are under-represented in studies of energy literacy, eco-feedback, and energy saving, relative to urban/residential customers.

Scope

The original scope of the research was to conduct phone and online interviews with 70 farmers from Queensland and New South Wales, attempting a split of contestable (those who can choose their electricity retailer) and non-contestable (those who cannot choose their electricity retailer). The timing of the research during a COVID-19 wave, the summer harvest, Christmas break, and the Qld/NSW flood events of February/March and May 2022 meant that 35 valid interviews were completed.

The key purpose of the interviews was to determine: (a) farmers' process of changing tariffs, including aspects of the decision-making process such as the sources of information farmers utilised to inform their switch, (b) the impact of their new tariff on operations and behaviour, e.g. whether and how farmers feel better/worse off on their new tariffs, (c) additional non-tariff related barriers to on-farm energy efficiency, and (d) farmers' ideas for future energy systems.

Background

Academic literature review

Agriculture is in the top four most energy intensive industries in Australia [1]. While often a substantial resource input, electricity has not featured prominently in efforts to improve the sustainability of agriculture relative to initiatives around land management practices and fertiliser optimisation [2–4]. Yet electricity can be a key resource input to agriculture, and farmers face a unique set of circumstances relative to other types of small-medium enterprises (SME's). Namely, unlike many other types of SME's, agricultural electricity use and output can vary substantially by season, depending on rainfall, farming methods, water availability and growing conditions [5,6]. This can make it difficult for farmers to compare electricity use between seasons and accurately identify the impact of sustainable retrofits or behaviour changes [7]. Despite notable exceptions, including the QFF's Energy Savers program[1] and isolated initiatives from specific grower groups, large-scale energy efficiency initiatives tend to focus on residential rather than agricultural consumers. For example Queensland's Climate Smart Home Service, the Federal Government Green Loans initiative [8] and the Federal Home Insulation Program all applied to residential consumers only and not to SME's or large customers [9].

Energy efficient behaviour change

A large-scale postal survey of farmers' drivers of adoption for renewable energy technologies found that farmers who were younger, better educated and worked on farms that were partly or fully owned were more likely to adopt renewable energy technologies. Economic incentives such as feed-in tariffs were strong drivers for solar PV adoption [10].

[1] https://www.qff.org.au/projects/energy-savers/

Regarding electricity tariffs in particular, relatively little literature exists on the impact of tariffs on farmers [6,11]. The effect of time-of-use and real time pricing tariffs is well documented for the residential and commercial sectors [12–15], but less so for the agricultural sector [11,16]. For residential customers, a large-scale study in Italy [15] found time-of-use pricing incentivised customers to load shift during the morning peak, but evening peak demand issues were more stubborn. This study additionally identified that the impacts of dynamic pricing may be unevenly spread and may provide unequal impacts, particularly for those customers with limited adaptability to load shift [15].

Upton et al. [16] simulated the economic effects of possible future electricity tariffs on Irish dairy farmers' costs, simulating flat rate, day/night (peak/off-peak) pricing, two time-of-use tariffs, and market-reflective pricing. The study found the greatest potential to reduce total annual electricity costs was to adjust milking start times on TOU tariffs with a higher potential for cost saving using this method relative to small or medium sized farms. The findings are quite specific to the dairy industry and relate to forecasting the impact of potential future tariff offerings rather than understanding the impact of existing changes [16].

A study of irrigated agriculture in Spain found that capacity-based (i.e. demand-based) tariffs[2] contributed substantially to farmers' electricity costs and recommended tariff reform towards aligning reducing demand-based tariffs and incentivising self-consumption of solar [6]. This case study highlights the complexities and specificities of the Spanish electricity market, including disproportionately high demand payments relative to other countries, and points to the difficulty in generalising findings across contexts due to differences in costing electricity between regions and countries. Similarly, while Gujarati farmers' adaptability to electricity tariffs is assessed, the heavily subsidised cost and variable provision of electricity (most received between 8-10 hours of electricity per day) limits the ability to generalise findings and highlights the need for regional case studies [17].

A California, study [18] finds significant potential for automation in irrigated agriculture to enable demand response (DR) to better take advantage of available tariffs. This study found that growers with on-farm water storage held the greatest capacity to participate in DR, yet there was little to no acceptance (at the time) among growers of automatic pump controls, which would be required to facilitate DR at scale. This study argues the importance of research to determine how best to gain grower acceptance for DR and permanent load shifting, highlighting the value of human-centred approaches to this problem [18].

Farmer-centric methodologies are a knowledge gap

Bottom-up (i.e. ethnographic) approaches to understanding farmers' perceptions and attitudes towards energy-related matters are rare, and Dew et al. [11] point specifically to the need for further work studying farmers' attitudes, acceptance and perceptions of energy tariffs. First-hand farmer experiences of eco-feedback were elicited through semi-structured interviews and surveys in a recent study of participants who received an energy audit and eco-feedback deployment as part of an energy efficiency initiative [7]. This study found farmers expressed a detailed knowledge of their growing practices, but relatively less understanding of electricity as an operational input; electricity was seen more as a fixed operational cost rather than an input over which they had control to optimise themselves. Despite positive reactions toward the energy use feedback installed, engagement with the eco-feedback was relatively low and caused limited self-reported behaviour change. The lack of behaviour change was explained as resultant from limited time to engage with the eco-feedback and the seasonal/crop cycles, meaning that comparing the effect of any specific intervention or behaviour change was difficult or required significant time [7].

This present study shares the methodological intention of Snow et al. [7] of wishing to gather authentic and substantial first-hand accounts from farmers of the effect of the July 2021 tariff reforms, practices of tariff switching, and navigation of the energy market. The study involves semi-structured interviews comprised of demographic information collection followed by substantive and ethnographically informed open questions, allowing room for participants to respond in depth and for follow-up questions to fully explore an issue.

[2] "Capacity-based" tariffs are known in Australia as "demand-based" tariffs, where a portion of each bill is a per kW or per kVA charge for the highest single demand peak recorded in a billing period.

Queensland tariff reforms of July 2021

A key driver of this specific study was a tariff re-structuring precipitated by the Queensland Competition Authority (QCA) and enacted by Ergon Energy, the primary electricity retailer servicing much of regional Queensland. We provide an overview of these changes here. The tariff changes followed a comprehensive review and a period of stakeholder consultation by QCA, with submissions received from several agricultural grower groups, including Cotton Australia, Cane Growers, and others. These submissions and their responses from QCA are available in the full QCA report[3].

Following QCA's determinations, as of July 2021, the following tariffs became obsolete and discontinued (Table 1 below). Table 1 provides details of which tariffs became -or will become- obsolete and a brief description of the tariff details. The table notes below provide links to further information on each of these tariffs. Customers were notified in advance of these changes and invited to change tariffs, with those who did not change beforehand moved to the most suitable alternative by Ergon Energy.

Table 1: Obsolete or soon-to-be obsolete tariffs

Tariff identifier	Small or large customer	Brief description	Obsolete in year:
21	Small	Declining block anytime use tariff. Declining cost per kWh charges for the first 100kWh, next 9,900kWh and additional kWh.	July 2021
20L	Large	Anytime use	July 2021
22L	Small or large	Time of use with demand charge component	July 2021
37	Small or large	Time of use, suited to large heating loads	July 2021
62	Small	Time of use and declining block: Cheaper rate after the first 10,000 kWh per month and for electricity supplied on weekends and 7pm to 7am weekdays.	July 2021
65	Small	Time of use: cheaper electricity on weekends and 7am to 7pm weekdays.	July 2021
66	Small	Anytime with demand charge component: Annual charge for first 7.5kW of maximum demand, remaining kW of maximum demand and flat-rate per kWh charge.	July 2021
22A	Small	Time of use pricing during summer months only: Peak pricing between 10am and 8pm during Dec-March only. Off peak all other times and all times of the day April-November.	July 2023
24	Small	Seasonal time of use with demand charge: Time of use as per 22A, but with peak and off-peak maximum demand charges.	July 2023
41	Large	Anytime use with demand charge component	July 2023

Sources of information for this table, and for more information, visit:

- Queensland Competition Authority (2022). Draft determination: Regulated retail electricity prices in regional Queensland 2022-2023.
  https://www.qca.org.au/wp-content/uploads/2022/02/draft-determination_-main-report.pdf

[3] • Queensland Competition Authority (2022). Draft determination: Regulated retail electricity prices in regional Queensland 2022-2023. https://www.qca.org.au/wp-content/uploads/2022/02/draft-determination_-main-report.pdf

- Ergon Energy (2021). Obsolete Tariffs. https://www.ergon.com.au/__data/assets/pdf_file/0005/912902/Obsolete-Tariff-2021.pdf
- Horan and Bird (2019). How to protect your business from the 2020 tariff changes. https://www.horanandbird.com.au/news/how-to-protect-your-business-from-the-2020-tariff-changes
- Ergon Energy (2021). Farming tariffs (obsolete). https://www.ergon.com.au/retail/residential/tariffs-and-prices/farming-tariffs
- Ergon Energy 2022. Obsolete tariffs expiring in 2023. https://www.ergon.com.au/retail/business/tariffs-and-prices/obsolete-tariffs-expiring-in-2023

Table 2 (below) details new tariffs which have been introduced (or amended to their newest format) in 2021.

Table 2: New or amended tariffs

Tariff identifier	Small or large customer	Brief description	Introduced in year
20 (amended)	Small	Anytime tariff Reduced per kWh and supply charge compared to pre-July 2021	2021
22B	Small	Time of use tariff with supply charge increasing based on total annual consumption brackets and includes time-of-day peak (4-9 weekdays), shoulder (4-9pm weekends, 9pm-9am weekdays) and off-peak components (9am-4pm every day).	2021
34	Small	Controlled load; as per residential tariff 33: electricity supply may be interrupted for up to 6 hours per day; customers are compensated with lower per kWh charges	2021- small business customers previously had access to tariff 33, a secondary controlled load, but not a stand-alone controlled load tariff.
60A	Large	Controlled load, interruptions up to 6 hours per day, for large customers > 100MWh per year.	2021
60B	Large	Secondary controlled load (i.e. accompanies a standard anytime tariff), interruptions as per tariff 34 and tariff 60A	2021

Sources of information for this table, and for more information, visit

- Ergon Energy (2022) Small business tariffs. https://www.ergon.com.au/retail/business/tariffs-and-prices/small-business-tariffs
- Queensland Farmers' Federation (2021). New Controlled load tariffs. https://www.qff.org.au/blog/new-load-control-tariffs/

Further details of all the tariffs, including pricings, are available from the sources listed above.

Key features of tariff reforms

Four key features stand out from this desktop review of the July 2021 tariff reforms:

A significant purpose of the tariff reforms is to nudge customer behaviour. The QCA Draft Determination on regulated electricity tariff prices confirms that a primary purpose of the tariff reforms is to leverage price signals through tariff structures to: *"guide consumer behaviour" (p.16)*[4]. This indicates that

[4] Queensland Competition Authority (2022). Draft determination: Regulated retail electricity prices in regional Queensland 2022-2023. https://www.qca.org.au/wp-content/uploads/2022/02/draft-determination_-main-report.pdf

tariff setting is relatively less about responding to (or catering for) the practices or business needs of customers (including farmers), and more about using tariffs as an economic instrument to nudge consumption behaviour toward market needs and projected future needs, including minimising consumption at peak times and accommodating the likely increase in electric vehicle charging[5]. An example of tariffs responding to market trends is the retirement of the "irrigation" tariffs 62, 65 and 66, which previously provided cheaper electricity at night, and the designation of "peak" and "off-peak" in new tariffs such as 22B (Table 2 above). Tariff 22B, for example, defines "off-peak" as 9am to 4pm on weekdays, reflecting the over-supply of residential rooftop solar on the Australian National Energy Market (NEM) during the day. The "peak" time is from 4pm-9pm on weekdays, indicative of the challenges of meeting growing demand in the afternoons after solar generation dies off as families arrive home, switch on air conditioners, appliances, and (may soon) choose to charge EV's.

Tariffs may be purposefully uneconomical: Related to the point above, the tariff reforms appear to include provisions aimed at actively pushing customers away from soon-to-be-obsolete tariffs. Tariff 65A is a "transitional" tariff, designed to allow customers time to switch to alternative tariffs, replacing the original Tariff 65 which expired in July 2021. Transitional Tariff 65A attracts a $0.52 peak charge (electricity consumed between 7am-7pm), $0.27 per kWh at all other times and a $1.16 per day supply charge. Yet Tariff 20 charges $0.28 per kWh at all times (including peak) and a $1.35 per day supply charge (refer to Ergon Energy Small Business customer tariffs link under Table 2 above), making it a clearly more economic choice. Tariff 22A (to be retired in 2023) is similarly uneconomic relative to Tariff 20, with a $0.65 per kWh peak charge and $0.27 per kWh off-peak charge, compared to Tariff 20's $0.28 per kWh at all times. These examples show a seemingly purposeful intention to nudge customers onto alternative tariffs prior to tariff retirement, which may additionally serve to penalise customers who remain on these tariffs until they are actively moved by the retailer following tariff retirement.

Lack of volume discount: Inverse to many other goods and services, certain tariffs attract an economic penalty (rather than a discount) for bulk purchases. Tariff 22B, for example, attracts a progressively higher supply charge based on projected total annual consumption, namely, $1.35 per day for 0-20 MWh/year (Band 1), up to $2.66 per day for 80-100 MWh/year (Band 5), despite the per kWh usage charge remaining the same in each band. Most daily supply charges on "Large Business" tariffs are over 20 times that of "Small Business" tariffs, without greatly reducing the charge per kWh (refer Ergon Energy small and large customer website links under Table 2), meaning volume discounts are only possible for customers with very high and sustained daily consumption sufficient to offset the supply charge increases.

Tariffs can be complicated. Navigating any given suite of tariffs requires a certain level of energy literacy. As an example of the complexity of certain tariffs, Tariff 22B, has a time-of-use component involving off-peak (9am-4pm each day), shoulder (4pm-9pm weekends and 9pm to 9am weekdays), and peak (4pm-9pm weekdays). It also features an inclining block supply charge (described above), where supply charges differ based on projected annual consumption totals. Obsolete Tariff 62 involved a time-of-use component and a declining block charge with cheaper per kWh rates for additional kWh consumed after the first 10,000 kWh each month. These tariff features such as inclining/declining block, time-of-use, and demand charge components may not be immediately understandable to time-poor and resource constrained farmers.

The findings of this desktop review motivate our intention to discuss with farmers how they navigate tariffs, how they have been affected by the July 2021 tariff reforms, and more general questions around on-farm energy use and energy efficiency.

Method

The literature review and desktop analysis of the tariff changes and available energy tariffs (above) were conducted at the project start-up in September 2021. Initial informal interviews were sought with contacts in this space, including Jefferson Dew (University of Otago), Energy Queensland, and contacts of Queensland Farmers Federation (QFF) to assist in scoping interview questions. A University of Queensland Ethics

[5] P.16 of Queensland Competition Authority (2022). Draft determination: Regulated retail electricity prices in regional Queensland 2022-2023. https://www.qca.org.au/wp-content/uploads/2022/02/draft-determination_-main-report.pdf

application was prepared and approved (project number: HE000538), which covered the research activities for this specific project.

Interview question development was also guided by the Water and Engagement Policy Committee (WEPC), formed by QFF members to assist in analysing regulation changes and communicating with key stakeholders. The research project was presented to WEPC at their meeting on September 1st 2021, where members had the opportunity to ask questions and suggest changes based on their expertise.

Sampling

Opportunities to participate in the research were widely advertised through QFF's website, UQ's website, QFF media releases such as "10 things", QFF's blog, QFF Energy Saver E-News, QFF and UQ's Twitter, Facebook, and QFF's LinkedIn, as well as through feature articles in rural newspapers and other publications, e.g. Rural Weekly, Warwick and Stanthorpe Today (refer to **Appendix A:** Media Coverage). In addition, snowball sampling was used, where we asked interviewees whether they could recommend further contacts who might be willing to participate. Participation was advertised a 40-minute interview, where all interviewees received a $40 gift card. Recruitment involved sharing the weblink to a short online survey used to gather demographic data and allow participants to choose a suitable time to receive a phone call from a researcher for the interview. At the bottom of the survey, participants were requested to provide recent electricity bills through email. Recruitment efforts were spread across Queensland and New South Wales, where we aimed to recruit primary producers from a range of industries (e.g. cane, cotton, livestock), but did not set specific quotas for production type. We also aimed to recruit an even number of contestable customers (those with a choice of electricity retailer) and non-contestable customers (those without a choice of electricity retailer). The Ergon Energy network, which includes a large portion of regional Queensland outside the southeast urban corner, is non-contestable. Targets of 35 contestable and 35 non-contestable customers, making 70 interviews in total were set.

A mixture of COVID-19 causing sickness and staffing pressures for farmers, the timing of the interviews across the summer harvesting season for certain production types, and the widespread flooding across large areas of Queensland and New South Wales in February and again in May, meant that recruitment targets were not met. This was despite considerably more effort than originally budgeted for recruitment and despite the use of snowball sampling, requests for additional contacts through interviewees and the addition of additional incentives introduced mid-way through the recruitment, including (1) a "refer-a-friend" incentive of a further $40 gift card to any farmer who successfully recruited two further successful interviews and (2) all interviewees earning a place in a draw for $500 paid off their next electricity bill. In total, valid interviews were conducted with a total of 35 farmers, half of the original target with additional interviews either unfinished or identified to ingenuine non-farmer respondents seeking the participation incentive.

Interview protocol

Demographics and recent electricity bills were gathered prior to each interview in a short survey, e.g. primary production or crop output, total land area, age, location etc. The interview then began with a discussion of the number of electricity meters operated by the farm, what each meter supplies power to and what tariff (if known) is on each meter. After initial questions around energy use, metering, and tariffs, the interviews elicited personal stories and perceptions, including *"when was the last time you changed tariffs?"* "*why?*" *"what factors informed your decision to switch to this tariff?" "what sources of information did you access when assessing options?"*. Then questions focused on the impact of the tariff changes, benefits/disadvantages, positive/negative impacts on operations, and self-reported changes to productivity, lifestyle or wellbeing as a result of the changes. Further questions involved discussions around topics beyond tariffs, including discretionary (flexible) energy use versus non-discretionary (inflexible) uses, barriers and facilitators to saving energy, ideas for "ideal" tariffs or improvements to the methods of electricity supply and retail, including whether non-contestable customers would like more/less choice over retailers, tariffs, and why. The full interview protocol is available in **Appendix B**.

Participants

Successful interviews were completed with 35 farmers, with a further three interviews being cut short and unable to be re-booked and one interview identified as an overseas scammer. Valid participants were primarily from Queensland, with four from New South Wales. Despite sampling and advertising through NSW grower groups and media, it is likely that many Queensland-based farmers were drawn to the study owing to its association with QFF and that QFF's readership of its blogs and publications are also mainly Queensland farmers. This feature meant that only 4 of the interviewees were from NSW and 8 of the participants (all NSW participants and three QLD participants in the South-East Queensland region) were contestable customers, with the remaining 27 (to the best of their knowledge) having only Ergon to choose from as an electricity retailer. Table 3 below provides an overview of the study sample.

Table 3: Demographic data of participants

Attribute	Number / Distribution
Age	21 to 73 years old (median 52)
Gender	24 male, 11 female
Location	31 QLD, 4 NSW
Contestable / non-contestable	8 contestable, 28 non-contestable
Primary output	Horticulture: 10 Cropping (cereals, pulses, lucerne): 7 Sugar cane: 6 Cotton: 6 Livestock: 5 Dairy: 1
Total farm area	30 ha to 9,500 ha (median 300 ha)
Solar PV ownership	Grid connect: 20, Non-grid connect: 3 No solar: 12
Solar PV capacity (kW)	Maximum system size: 276kW Minimum system size: 2.4kW Median system size: 17kW
Battery	Grid-connect: 2 Non-grid connect: 1 (car batteries for electric fence)

Several primary agricultural sectors are represented in the study, however, no viticulturalists and only one dairy farmer are present in the sample. The study does not attempt to generalise findings across grower groups, nor claim representation or statistical power for each of the production sectors. It should be noted

that farmers are categorised according to “primary” output in Table 3, but there was some overlap in production on certain farms, e.g. sugar cane and macadamia nuts for P17, or cotton and cereal crops for P6.

Analysis

Analysis of interview responses was split into two components: content analysis and thematic analysis.

Content analysis: Demographic information and responses to questions where answers can be categorised e.g. “Which tariffs do you operate?”, “Can you list the benefits and disadvantages of this tariff switch?”, were collated and tabulated. This process resulted in a quick reference to all participants’ answers to each of the key questions asked.

Thematic analysis: Secondly, a group thematic analysis took place. Thematic analysis is a widely used and robust method for analysing qualitative data [19]. This process involved de-coupling responses from the questions asked to allow for an analysis of emergent themes from the data, which are not immediately related to the questions. The thematic analysis process involved researchers reading all transcripts and colour-coding participant quotes according to themes emergent from the data.

The thematic analysis was a two-stage process completed by two researchers to reduce potential biases, using the online whiteboard software “Miro”. The first stage involved researchers inductively grouping quotes into themes and assigning tags where appropriate. This involved adding as many themes as appeared throughout the data, initially creating a total of 37 themes and numerous tags assigned to quotes placed under themes to add greater context. The second stage (convergence) involved grouping similar themes together, thereby creating a number of meta-themes, within which were a large number of sub-themes. A portion of the Miro board is shown below in Figure 1, following the second stage of analysis, where green notes are themes, yellow notes are quotes, and pink notes are tags. This process assisted in formalising the 19 themes finally identified. We report specifically on those themes relevant to electricity tariffs, alongside the reporting of the results of the content analysis (i.e. categorising responses to individual questions). The reported themes are explained in the section below.

Figure 1: Example of coding responses under themes (left-hand side) and a close-up of a quote under the theme of fairness with two tags assigned (right-hand side)

Findings

Following a brief **overview** of the qualitative data collected, the findings are presented according to the key objectives of the study: (1) Understanding the **processes** of tariff switching (e.g. how often, why, and what

sources of information are used), and (2) Understanding the **impacts** of tariff switching (i.e. how existing tariffs suit farmers' operations).

Overview

Number of tariffs / meters: Farmers operated between one and 40 electricity meters (median of five meters), and almost every farmer interviewed was subscribed to more than one electricity tariff (Table 4 below). For those with multiple electricity meters, the meters were typically geographically separate, e.g. to power a single pump. P4, for example, had one residential meter which supplied power to two residential houses, one meter for the shed/workshop, and six meters spaced around different areas of the farm, which ran a total of nine irrigation pumps (two pumps connected to three of the meters). P15, who operated a cattle property with spring-fed creeks, used only one meter on the property which supplied power to the shed. All other farmers had two or more meters, up to P28 who estimated his horticulture operation drew electricity from 40 meters spread across multiple properties.

Farmers would not always be in control of all their tariffs or all their meters. P9, P27 and P28 all rented fields from other land owners, meaning that the electricity bills for meters on these fields would go to the land-owner rather than the participant themselves. P28, manager of a large vegetable growing operation in Central Queensland, estimated his business drew power from up to 40 separate electricity meters, of which 29 were in his name. For long-term leases on land he would take over the electricity account for that meter, but for shorter-term leases the electricity account would remain in the name of the land-owner, meaning P28 would either be sent the bill to pay or alternatively have electricity included in the lease price. In these situations, for up to 11 meters, P28 had little or no control over the tariffs on the meters his business was drawing power from.

Multiple tariff suites: Farmers may be required to navigate up to three different tariff suits, i.e. domestic tariffs for the house, SME tariffs for certain meters, and large customer tariffs for meters on which over 100 MWh/year is used. Table 4 below shows how nine of the farmers were subscribed to four or more tariffs, where in seven of these nine cases, participants had meters connected to all three (residential, SME, and large customer tariffs).

Table 4: Qualitative data related to meters, tariffs, and tariff selection

Attribute	Number / Distribution
Number of electricity meters across operation	Min: 1 Max: 40 (median 5)
Number of electricity tariffs	One tariff: 1 Two tariffs: 9 Three tariffs: 9 Four or more tariffs: 9 Third party managed: 3 No data / Don't know: 4
Last time you changed tariffs	In the last year: 16 Between 1-4 years ago: 3 Over 4 years ago: 8 Not sure / Can't remember / No data: 8

Sources of information accessed when changing tariffs: *NOTE: many farmers utilised more than one source of information, so numbers add up to more than 35*	Verbal conversations with electricity retailer(s): 14 Internet searches: 15 Informal sources (friends, family, other farmers, tradespeople): 10 Formal sources (e.g. grower groups, energy consultants, farmers' federations) 10 No source / No data: 3
Largest contributor to bill	Pumping: 22 Household appliances: 5 Cold storage (e.g. cold rooms, freezers): 3 Other (workshop, compressors, lighting/heating) No data / uncertain: 5
Choice over electricity retailer	Yes: 8 No: 27
Participants drought declared at the time of the interview	Not drought declared: 13 Drought declared: 12 No data / don't know: 10

Energy consumption by sector

While we do not have sufficient numbers to generalise across a sector, our initial questions around where and how energy use was used on farms, highlights the diversity in consumption patterns across different farming sectors.

Cotton (P1, P2, P4, P5, P6, P13): The cotton farmers we spoke to primarily used flood irrigation, which involves storing large quantities of water in dams on-site, replenished by pumping from the river during flood events and irrigating crops by releasing water through channels. Electricity use was concentrated around water pumping, specifically during river flood events where very large capacity pumps (sometimes over 100kW) will be used infrequently to extract available water from the river to fill on-site storage. Smaller pumps may be used to move water around the property, but a large proportion of the energy use may be concentrated around 10 days or less per year.

Cane farmers (P3, P14, P17, P18, P33, P34, P35) and croppers (P16, P20, P21, P23, P26, P27, P31): Irrigation also represented the biggest electricity use for cane farmers and croppers, where water (and hence electricity) use depended on seasons and crop stages. Typically, large capacity electric pumps were used for irrigation and water and electricity use depended on rainfall and crop maturity. Flood irrigation (described above) was also used in some instances by croppers.

Horticulture (P7, P8, P9, P10, P11, P25, P28, P29, P32): Horticultural operation used electricity for packing sheds and irrigation. All three of the participants who listed "cold storage" as the biggest contributor to their bill were in horticultural operations. Packing shed loads typically incorporated cold storage, packing machinery, lighting and (potentially) heating. P7 spoke of a substantial hot water heating load used for their nursery.

Livestock: Livestock farmers (P15, P19, P22, P24, P30) used less electricity than all other farming types discussed here, and typically used petrol or diesel pumps for stock watering if required. P15 in high rainfall Far North Queensland did not require water pumping due to spring fed creeks traversing the property, used old car batteries to power electric fences and ran primarily power tools in the workshop. He claimed the 60-

120 head beef operation required little -if any- additional power other than their household's consumption. Livestock farmers in the sample operated the least number of meters and tariffs (Table 4).

Dairy: Only one dairy farmer (P12) responded to the multiple interview calls. P12's main loads are related to milking equipment, pumps, compressors and cold storage.

Process of changing tariffs

Here we describe factors affecting the process of changing electricity tariffs, including the frequency of tariff changes, sources of information accessed by farmers when changing tariffs, how the complexity of tariffs affects their selection, the drivers of complacency among farmers in reviewing tariffs, the outsourcing of tariff selection by non-contestable customers, and the role of drought assistance in tariff selection. These findings are drawn from the Content Analysis of the interviews.

Frequency of tariff changes

Sixteen of the 35 farmers had changed tariffs in the previous 12 months (Table 4). Of the remaining 19 participants who had not changed them in the last 12 months, 16 had not changed tariffs in over four years or long enough that they couldn't remember. Responses included: "years!" (P15), "10+ years" (P30), and "probably 20 years" (P23).

Overall the findings detail a lack of pro-activity toward tariff changing. Many recent tariff changes were not initiated by the participants themselves. All 16 who had changed tariffs in the past year, had been moved off expiring tariffs by Ergon Energy as part of the July 2021 tariff reforms (although some chose to change additional tariffs at the same time). Retailer-initiated tariff changes also resulted from participants having their electricity accounts re-designated to "large customer" status, based on a determination that a given meter had consumed -or was projected to consume- over 100 MWh over a 12-month period. Below in the section **"Small/large customer tightrope"** we discuss how this (sometimes unexpected) large customer designation was found highly problematic by farmers.

Sources of information accessed when changing tariffs

Table 4 (above) shows that internet searches represented the most common method of information when switching electricity tariffs or seeking information on tariffs (16 participants). "*Verbal conversations with retailers"* were the next most common (14 participants), however, it should be noted that many of these conversations were initiated by the electricity retailer rather than the farmer. This owes to the July 2021 tariff reforms, where Ergon Energy contacted all farmers on expired tariffs who were to be changed.

Ten participants sought information on tariff selection from informal sources such as friends, family, other farmers, and visiting tradesmen (Table 4). Advice from these channels was influential in decisions, e.g. P18 had avoided Tariff 34 due to conversations with the previous farm owners, and P32 was waiting to hear from others before trying Tariff 34 himself. P22 had not purchased solar hot water due to discussions with an electrician: *"I actually spoke to our electrician who was out the other day and I said, "I'd really like to get a hot water system on a solar." And he said, 'Nobody at Tenterfield has solar hot water. It's just not enough sun.' And I was like, 'Okay, really?'"* (P22). P32 was holding off changing to Tariff 34 (controlled load), waiting to hear of others' experiences first: *"I'm just going to see how some other people run with it, have a chat and maybe change one of them"* (P32).

Complexity of tariffs and lack of time to understand them

Farmers reported having limited time to spend understanding and choosing electricity tariffs. The level of complexity of tariff selection, the dispersed nature of information online and poor usability of existing resources acted as barriers to regularly engaging with (hence changing) tariffs. The themes of complexity and being time-poor appeared to interact, where the perceived complexity of electricity tariffs meant tariff selection required more time and the large time investment acted as a barrier to better understanding or more regular analysis. 13 of the 35 farmers (P2, P8, P9, P10, P12, P13, P17, P21, P22, P23, P25, P26, P33)

remarked on the complicated nature of electricity tariffs and/or having limited time to deal with this complexity, e.g. P26 reported to have "lost track" of some of his tariffs, P13 had put tariffs "*in the too-hard basket*", and P22 described electricity as *"one detail too many"* in a life full of details. Responses detail farmers' frustration and confusion with the complexity of electricity tariffs:

"You've got your kilowatt usage, then your demand usage, and your daily cost of just having the tariff and […] they look at your demand every hour and if you go over 50% of that demand where you pay more and it's just so confusing". (P33)

"It's not like normal shopping around, the factors are very confusing and insane, and the rules keep changing. An example is going to town to get loaves of bread as a business, the criteria for suppliers are things like quality, price, reliability, but for power these kinds of straightforward criteria don't exist." (P17)

"...how can you make an informed decision if you can't work out what the demand tariff is?" (P2)

The complexities of electricity tariffs meant that electricity was not scrutinised as closely as other large resource inputs, *e.g.: "I know that they're big decisions… I just don't have the time to sit down and analyse all this stuff" (P26).*

Usability: Three farmers mentioned information availability and poor usability was a limiting factor in their understanding of tariffs. P2 described their retailer's website as *"awkward"* and that understanding information was difficult. P9 shared their screen during the interview and challenged the interviewer to interpret graphs of their usage they had received: *"Can you see from that thing how many kilowatts we'd use at the peak? From those charts? Because I don't understand those charts, things, those graphs."* (P9).

"All that A, B, C tariff stuff, I don't really understand it. [But] I can see what the solar is and it comes back, it's a credit to our account and all that sort of stuff. They could probably explain their accounts a lot better and make them more meaningful for people" (P31).

P12 had attempted to research online, but found it difficult and instead learned how to calculate consumption through a phone call with their retailer: *"When we realized how your usage is calculated, it's not hard to work it out. If you turn a five kilowatt pump on for four hours, you are using 20 kilowatts of power... And that simple little calculation, we've been dairying together for 24 years, it's the first time we've ever found that calculation out"* (P12).

Trust: Because of a limited understanding of electricity tariffs, four (P8, P9, P23, P26) of the 13 farmers above simply trusted their electricity retailer would do the right thing by them: *"I just put trust in Ergon. They know the system. They're the people that looking at this every day."* (P26). P23 couldn't remember the last time he changed tariffs, but said: *"I would've relied on Ergon because there was no one else. And they would've said, well, this is the tariff to go on to"* (P23). Up until the interview, P9 had been unaware that there was more than one large customer tariff, having simply left it to Ergon to assess what tariff suited his operation best.

Drivers of complacency; barriers to engaging with tariffs

While the complexity of tariffs and difficulty navigating tariff selection (detailed above) served to complicate tariff review, the low perceived cost savings appeared to drive complacency among some farmers to not bother looking in the first place. Five farmers (P1, P2, P13, P25, P28), including small (P13) and large-scale farmers (P25), viewed electricity as: "*a cost that I'm not willing to put too much effort into*" (P13), where the (assumedly small) savings made by optimising tariffs was not worth the hassle of doing so: *"Look, if you're paying $10,000 a megalitre for water and it costs you $120 to get it out of the ground each year, and all you're going to save is $10 a meg, it's a drop in the bucket."* (P1)

Two horticulture operators compared the small cost savings of tariff optimisation to those of staff costs (P29) and operation risks (P9), where watering had to be carried out during the day when staff were present. This meant there was little opportunity to respond to (or avoid) peak, shoulder, or off-peak charges and the savings possible through tariff selection were far exceeded by the staff costs of employees checking the irrigation lines and the risks of not doing so. *"If one or two trees the sprinkler's blocked, which is easy to happen, then all the fruit on those trees will fall off…. The cost of that is far greater than any electricity bill. So, we ignore the times that you can operate, the times that are cheaper, whatever. We just do the best job we can and pay the bill that comes with it."* (P9)

The non-discretionary nature of water use also acted as a disincentive to engage deeply in tariff selection. P2, P6, P18, P21, P28, P29 and P34 all described their electricity use as entirely dictated by the crop, meaning they had little to no ability to load shift. *"I'm short interval watering all the time and day time, which is the time that you're never going to get a good [electricity] deal anyway, I don't know if it really matters what tariff I'm on, to be honest. When it doesn't rain for two years, you're watering every day, you've got no choice."* (P28). *"When the crop requires the irrigation, you've got to water it"* (P6).

P25 admitted: *"It's a $100,000 a year bill, it's obviously something I should investigate, but it's something I've never knew or never thought about changing tariffs to fine tune our electricity bill"* (P25). P28 didn't see the point in "whinging" about details: *"The day you sit back and start whinging about what it costs, little old me is not going to change it, so you've just got to get on with life and pay the bill and work a bit harder."* (P28).

Actively seeking opportunities

Despite the prevalence of complacency and lack of time to instigate tariff reviews, a minority of farmers (P14, P16, P27, P35) regularly reviewed tariffs and actively sought opportunities to optimise tariffs and save costs. P14, P16 and P27 all spoke of taking advantage of free advice or government initiatives wherever possible, seeking opportunities to improve efficiency. P35 used the retailer's website to regularly check and compare tariffs. P16 had participated in two separate free or subsidised initiatives from grower groups, receiving a free energy audit through one and subsidised pumps through another: *"…through that [subsidised initiative], we got both the pumps on the electric dam done and a couple of diesel pumps as well."* (P16). P14 had spent time with a (subsidised) energy auditor identifying potential tariff tweaks: ***"****We yeah, zoned in on our bills individually and worked out existing tariff times…It was really good to really sit down with a professional and yeah, nut it all out"* (P14).

Outsourcing tariff selection

Due to the predominantly regional Queensland focus of the study, only eight of the 35 participants had a choice over retailer (the remainder being Ergon Energy customers) (Table 4). Three (P6, P7, P31) of these eight had outsourced the management of their electricity to a third party. All three reported positive experiences from this arrangement, where they felt they were saving through the bulk discount offered by the company, without needing to: *"get my head around it [electricity tariffs]."* (P31)

"As far as I've had it explained to me, they put it out for tender and these companies will bid to be the provider. The kWh charge on its own is low, but here's these other charges that get added on" (P7).

"It saves me a lot of time versus doing these things myself. Like with the kids, like we were in [COVID] lockdown and I was home-schooling three kids. So I was just like that is something that I don't have to go out and do myself So yes please do it!" […] They were able to go in on our behalf and ask for a change our contract [with the retailer] and then keep working with them every month because when the first month we noticed that the solar feeding tariff wasn't there and it kept happening and they did all the work to make sure that that appeared there." (P6)

These third-party services were not (as far as we are aware) available to the majority of the sample who reside within the Ergon Energy network, for which Ergon is typically the only retailer available.

Drought assistance and tariff selection

Drought fundamentally affected how farmers interacted with electricity and with tariffs. The timing of the interviews (October 2021-June 2022) coincided with a period of widespread above average rainfall after what had (for some) been over a decade of drought. 14 of the 35 farmers were drought declared at the time of the interviews, however some had already, and many farmers were expecting to have the drought declaration revoked in their Local Government Area LGA in the following months.

Drought had forced three farmers to source alternative income, including part-time work (P19, P30, P31). One participant had required assistance from charity for a time, to pay bills and cover the cost of food for their family. These factors meant electricity and tariff selection had not been a high priority for several years and remained so, while more pressing matters were attended to: *"We're just now catching up on things that we haven't been able to afford. We've had the dozer sitting there for 12 months. It's broken down and we couldn't afford to fix it."* (P30)

The Drought Assistance available to farmers in Queensland entails waived supply charges for those without water in drought declared LGA's (full conditions here[6]). The waived supply charges played a significant role in tariff selection. Nine farmers (P4, P10, P13, P14, P21, P23, P24, P26, P27) all spoke of the need to reconsider tariffs once the drought declaration was lifted. P23 had calculated the cost/benefit of Tariff 66A versus Tariff 20 with/without the drought declaration: *"If the drought declaration had been revoked I would've lost $2,131 (per month) by staying on tariff 66 compared with tariff 20, according to that thing. But with the drought on I saved $434 by staying on tariff 66A and not going to tariff 20" (*P23). For P23, these costs were significant and the quote exemplifies the involved nature of work to determine the optimum tariffs depending on seasons, usage and drought status.

Impact of changing tariffs

In this section we report on the results of the thematic analysis of results, reporting on each of the key themes that relate directly to electricity tariffs.

The small / large customer tightrope

Ten of the 35 customers were -or had recently been- subscribed to large customer tariffs. Six of these 10 farmers (P5, P9, P17, P21, P26, P32, P33) described having been moved from "small" to "large" customer designation, based on a projection by Ergon Energy that they would consume more than 100 MWh per year on that meter[7].

In each of these 10 cases, the sometimes-unexpected re-classification to large customer status had been a source of severe concern and economic implications. Re-designation to a large customer meant losing all solar feed-in revenue and attracting far higher supply charges. As of July 2022, large customer tariff supply charges start from $45.87 per day, up to $376 per day, compared to supply charges of $1.35 per day for Tariff 20 (small customer)[8]. All large customer tariffs additionally feature demand charges based on the largest draw of electricity over a specific time. These features mean that benefiting from the cheaper per-kWh consumption charges compared to small customer tariffs requires a substantially higher average consumption to offset the much higher supply and demand charges. Yet the majority of customers who had been switched to large customer status did not consume far beyond the 100 MWh per year threshold, making the tariffs uneconomical for them. The large customer tariffs (or process of redesignation from small to large customer) was described as *"confusing"* and *"unfair"*: *"When this one site of ours become classified as large customer, the charges jumped considerably in excess of like 100% on top of what we were already paying."* (P21). P17 described the economic disadvantage of being transitioned to a large customer as: *"…so*

[6] https://drought-electricity-rebate-application.epw.qld.gov.au/
[7] Electricity consumption of 100 MWh or more per year is the threshold used by Ergon Energy to differentiate "small" and "large" customers. Source: https://www.ergon.com.au/retail/business/tariffs-and-prices/large-business-tariffs
[8] https://www.ergon.com.au/retail/business/tariffs-and-prices/large-business-tariffs

extreme that installing a new powerline… new pumps, and considering a $200,000 pivot irrigator is cheaper in the long run" (P17).

"Wasted" supply charges: Large customer tariffs attract significantly higher daily supply charges compared to small customer tariffs. P9, who had breached the 100 MWh/year large customer threshold on their packing shed, described the situation as *"incredibly frustrating",* given the packing shed only operates for a few months of each year: "*Nothing runs [during the off-season]. Just LED lights so we can do some maintenance. And it's costing us well about $2,200 a month for a few LED lights, because we're a large user as far as I know. So, I think we have to pay 50 bucks a day just to be connected"* (P9).

No meaningful choice of large tariffs: P33 highlighted the lack of meaningful choices of large customer tariffs for most farmers, given the cheapest supply charge (at the time) was Tariff 50 ($38.62 per day) and all other large customer tariffs had substantially higher supply charges: *"As a large user, you're pretty much, you have no choice really. You've only got [tariff] 50 and that's about it...There's others there, but they [the supply charges] go way up…There was no choice at all really. And I find them really confusing too*" (P33).

Extreme lengths to avoid large customer designation: The threat of becoming a large customer had caused two farmers to consider actions they considered impractical or unnecessary. Citing federal renewable energy targets, P17 spoke of his surprise at his retailer suggesting he supplement pumping with diesel to remain under the 100 MWh large customer threshold: *"It's confusing. Ergon themselves actually suggested using diesel generators to take some load off the network and go under the large customer rating"* (P17). P5 spoke with exasperation at having to apply to the retailer for a second electricity meter that he intended to place next to the existing meter to avoid the large customer designation: *"I'm going to apply for another NMI [meter] and I'm going to change [the pump to] that when I get to 99 megawatt hours... And then I'll get 200 megawatt hours on the small tariff that way... I mean, that's what they're making me do. It's just madness"* (P5).

Fairness: P9, P17, P21 and P33 all expressed similar frustration that the large customer pricing made it cheaper to consume the same amount of electricity across multiple meters than on the one meter: *"Yeah. I have one property that we don't even use much, and I've got four things there. Four accounts there!"* (P9).

P33 expressed frustration at having attempted to simplify and consolidate his operation, but instead found himself over the large customer threshold: *"I think the most annoying part for me is that I know [...] a lot of the larger growers would have five or six pumps that would pump way more than me. Way more. Use more power than me. But because they're all separate meters, they're not large users. Whereas I've tried to be efficient, put all three pumps together [on the one meter] and it bit me in the arse really.*" (P33)

"It doesn't make sense when I could make smaller sites with the same total load but it [would be] cheaper because it's not a large customer" (P17).

Uncertainty over the process of changing to/from large customer: There was some confusion among farmers around exactly how the designation took effect, and similarly, what process was required to prove to Ergon Energy that you were no longer a large user: *"I think they use about a six month, 12 month period, looking at the usage and then based on that, they'll change it back to a small or large. So every time I ring them and say 'You can't do this because summer I pump lots'.....it's all weather dependent and the last two months I've used, I think it was 45,000 kilowatts [but will use far less in other seasons].* (P33) *"I've just got to get out and try and become a small customer again. I don't know how I'm going to convince them, but that's what I've got to do"* (P5).

Drought assistance: As described above, drought affected farmers could apply for Drought Assistance which waives electricity supply charges for the duration the LGA is drought declared. Several farmers had chosen tariffs to shield themselves from high supply charges. P26, an irrigation-dominant operation had recently been re-classified a large customer on one meter. When considering tariffs for all meters, P26 noted: *"….our decision [regarding tariffs] is based on the drought relief. If they were to revoke the drought*

relief, well then we would be in there looking at that tariff [Tariff 40] a lot harder and even considering not using Ergon and going back to diesel, I think" (P26).

P21, however, had experienced the limits of this tactic, claiming Ergon Energy had "forced" him off his chosen tariff. While drought was declared and designated as a large customer on a meter, P21 had chosen Tariff 46, which provides a very low consumption charge ($0.12 per kWh) but a very high supply charge ($376 per day), intending to waive the latter through drought assistance: *"…and we received a phone call from them basically saying that it was uneconomical for us to be on that tariff. It was uneconomical for them because they were losing out on a lot of money and they told us that they'd be stopping the drought relief on Tariff 46, and we had to choose an alternative large business tariff. If we stayed on Tariff 46, they said they would drop the drought relief"* (P21). This experience caused a loss of trust from P21 towards the retailer, feeling like the rules were being changed against him, having not previously seen anything written about the unavailability of drought assistance on Tariff 46.

Electricity pricing / tariffs pushing farmers towards diesel

The pricing of electricity has the potential to cause negative environmental outcomes, given a large number of our participants mentioned they were regularly assessing the cost and benefits of moving more of their pumping operations to diesel. Diesel was discussed by farmers (below) in terms of (a) utilising diesel generators to run electric powered pumps, or (b) replacing electric pumps with diesel pumps. Particularly for farmers who had one or more meters designated as large customers (refer above), diesel was a cheaper option compared to electricity. Many farmers (P1, P2, P4, P16, P17, P21, P23, P24, P27, P28, P33, P35) had themselves -or knew of friends and neighbours who had- changed pumps to diesel. Diesel was considered in some instances cheaper and more reliable.

Cheaper: Several farmers (primarily flood irrigators) noted how increases in electricity prices or changes to tariffs were making diesel a cheaper option to power pumps in certain circumstances. P17, P21 and P27 had started supplementing water pumping with diesel alternatives: *"One change we've had to make is to put another pump in there that's actually driven by the PTO [driveshaft] of a tractor. So, that way, during those expensive times, if we do need to pump, we can take a tractor down there and hook it up and pump"* (P21). P27 used to operate on Tariff 65 (cheaper night time use) but when Tariff 65 was replaced by Tariff 65A (transitional), resulting in an increase in peak time electricity, he began supplementing his pumping with a diesel generator: *"When we were being charged 45 cents for peak power and 16 cents for off-peak power, well, that's when we set up a diesel generator and ran mains power on off-peak and diesel generator when it was peak time"* (P27). As mentioned above, P17 had been advised by his electricity retailer to use diesel as a means of staying below the 100 MWh/year large customer threshold.

P5 relayed stories indicating that many farmers were doing the same thing: *"I've got mates out here who've taken all their electric motors off and put diesel motors on. They've [electricity tariffs] have just gotten too dear, that's all. It used to be cheaper to use electricity than diesel. It's not anymore." (P5)*

P2 and P4 both chose to remain on electricity, but had calculated it would (at the time of the interview) be cheaper to switch to diesel. *"I have priced diesel generators. It'd be cheaper to put a diesel generator in [than] to pay the fixed fee on Tariff 46….I guess my comment overall would be, [these] changing tariffs, [are] pushing current energy users back into diesel users"* (P4). *"It's about $7 a meg [megalitre] to pump the water using diesel, and it's around $10, a meg for the electricity pump. It used to be that electricity was cheaper than diesel. It's now getting dearer. If it goes to $20 a megalitre, then we would go back to diesel... If we're paying only $7 or $8 a meg with diesel, why would we pay $20 a meg for electricity?"* (P2)

Reliable*:* Diesel was also described by some as more reliable, being unaffected by power outages and agnostic to periods of poor power quality. P13 and P26 both had diesel pumps which could be deployed as a contingency, as neither completely trusted the power supply in their area. *"The manager loves diesel. Because it doesn't go out when we get storms. Because when you get storms, we lose our power quite often…. If they're [the electric pumps] are cut off... for more three seconds, the pump shuts down permanently. [But] diesel just keeps thumping away there"* (P13).

"Well, these smaller motors on the submersible pumps are actually running at about 102% [capacity] because of the low voltage [on the local network]. So they're running over on their rating and there's not a lot we can do about that. And that's another reason why people are going [diesel] generators because you can guarantee the quality of the power, of the electricity" (P1).

Frustration at being "pushed" to diesel: Despite being considered cheaper or more reliable by some, diesel was also described as more maintenance (P2, P23), incompatible with other electrically driven infrastructure on the farm (P23), incompatible with their existing telemetry and smart technology to remotely control pumps (P2) and worse for the environment (P1, P5, P16). This meant the situation of diesel overtaking electricity as a cheaper alternative was, in fact, a source of considerable frustration for many farmers in this predicament, where electricity prices and tariffs were "pushing" them towards what they saw as a highly sub-optimal outcome. P5 vented his frustration at the growing economic desirability of diesel: *"I'm in the process of trying to stop using fossil fuels, not use more of them!"* (P5).

Drought assistance ending*:* Coming off drought assistance (meaning electricity supply charges would no longer be waived) represented a potential transition point to diesel. P1 described how he and other farmers in the area were remaining on electricity while they were drought declared, but he expected many would move to diesel once the drought declaration was lifted following the 2021-2022 rain event and floods. *"[paying the supply charges] doesn't make sense if you're only using the meter 5-6 days per year"* (P1). P1 noted the area (Western Downs) had been drought declared continuously since 2013, meaning many had not been paying supply charges for years and this change would prompt (for many) large-scale tariff re-assessments and decisions over whether it was economical to remain on electricity.

These findings suggest that many farmers find themselves at -or close to- a tipping point, at which using diesel or petrol power is cheaper than electric power, suggesting that further price rises or tariff changes must be very closely inspected for their potential to precipitate poor environmental outcomes by incentivising more farmers to transition to diesel.

Impact of retiring "irrigation" tariffs (62, 65, 66)

A specific focus of the study was to understand the impact of the retirement of the (now obsolete) "irrigation tariffs". Tariffs 62, 65 and 66, were promoted as farming tariffs and were not replaced by other clearly identifiable farming tariff options. Tariffs 62 and 65 were time-of-use tariffs that formerly provided cheaper electricity at night, while Tariff 66 was a demand-based tariff for farmers using pumps greater than 7.5 kW capacity for long periods of time.

Of the farmers who had previously taken advantage of the irrigation tariffs, seven felt they were worse off, seven felt better off, and two did not describe themselves as better or worse off. It is important to note here that farmers tended to discuss the irrigation tariffs in terms of their previous incarnations, when the tariffs delivered substantial night time cost savings, i.e. before their transitional replacements (Tariff 62A, 65A, 66A), which (appear) to deliberately make the tariffs uneconomic by increasing the off-peak charges in comparison with Tariff 20, and increasing the peak charges to $0.52 per kWh, almost double the anytime usage charges of Tariff 20.

Negative impacts

P1, P3, P8, P12, P18, P20 and P23 all listed negative impacts of losing discounted electricity at night through Tariffs 62 and 65, including worse water efficiency (P1, P8, P20, P23) and the (former) night tariffs better suiting farmers' operations compared to other alternatives (P3, P12, P18).

Water use efficiency: "*Well, I'd prefer to water at night because obviously then more of it hits the ground than during the day…. But if the saving was big enough, you might even change that.... you'd just about waste the water and get the cheaper electricity".* (P23) *"You want to irrigate at night time because you get less evaporation. So irrigation has always been a night time thing"* (P20).

"What frustrates me about [irrigating during the day] is you're losing so much in evaporation during the day. It's just the structure is not rewarding sustainable practice […] The system would be much better... if they encouraged sustainable activity by having a cheaper rate at night so we can irrigate at night and not waste water through evaporation" (P8).

Alignment with farm operations: P3, P12 and P18 noted how the previously cheaper night rates of Tariffs 62 and 65 used to fit in better with their farm operations. P12 (dairy) noted: *"Night tariff used to be up until seven o'clock in the morning and we used to always get up and be... finished [milking] by seven. So we'd do all our morning milking on the cheap tariff plus half our milling in the morning and then, see, that just goes. "* (P12). *"[Tariff 65] used to suit the farmers, because you just turn it on at night time and leave it. There were a lot of growers that adapted to that"* (P3).

P18 felt like the retirement of the irrigation tariffs was unfair, feeling like the retailer was profiting, where the (assumed) lower price of electricity at night was not being passed on: *"...we could irrigate at night -and that's when we want to be able to irrigate- there's less of a power load at night, and yet we aren't given the opportunity to access that*" (P18).

Positive impacts

Lifestyle: Improved wellbeing was an unexpected impact of the retirement of the irrigation tariffs. P9, P14, P33, P32, and P34 all provided answers indicating positive lifestyle benefits from not being incentivised to water at night: *"So I'd go out at nine o'clock at night, start my pumps and then switch them off at seven o'clock in the morning. And I was saving the money doing that, but I find it's such a pain in the bum, going start at nine o'clock at night and all that sort of stuff. So I just said, 'that's It', got a flat rate and they just run no matter what. So I made a sort of a lifestyle choice in that regard and I think it cost me about $2,000 extra a year"* (P33). Similarly, P14 had specifically factored lifestyle into his considerations when changing tariffs, *"I mean, that was one of my criteria, not the change the way I operate. I've got a young family and... Yeah… to drive out at eight o'clock at night and switch the irrigation pumps off and all that. It was more practical sense, just to go to Tariff 20"* (P14). Similarly, P34 described the enjoyment of finishing work earlier, even if it meant a slight inefficiency in operation: "*I could start the irrigator at 5 [pm] and it might be still a little bit windy, but I can go crack a beer and not have to stay awake till 9:00pm"* (P34).

Workforce: P9 noted how watering during the day was necessary for staffing, given the supervision required for the irrigation lines for their avocado orchards: *"Some farmers operate by just watering at night time, because it's cheaper. That might be great for electricity. It's not great to run your farm that way. Every time we turn the irrigation on, we have people running up and down checking that none of the sprinklers are blocked. Because if on one or two trees the sprinkler's blocked, which is easy to happen, then all the fruit on those trees will fall off"* (P9).

P20 and P32 had both calculated that even generous cost savings from night tariffs would pale compared to staffing costs: *"When you do the sums of my, well, what it would cost to pay overtime and all that to go and switch irrigation pumps off and on and off at night time"* (P20). "*If you're a big operation and you employ people, you got to weigh in the cost of overtime. It's not as straightforward as it was, say, 20 years ago,* " (P32).

Night tariffs do not suit intensive operations: A transition to more intensive farming practices from P13 and P26 meant while Tariff 62/65 had previously been suitable for both farmers, Tariff 20 was now more suitable irrespective of the extent of any night time discount: *"My uncle, prior to us taking over, he used to run [pumps] more on a night tariff, where he'd only used them primarily to water through the night. Now, when I took over, we were a lot more intensive in our farming operation and we would never keep up [if we were] watering just at night. We just wouldn't keep up. We were far better off going 24 hours a day" (P26).* Similarly, P13 outlined how pumping at night alone would not meet water demand: *"[The pumps] go day and night. We don't actually specifically try and run them at night. Because we just need them in a hurry. Like we thought about just running them [only] at night, but we just can't get enough water." (P13)*

Considerations around transitioning to Controlled Load (Tariff 34)

Tariff 34, introduced in 2021, is a new controlled load tariff which guarantees 18 hours per day of power, but which the network can switch off at any point, with the interruptible nature of supply compensated with a lower kWh rate than other tariffs with guaranteed supply. Five farmers had already switched certain pumps to Tariff 34 (P3, P17, P27, P32, P34) with others having considered it, but either waiting for more information and one believing it is not available in their area.

Barriers to Tariff 34

Unscheduled interruptions: The interruptible nature of supply was a barrier to Tariff 34 for P18 and P32. P18 spoke of the previous owners advising him not to take up Tariff 34 *"…so you think you'd be irrigating and you'd go down and find that you're not"* (P18). P32 spoke at length about Tariff 34, having considered it for several pumps, but running a horticulture operation, irrigation was supervised, where drip irrigation required manually checking lines to make sure they were free of debris.

"As soon as the power goes off, the pumps go off. You then got to restart the whole system. There's a huge lag time to do that. There's the cost of doing that. Getting someone to do it is not worth it, so we'll go to Tariff 20. I have contemplated looking at 33 and 34, but I like the ability that I can turn my pump on anytime I want versus where it could be switched off" (P32)

Need for pre-warning: Both P32 (not yet on Tariff 34) and P34 (already on tariff 34) wanted notification of power cuts on Tariff 34. For P32, this was central to whether he would subscribe, and he was waiting to hear from other farmers how they had used it: *"I think a lot of people have been watching to see how [tariff] 34 goes, to see how often it switches off, and I guess we'll get some feedback from other farmers about it at some point. One of the things we'd really like to see…… That there'd be a text message going out, a warning. Even [if it's received] when it's happened, to say the pumps will stop."* (P32)

Incompatible with pumping needs: P4, a flood irrigator noted how a switch to Tariff 34 could mean missing out on the full potential of a water harvesting event, where he needed pumps to be running 24/7 throughout the length of a flood: "When the river is running at a certain height and it may happen two or three days or no days in a year, then you would have all those pumps going 24 hours a day". **Fire fighting/safety:** Relatedly, P32 had considered fire safety in his choice not to make the switch to Tariff 34 for the pumps near the packing shed: "*I don't want the risk of not having water to use in firefighting situation."* (P32)

Not available in area: P5 wanted to convert to Tariff 34, believing it would reduce his pumping costs to a comparably low price to diesel, but understood Tariff 34 wasn't available in his area. This assumption appears to be based on conversations with other farmers rather than on direct conversations with the network or retailer: *"That's the one I want to go on... But I don't even think it's available out here... I've heard people say to me, "No, you can't even get that out there." They said, "They haven't got the gear to do it," which is just bizarre."* (P5).

Facilitators of success with Tariff 34

Automation (smart technology): Automation (whether smart or otherwise) was central to the success of P3, P27 and P34 saving money on certain pumps with Tariff 34. The switch for P3 had required investment in both a meterbox upgrade and the purchase of smart technology, however this move had paid off given the smart technology caused pumps to automatically restart if they lost power: *"For me, doesn't really worry me now. Like that's what I'm saying with automation. I can go to [tariff] 34, and then I can start pumping at night time, which I will. And if it does shut off, well, I know it's going to restart again. So, I've got the elasticity, whatever you call it."* (P3)

Automation (pump timers): P27 had re-purposed a simple pump timer which had previously been used to schedule pumps to run during off-peak times on the former irrigation tariffs. This involved setting the timer to

constantly switch on, which if the pump was already on, made no difference, but if the pump had turned off, it would be restarted as soon as there was power available: *"[The timer trick] sort of came about by accident. I don't know why. When we were pumping water to the reservoir for stockpiling, I'd set that time clock [pump timer] to only run during off-peak... So that's why we had the time clocks put on there by the electrician. That was the purpose of those... And then when we got off that [time of use] tariff and onto really any other tariff, I sort of figured out that if you want that pump to be on, anytime the power's there, you just tell the time clock to be constantly on"* (P27).

"Forgotten" Flood and river irrigators

Flood irrigators who utilised high capacity pumps to extract water from rivers during flow events (P1, P2, P4, P5, P26, P27) were particularly disadvantaged by current electricity tariff structures. The high peak drawn on start-up from the large capacity river pumps meant these farmers paid high kW rates on demand tariffs. Controlled use tariffs were not viable, because of the need to pump 24/7 during the short window water is available, which meant farmers couldn't risk being turned off mid-event. Solar was not typically a viable option on these meters, because the electricity profile is made up of short but substantial peaks of use, followed by very little use at other times, and the low 6.5c/kWh solar feed-in rate (or no feed-in tariff if a large customer) means it is uneconomical to install given the little self-consumption. Finally, farmers felt like the daily supply charges (particularly so if a large customer) were either unfair (P26) or "wasted" (P1, P5), as the pumps may be used less than 10 days per year. This could be particularly problematic for farmers on "announced" water allocations, where limitations to water licences could further limit the ability to pump during flood events:

"…so if the water levels continue to drop with monitoring, we'll still have an announced allocation. If it drops further, well, you know, we just can't afford to have too many bores, basically. So from a maintenance perspective, as well as an infrastructure perspective, as well as with these […] tariffs, your payment is sitting there." (P1)

P4 and P26 felt authorities (in this case the QCA tariff setters (P4) and electricity retailers (P26)) did not understand their situation and felt "forgotten"; without any suitable tariffs for their operation: *"They haven't actually allowed for a tariff for water harvest things. That's when a high flow event happens in the river system, to be able to make use of your maximum time available to pump the maximum amount water that your license allows you"*. (P4)

"[The retailer] commented, "Oh, well, could we just... turn your account off for say April through to October?" Well, when is the river going to flood? If it floods in the middle of June, we won't have our power. We'll have to get [the retailer] out to turn it on. And that could take two weeks and we will have missed that opportunity. So we sort of got to have [pumps] ready to roll, at any day of the year, but they might only be getting used for 19 days a year." (P26)

P26 considered a potential solution might be to activate or de-activate electricity meters with controlled load pulses to avoid wasted tariff supply charges: *"Potentially if we could have some of those NMI's [meters] that would be sitting idle for 350 days of the year- whether they could just send a pulse down the line and kick them in because we do get 24 hour's notice of a pumping insertion... If they could send a pulse down the line that flicked our meters on or whatever, and then for the rest of the time that they're not on, I mean that could be something…But yeah. It's only 24 hours [notice] we can give them. We can't be waiting a couple weeks [to reconnect a meter]*" (P26).

Solar as an insulator against tariffs

23 of the 35 farmers had solar PV (20 grid-connect, 3 standalone/off-grid systems) (Table 3, above), however the median size of the system was relatively small: 17kW. This meant that for the majority of farmers, solar PV did not greatly reduce their' exposure to tariff changes. While farmers spoke at length about the benefits of, barriers to, and considerations around solar PV, none of these related to the role of solar in choosing tariffs or insulating against the July 2021 tariff changes.

Beyond tariffs: Barriers and opportunities

The in-depth and wide-ranging interviews led to a range of opinions, issues, and considerations on agricultural energy issues beyond electricity tariffs, which we feel is valuable to share here to provide a broader perspective on energy-related issues facing farmers. We categorise these findings according to (a) farmers' self-reported barriers to greater energy efficiency, and (b) dreams, ideals and opportunities for future energy systems.

Barriers to better tariff utilisation and energy efficiency

Non-discretionary energy use: The non-discretionary nature of electricity described by P2, P6, P9, P18, P21, P28, P29, and P33 was both a source of complacency for engaging in tariff selection/optimisation (as reported above) and a barrier to the utilisation of time-of-use tariffs. P9, P18, P21, P28 and P29 were tied to daylight hours for their operation due to staffing requirements and specific growing seasons for their operations and hence could not adapt to suit either time of use or seasonal tariffs (e.g. Tariff 24 where "peak" relates to weekday evenings during summer only).

"Stuff like that during the day can't really be rescheduled to night because people need to go home at night and get some sleep and stuff like that. They don't like sleeping during the day and working at night, it doesn't really work on a farm". (P21) "[Sarcastically] I can't get guys to work all night." (P28)

"If it [the crop] needs a drink during the day, then you have to do it, otherwise you kill the plant and you get no production." (P29) *"We can't just turn [pumps] off in the middle of the night or in the middle of day or at peak times and then start watering again. That would be very inefficient from an agronomy point of view."* (P2)

Barriers to solar (or more solar): Several barriers related to solar purchase or expansion emerged as constraints to farmers operating as they would like. Barriers included the prohibitive cost of solar PV (P21, P30), older age causing large investments to become less attractive (P23) and the seasonal nature of farming (P1, P2 P9, P13, P25, P28). P1 had considered putting solar on the meter of a large capacity river pump, but had calculated that the infrequent usage of the pump and the low feed-in tariff meant the investment would not be viable. P2 noted how it was typically cloudy during a heavy rain event when he was most likely to be pumping, reducing the viability of solar. P9 and P25 operated packing sheds which they had both considered installing solar on, but had decided not to:

"Even the packing shed only goes three [months] per year, so we would have excess power to put into the grid. We just haven't been enthusiastic by the deals to go with solar. If we were going 12 months a year, I think it'd be a different scenario" (P25).

P28 had installed solar on his house, which had caused him not to consider installing it on any of the farm meters: *"It's the biggest waste of money […]. I'm going home at night after I worked all day and I'm not creating solar at night time. Then the f***ing 8 cents they give you [per kWh solar feed-in tariff]. Take me the next bloody 10 years to pay it off!"* (P28).

P5 and P25 both identified the lack of ability to share generated solar power between meters on the same property as a barrier to installing more solar: *"[The solar PV sites are] all within 20 meters of each other, but I can't use the power from all the solar on just one pump…I want to be able to use the solar from one [site] at the other, but I can't even do that... I'd be happy to pay Ergon 8 cents [per kWh] just to transfer my solar from one site to the other, but they're just not interested*" (P5).

Lack of ability to forecast or measure: Four farmers (P10, P21, P25, P33) commented how the seasonal nature of farming reduces the ability to measure the effect of any improvements made: *"A business in town knows exactly what they're going to use every year. So they know exactly what they need to do or they've got a way to work around it, whereas every year it's different for me. So I don't know whether it's feasible…there's just no real goalpost for me"* (P33). *"It's a $20,000 investment to put a VSD [variable speed*

drive water pump] down there, and I don't know that it would be worth it. […] no-one can tell me that" (P25). P10 described how attempting to measure the effect of a change would require finding and comparing electricity accounts between separate years. P21 mentioned the variability in almost all aspects of their electricity use, from irrigation to silo aeration *"We could try and run them [silo aerators] more at night, less during the day, whatnot, but even that becomes a bit difficult to manage…Depends on how wet the crop is when we harvest it and whatnot. So, it's hard to forecast".* (P21)

Lack of bulk discount: P2 commented on the lack of bulk discount for electricity, including the disincentive of using more than 100MWh per year on a meter which triggers a re-designation to a large customer and higher supply charges: *"We're in a new world now where using more is bad and you get penalized for using more, whereas everything else, if you buy and bulk, you should get a cheaper rate. I don't know why it doesn't happen with electricity. If you use more electricity, you should get it cheaper". (P2)*

Dreams, ideals and ideas for future electricity arrangements

The thematic analysis process resulted in many themes related to the barriers and facilitators to more suitable electricity arrangements. Participants were invited to share their ideas, even if they felt their ideas might not be immediately feasible, providing insight into ideal energy futures.

Competition in electricity retail

Twenty seven of the 35 farmers interviewed were located in the Ergon Energy network, meaning little or no choice over electricity retailers. All these farmers were asked on their thoughts about increased competition in the electricity retail market. Of these 27, a majority, 18 participants were in favour of opening the retail market to increase competition, with many participants articulating considerable frustrations with Ergon Energy and the lack of choice. Responses included feelings that competition is healthy and keeps market participants honest (P9, P10, P14, P16, P22), expectations that competition would reduce prices (P6, P12, P26 P29, P34) and that competition would cause retailers to improve customer service (P5).

"Well, anything's got to help, because this is ridiculous. I even consider just turning our generator on and not turning it off, telling Ergon to get nicked" (P9). *"Competition's the life of trade and people tend to sharpen their pens if they know there's a better deal*" (P10).

Nine of the 27 customers subscribed to Ergon were not immediately keen on more competition or did not provide a preference either way. P13 was hesitant of *"jumping from the frypan into the fire"*. P2 and P8 both identified the greater number of potential electricity offers with more competition and no time to assess the costs or benefits of them. P2, a flood irrigator described the value of electricity reliability (which he was currently happy with) far exceeded the (perceived) minor cost saving of changing electricity retailers: *"It might make you feel better that you're not dealing with a monopoly, but that's secondary to reliability…Electricity reliability is key." (P2)*

P28 spoke of the potential problems caused by increased competition in retail, when the electricity network is still operated by Ergon: *"My first reaction is to say yes [that competition is good], but you gotta be careful what you wish for [because] Ergon still owns the network. […] Say NBN and Telstra, we're wireless to the NBN tower on my neighbour's property. When I've got a problem, I call Telstra. If there's a problem with the NBN tower, Telstra needs to contact NBN. So if you go to another [electricity] provider, will I still be in the problem where retailer has to rely on the network? More providers mean more daisy chaining but Ergon still own it" (P28).*

P1 felt that increased competition would cause the drought relief provision to be lifted, as competition squeezed margins: *"I've got a handle on what it costs to maintain this network and they [Ergon] do a good job of it. If that was all opened up, the margins on the retail would shrink. We'd lose our drought provision. [Without competition] there are no surprises. We appreciate the relief in the drought times, we really do"* (P1)

Consolidating consumption and generation across multiple meters: Several farmers wished for greater flexibility in how electricity was metered across their operation, expressing a wish for a greater ability to share electricity between separate meters on the one property and combine billing of electricity across separate meters.

Consolidating consumption: P4 (like many others) identified how large customer tariffs were more profitable when consuming in bulk, i.e. when consuming far over the 100MWh per year threshold, when the cheaper per kWh overcomes the higher supply charge of small customer tariffs. P4 suggested it would be beneficial to be able to consolidate electricity purchases across multiple meters and purchase electricity in bulk across all his meters: *"if you become bulk [become designated a large customer], we want to be high usage... Well, why not combine the whole lot together... In other words, I agree to buy 'X' megawatts of power type of thing?"* (P4).

Consolidating generation: P5 and P25 both identified the limitation of solar PV only being able to power equipment connected to the same electricity meter and the value of being able to share solar power between meters, or direct excess solar from one site to another. P25 spoke of a pump on a separate meter by the river, where he wanted to install more solar on his packing shed roof and run a cable down to the pump, where it was not feasible to install solar proximal to the pump itself: *"One of the things that I would really love to be able to do is, on my packing shed roof I would love to be able to put in 100 kilowatts, 150 kilowatts of solar, and use Ergon's electricity lines, to run it down to my river pump. Because it's actually two kilometres from the packing shed to the river pump, and down on the river I actually only have a small allocation of land" (P25).*

Match electricity billing to on-farm cashflow:

P16 described how the largest electricity bills of the year (for irrigation) arrive before their crop reaches the market and hence the value of a payment plan or deferral option to match bill payment with crop income: *"You have a cashflow issue at this time of year because you're waiting for your summer crop to come in, your income from your summer crop, and the cost of the irrigation are hitting us now when your cashflow is pretty tight. So if there was an option to have it spread out over the year, that would be definitely an option, or deferring payment until your summer crop income comes in, that would definitely be beneficial." (P16)*

Sharing, producing

P5, P6, P24 all expressed interest in peer-to-peer trading or more flexibility in sharing excess electricity: "*Is there some way that you can be your own energy retailer if you've got a big enough solar system? You're making enough power that when say Essential Energy needs extra power, you can say, 'We've got a hundred kilowatts, here it is!*'" (P6). As noted above, P5 was willing to pay a network charge to trade energy within his operation, "*Like selling my excess power to somebody else who needs it or giving it away to somebody else rather than Ergon, or using it peer-to-peer to myself. They're things that are not going to hurt anybody*" (P5).

P27 spoke of an eagerness to work with retailers to try to align farm electricity use with when rooftop solar provided an excess of supply on the network: "*Well, I'm one of those people that are happy to work with the system, and try to make it work as well as I can…. We want price signals […] from the retailers, they tell us how they want us to use the power If they're looking to get rid of cheap power during the day, we could help them. If they made it cheap enough*" (P27). This quote also hints at the relative lack of price signals through current electricity tariffs, e.g. how (soon-to-be-obsolete) night tariffs are no longer substantially cheaper at night and that certain farmers may be able to find opportunities for flexibility in time of use if there is a large enough incentive to do so.

Discussion and implications

Key findings

The initial desktop review of the 2021-2023 Queensland electricity tariff reforms determined that current Queensland electricity tariff setting practices do not attempt to cater for farmers' (or any other businesses')

demand profiles and are instead set primarily to accommodate present and future demand trends. Analysis of the 35 interviews revealed that farmers typically operate multiple electricity meters, most are subscribed to multiple tariffs and may have to navigate tariff selection across all three tariff suites (residential, small, large). The majority of recent tariff changes were initiated by the retailer as part of the July 2021 tariff reform, or due to a meter being re-classified as a "large customer". Over three quarters of farmers who had not changed tariffs (or been moved between tariffs by their retailer) in the last 12 months had not changed in the last 4 years or could not remember. Tariffs were considered complex, difficult to understand, and informal sources featured as prominently as more formal sources when gathering information about tariffs. Solar provided limited economic insulation against electricity tariffs, given the (relatively) small size of solar installations operated by farmers, the low feed-in tariffs available to solar customers and the inability to share generated solar electricity between multiple meters. Farmers found the 100 MWh/year threshold for large customer classification to be problematic and uneconomic and spoke of going to considerable lengths to avoid re-classification. Tariff-setting and the overall price of electricity has potential to foster poorer environmental outcomes through disincentivising night time watering (hence decreasing water use efficiency) and incentivising the use of diesel for water pumping. Farmers desires included increased competition in the energy retail market, the ability for greater peer-to-peer trading between meters on their farm, the ability to consolidate bills across multiple meters, and for payment plans that accommodate seasonal farming cycles. The findings unearthed important considerations such avoiding controlled load tariffs for water pumps which may be called upon for firefighting and cash flow issues for farmers caused by the misalignment of electricity bills and crop income.

Comparison to international literature

Our findings are in broad agreement with international literature identified in the literature review. As per residential studies of demand response [14,15], participants were strongly price sensitive and cost considerations were the strongest factor in tariff selection. On the other hand, it also appears feasible that (as per residential customers) cost-reflective pricing might be expected to produce highly unequal impacts between sectors (or even individual farms), given the high number of non-discretionary loads such as irrigation of crops at early growth stages. As per a largescale study of irrigated agriculture in California [18], our findings highlight the potential role of smart technology in enabling farmers to take advantage of alternative tariffs (in this case Tariff 34 controlled load) by restarting pumps, but equally that limited time to engage and limited digital literacy by certain farmers may represent impediments to technology acceptance or utilisation. As per many studies of specific farming sectors [3,6,11,16,18], we too caution against generalisation of results across network boundaries, states or countries, given the particularly high degree of geographic and economic specificity of results.

Limitations and future work

It is important to consider the results in light of the limitations of the study. These include the small number of participants and the nature of the study seeking to gather perspectives from a range of industry groups; meaning we do not have sufficient representation from any one group to support strong generalisations. The majority (28 of the 35 farmers) were non-contestable customers, which is a strength of the sample, providing a uniquely in-depth focus on regional Queensland agricultural customers of Ergon Energy Retail, which, to the best of our knowledge is unique in the literature. However, due to the specific tariffs available to Ergon Energy customers and the timing of the interviews following a tariff reform, we do not expect all issues faced by our sample to translate to other Australian states or even contestable areas of Queensland.

Future work is required to further explore many aspects of our findings. These include determining the applicability of the key findings of this report to other jurisdictions, more in-depth studies of technology acceptance, e.g. to better determine the potential of smart technology to facilitate greater adoption of controlled load tariffs and more representative studies of individual grower groups. The findings also point to a great potential for advocacy towards better serving the needs of participants. Below we outline opportunities for advocacy and our own efforts to date based on this research.

Implications for advocacy and policy

Based on the results of this research, we provide several implications for advocacy and/or policy, where we feel policy may better serve the needs of farmers in respect of electricity tariffs.

Reducing the complexity of energy tariffs: Specific to non-contestable regional Queensland farmers who cannot outsource tariff selection to third parties, our findings highlight how this group of farmers struggles with the complexity of energy tariffs, the (sometimes) poor usability of existing information and a relative lack of consolidated information. Potential responses include:

- Work is warranted to consolidate tariff information and increase the usability and accessibility of existing web-based information on tariffs and positively contribute to farmers' energy literacy.
    - **ACTIONS**: UQ and QFF have already provided a web-based resource for Queensland-based farmers with links to chaptered webinars, stories from farmers in similar situations, links to enable visitors to share their own story and a consolidated list of links to information on available tariffs. See "Outputs" heading below. This web page is currently live at: https://www.qff.org.au/projects/electricity-tariffs-agriculture/
- Allow farmers to access metered energy data in real time to assist in assessing tariff options: At present, farmers have limited access to meter data, even when a smart meter has been installed at the site. Consideration should be given to improving access to smart metered energy data in real time to avoid having to seek data through the retailer or network service provider. Customers could access data through third party applications which could develop algorithms and alerts to choose tariffs and assist in managing consumption within a tariff's parameters. Section 7.8.2 of the National Energy Market rules could be updated to incorporate a provision to allow customers to be able to access data from meters on their premises in real time.
- In line with existing literature [7], our findings suggest many irrigators consider electricity primarily as an input cost of water extraction and we advocate future research which combines energy use feedback and water use feedback to better determine how this combination may improve energy literacy beyond existing electricity-only dashboard options through retailer websites.

Small/Large customer tightrope: The small/large customer issue (e.g. unexpected large customer designation) was problematic for almost one third of the sample. Large customer tariffs may be highly suitable for energy intensive commercial/industrial operations with a single meter and large electricity demand (e.g. cotton gins) but not for farmers who are unlikely to greatly exceed the 100 MWh/year threshold by a sufficient margin to have the lower per kWh charge outweigh the considerable daily supply charge increases. Potential responses include:

- Introducing a large customer tariff with a lower per day supply charge, which may be more suited to customers who do not consume far above the 100MWh/year threshold.
- Increase the 100MWh/year threshold: We suggest an increase of the threshold may provide many of the farmers in our sample the opportunity to remain as small customers and avoid expenditure on actions to avoid re-designation, such as installing additional meters.
    - **ACTIONS**: QFF is already advocating for a raise to the 100 MWh/year threshold (Source: QFF Policy Officer Sharon McIntosh).
- We suggest in addition to the above, a subsidised 'Energy Savers' style efficiency and demand management program to assist customers in reducing their energy consumption to below the small customer threshold. Such a program may be targeted at customers using between 100MWh and 160MWh per year and could gather further information about farms in this category for future tariff design.

Peer-to-peer to unlock consolidated billing, incentivise solar: We suggest peer-to-peer arrangements which enable sharing electricity between meters on the one account (or one property) may overcome several of the issues identified by farmers in this study:

- Consolidating electricity billing across meters would reduce the number of electricity accounts and tariffs operated by farmers and potentially assist in reducing the complexity of tariff navigation which this report finds is an impediment to greater engagement in electricity tariffs.

- By purchasing electricity in bulk across several meters potentially overcomes the small/large customer tightrope faced by several farmers and would avoid costly investments in additional meters simply to remain under the 100 MWh/year threshold.
- Being able to share generated electricity between meters on a property has the potential to increase solar adoption, given a specific barrier to further solar adoption for P5 and P25 was the inability to redirect their solar to other meters on a property, and instead having to sell it back to the grid at an unattractive feed-in tariff. Sharing generated solar electricity within a farm may also assist in managing emerging minimum operational demand issues if farms are encouraged to use more power when their solar systems are generating power.
    - **ACTIONS:** Both UQ and QFF are working on projects which identify the barriers and facilitators to microgrids in regional towns (UQ) and within farms (QFF). We intend to consolidate our respective work in a white paper on this topic in the future.

Consideration of electricity tariffs impacts on emissions targets

The findings suggest that many farmers find themselves at -or close to- a tipping point, at which using diesel or petrol power for water pumping is cheaper than electric power. Which suggests that further price rises or tariff changes should be closely inspected for their potential to precipitate poor environmental outcomes by incentivising more farmers to transition to diesel.

- Further work is necessary to study these tipping points more exactly and across a broader range of production types to determine more exactly how many farmers have or will move to diesel and under what circumstances.
- Our findings suggest that electricity tariff setting needs to be considered in light of other agricultural resource inputs (e.g. oil/fuel prices) and hence their potential impact on emissions targets, given relatively small adjustments appear capable of causing en-masse movements of farmers off electricity towards fossil fuel power sources.

Flexibility in supply charge for irregularly used meters: Paying daily supply charges for meters that may only be used five or less days per year was a substantial issue for flood irrigators and these “wasted” supply charges were central to farmers’ calculations around converting pumps to diesel. Not knowing when flood events may occur means it is not sensible for farmers to have meters disconnected and re-connected by the network.

- We suggest consideration be given to flexibility in supply charges for these types of meters, e.g. remote enabling/disabling for a set fee to avoid farmers (particularly large customer farmers) paying supply charges on the meter over months when the meter is not used.

Pro-active rather than re-active consultation in tariff-setting: Tariff-setting in Queensland is managed by QCA, where submissions from industry bodies and others are invited to draft determinations for future tariff proposals. This process facilitates feedback from industry and grower groups, but results in retrospective input, rather than involving industry sectors themselves to inform tariff setting.

- We advocate more detailed and industry-specific qualitative and quantitative research on existing tariff suitability, operations and load profiles.
- We advocate for a process of transparency in tariff-setting whereby key recommendations should be seen to be considered in the process of tariff setting to maximise the suitability of a given tariff suite to the full range of end-users.

Information sharing on smart technology for Tariff 34: Certain farmers reported being able to access considerable savings through the lower per kWh consumption charge on Tariff 34 (controlled load) by using smart technology and pump timers to restart pumps after power interruptions.

- We advocate the provision of resources, discussion forums and information sessions (by grower groups etc) about potential smart technology solutions to utilise Tariff 34 for irrigation.
- Information should include an overview of the different available brands, products, communication protocols, costs and potential savings of smart technology should be made available to farmers considering controlled load tariffs for irrigation. Additionally, the limitations of Tariff 34, such as where

it is not suitable, e.g. for pumps that require continuous 24-hour operation or pumps which may be enlisted in firefighting situations.

Regulations on the uses of controlled load tariffs: Also related to controlled load tariffs, the consideration of firefighting in tariff selection may be worthy of further work. Without having taken any in-depth analysis of firefighting guidelines/regulations on farms, we suggest the following:

- We advocate an assessment of firefighting regulations to determine farmers' obligations for firefighting or water for firefighting.
- If suitable, we advocate that energy retailers, grower groups and other online sources of information on tariff selection flag firefighting as an important consideration when selecting tariffs, e.g. warnings on controlled load tariffs, such as "not suitable for pumps which may be enlisted in firefighting" with links to relevant further information on the topic
- If suitable, a change in regulations may be required regarding which loads can or cannot be connected to Tariff 34.

Outputs

The key outputs of this work include:

1. This final report
2. A new standalone page on QFF's website providing tariff-related resources to farmers, titled Agricultural Energy Tariffs: https://www.qff.org.au/projects/electricity-tariffs-agriculture/
3. Two webinars we commissioned a follow-up to the research where we sought feedback on the key findings from: (1) Bonson Lam from Ergon Energy Retail and (2) Sharon McIntosh, a policy expert from QFF. The webinars are linked in multiple places from the Agricultural Electricity Tariffs website and are chaptered, meaning they can be quickly navigated to specific points of interest, rather than having to watch the whole video to find a point of interest.

Website: The Agricultural Electricity Tariffs website acts as central resource for farmers which combines information on the Queensland tariff changes, overviews of the key findings, links to further web resources and sources of information on each topic, links to specific chapters of each of the webinars and a *"share your story feature"* on each of the topics to elicit further stories from farmers, ensuring the impact of the research extends beyond the duration of this given project.

- **Home page:** An overview of the project, scope and aims.
- **Tariff overview page:** A summary of all the recent (2021) and forthcoming (2023) changes to Queensland Small and Large Business tariffs, providing a useful reference resource to farmers. This page includes multiple links to further web resources including Ergon Energy's tariff pages, additional overviews of the tariff changes by Horan and Bird (energy consultants), QFF and Ergon Energy and the Queensland Competition Authority (QCA) Draft Determination which outlines details of the tariff setting process in Queensland.
- **Scenarios pages:** The remaining pages on the website relate to key findings of the study which are expressed as "scenarios", where an issue identified in multiple interviews are consolidated in a single scenario, e.g. *"Royce utilises flood irrigation on his cotton and runs large-capacity pumps. He recently experienced a situation where a meter running some of his pumps exceeded 100MWh in a year. This triggered a change in his position to a 'large customer'….."*
    - Each scenarios page involves
        - An overview of the scenario (e.g. information on the 100MWh threshold between small and large business customers) and details of how this was experienced across the study,
        - Specific stories with (anonymised) farmers' experiences of this scenario
        - Resources for farmers dealing with this scenario, e.g. links to webinars, links for further resources.

- A "**Share your story"** feature, allowing farmers who have not yet participated in the research to share their own experience with a particular issue or topic, allowing further information to be gathered beyond the 35 interviews undertaken in this project

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Appendix A: Media coverage

Farm Weekly: QFF – UQ interviews
https://www.farmweekly.com.au/story/7374717/plugging-into-what-farmers-really-need-in-a-power-contract/

Queensland Country Life: QFF Column
https://www.queenslandcountrylife.com.au/story/7440083/ag-irrigators-powering-up-with-electricity-tariff-research-study/?cs=4726

Warwick Stanthorpe Today
https://warwickstanthorpetoday.com.au/news/2022-02-03/rural-news-in-brief/

QFF Facebook
https://www.facebook.com/qldfarmers/posts/4141739819269106

QFF Twitter
https://twitter.com/QldFarmers/status/1434697895777820674

QFF Linkedin
https://www.linkedin.com/posts/queensland-farmers%27-federation_queensland-and-new-south-wales-farmers-could-activity-6891192172939501568-LmCt
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https://www.linkedin.com/posts/queensland-farmers%27-federation_expressions-of-interest-are-being-sought-activity-6841182817616048128-El66

Project QFF webpage
https://www.qff.org.au/projects/electricity-tariffs-agriculture/

QFF media releases
https://www.qff.org.au/media-releases/farmers-sought-electricity-tariff-talks/
https://www.qff.org.au/media-releases/500-bill-discount-offer-tariff-talks/

QFF blog
https://www.qff.org.au/blog/electricity-tariffs-research/
https://www.qff.org.au/blog/tariff-changes-leads-savings/

QFF Energy Savers e-news
https://us6.campaign-archive.com/?u=be9cc2409cc55bcb17498482a&id=b03f031342
https://us6.campaign-archive.com/?u=be9cc2409cc55bcb17498482a&id=74233fb478

QFF President's column
https://www.qff.org.au/presidents-column/ag-irrigators-powering-electricity-tariff-research-study/

QFF webinar
https://www.qff.org.au/events/talking-electricity-tariff-webinar/

QFF 10 Things to Know (weekly media highlights)
https://www.qff.org.au/10-things-to-know-from-qff/10-things-know-qff-16-august-2021/
https://www.qff.org.au/10-things-to-know-from-qff/10-things-know-qff-6-september/
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Appendix B: Full interview protocol

How many electricity meters (NMI's) do you have?

How many electricity tariffs do you have? Please describe the purpose and the main loads connected to each (including feed-in tariffs)

What is your approximate annual electricity consumption and cost or typical/average electricity bill consumption/cost?

What proportion is electricity as a cost relative to total turnover?

Has it always been like this?

Have you previously taken part in an energy audit or energy-related program? Or battery trial or Direct Load Control appliance trial or similar?

Have you received adjusted electricity costs due to drought relief or similar?

Do you know what is/are the biggest contributor to your electricity bill? (e.g. Irrigation, cold room, dairy shed, etc)

(For cotton only)- "Cotton Australia defines three broad categories of pumpers (1) River pumpers (2) Ground Water users, (3) Pressurised irrigation systems (often on peak tariffs). Do you identify with any of these?

When was the last time you changed tariffs? What prompted the change?

What features drew you to your current tariff(s) or retailer? Did you have a choice over which tariff?

What factors informed the choice of your current tariffs or retailer? (e.g. why did you choose retailer X over retailer Y?)

Was this an easy choice? If so why, or why not?

What sources of information did you access when making the change (e.g. spoke to friends, internet searching?) What information did you lack when researching this?

Did you use Ergon Energy Check?

If so, how did you find it?

Have you experienced any benefit/disadvantage with the change, such as a change in your energy costs or energy usage?

(IF APPLICABLE) How has this benefited your solar or battery storage? E.g. feed-in tariffs

How do your current tariffs suit your modes of operation? (e.g. incentivised to irrigate at night)- Are these effects good or bad? (e.g. incentivised to irrigate during day when night would be better for evaporation etc etc)

Have you had to make changes to your operations based on the new tariff(s)? If so, what have been the impacts of these changes?

Has the tariff change affected your farm's productivity? How?

What activities or electrical loads are the most discretionary? E.g. the easiest to change or re-schedule? Why?

What activities or electrical loads are the least discretionary? E.g. the hardest to change or re-schedule? (e.g. you can't turn off cold storage).

What opportunities or barriers can you describe to improving your energy productivity or saving energy without negatively affecting your productivity?

Have you taken actions to improve energy productivity or reduce your electricity consumption? Please describe.

Have you had any external help in doing this? (e.g. energy audits, energy monitoring)

IF ERGON CUSTOMER= would you prefer to have a choice over retailer? Prefer to be in an area where you an choose between many retailers?

Have you ever reported issues to an advocacy group? Would you like to be more involved in tariff setting (if non-contestable) or more involved in setting regulations for energy retail? If so- how?

Describe your ideal electricity tariff.

Explain key features.